MSc in Business Administration, Analytics and Information Systems

ΠΜΣ σε Διοίκηση, Αναλυτική και Πληροφοριακά Συστήματα Επιχειρήσεων

Ακαδ. Έτος 2017-18

Master Thesis

Econometric Analysis for Inbound International Tourism in Greece: A Panel Data Approach

Οικονομετρική Ανάλυση για τον Εισερχόμενο Διεθνή Τουρισμό στην Ελλάδα: Προσέγγιση μέσω Πάνελ Δεδομένων

Efthimios Karanikas

Supervisor: Evangelos Vassiliou

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Econometric Analysis for Inbound International Tourism in Greece: A Panel Data Approach

Ευθύμιος Καρανίκας

Επιβλέπων: Ευάγγελος Βασιλείου

Master Thesis submitted to the Department of Economics of the National and Kapodistrian University of Athens as part of the requirements for obtaining the Master Degree specialized in Business Administration, Analytics and Information Systems.

Efthimios Antonios Karanikas confirms that the submitted Thesis is personal except for references made in the work of others.

Abstract

The present master thesis aims to investigate the causes that affect the international tourism demand of Greece. The analysis is based on a panel data from 34 countries, which refers to the 91.5% of total tourism demand in Greece over the period 2000-2015, in order to include the 2008 financial crisis and the subsequent debt crisis to export more secure conclusions. Tourism demand is estimated using static and dynamic equations that take the number of arrivals of tourists from their countries of origin as a dependent variable. The explanatory variables used to explain the demand function are quantitative and are mainly economic and demographic. Regarding the estimation of regression coefficients, statistical methods have been used to take account of the complexity of panel data. The OLS, FE, RE and GMM-SYS methods were followed using the Stata / SE 12 statistical package.

This study differs from previous empirical studies in the analysis of Greece's international tourism demand as it uses a very large set of data that includes most of the countries of origin of tourists and uses additional explanatory variables. More specifically, this thesis consists of the theoretical and empirical parts and has the following form:

In the first chapter, we present the various definitions that have been given for the concept of tourism according to the international literature and additionally, the official definitions of the concepts of "tourism" and "tourist" that have been formulated by the World Tourism Organization (WTO) are given. Finally, the concept of tourism is described as an economic activity, the course of international tourism and its contribution to the Greek economy. In the second chapter, determinants of tourism demand and its characteristics are mentioned. Moreover, in the third chapter there is an extensive literature review of previous studies in the context of analysis of the international tourism demand. In particular, we present the main models (chronological, econometric and artificial intelligence), estimation methods, dependent and independent variables and error metrics as well.

In the fourth chapter, empirical analysis of the tourism demand of Greece is carried out using static and dynamic data panels. Then, through necessary statistical tests, an effort is made to select a suitable econometric model that better explains the data. Finally, the conclusions that are deducted from this analysis are presented.

Περίληψη

Η παρούσα μεταπτυχιακή εργασία έχει ως στόχο να διερευνήσει τις αιτίες που επηρεάζουν την διεθνή τουριστική ζήτηση της Ελλάδας. Η ανάλυση βασίζεται σε ένα πάνελ δεδομένων από 34 χώρες οι οποίες αποτελούν το 91,5% περίπου της συνολικής τουριστικής ζήτησης στην Ελλάδα κατά την περίοδο 2000-2015, προκειμένου η μελέτη να συμπεριλάβει την χρηματοπιστωτική κρίση του 2008 και την επακόλουθη κρίση χρέους ώστε να εξάγει πιο ασφαλή συμπεράσματα. Η ζήτηση για τουρισμό εκτιμάται χρησιμοποιώντας στατικές και δυναμικές εξισώσεις που λαμβάνουν τον αριθμό αφίξεων των τουριστών από τις χώρες προέλευσης τους ως εξαρτημένη μεταβλητή. Οι επεξηγηματικές μεταβλητές που χρησιμοποιήθηκαν για να εξηγήσουν την συνάρτηση ζήτησης έχουν ποσοτικό χαρακτήρα και είναι κυρίως οικονομικές και δημογραφικές. Για την εκτίμηση των συντελεστών παλινδρόμησης χρησιμοποιήθηκαν στατιστικές μέθοδοι που λαμβάνουν υπόψη την πολυπλοκότητα των δεδομένων πάνελ. Ακολουθήθηκαν οι μέθοδοι OLS, FE, RE και GMM-SYS με την χρήση του στατιστικού πακέτου Stata/SE 12.

Η παρούσα μελέτη διαφοροποιείται σε σχέση με προηγούμενες εμπειρικές μελέτες στην ανάλυση της διεθνής τουριστικής ζήτησης της Ελλάδας καθώς χρησιμοποιεί ένα πολύ μεγάλο σύνολο δεδομένων που περιλαμβάνει τις περισσότερες χώρες προέλευσης των τουριστών και χρησιμοποιεί πρόσθετες επεξηγηματικές μεταβλητές. Πιο συγκεκριμένα, η εργασία αποτελείται από δύο μέρη το θεωρητικό και το εμπειρικό και έχει την ακόλουθη μορφή:

Στο *πρώτο κεφάλαιο,* παρουσιάζονται οι διάφοροι ορισμοί που έχουν δοθεί για την έννοια του τουρισμού σύμφωνα με την διεθνή βιβλιογραφία και στην συνέχεια δίνονται οι επίσημοι ορισμοί των εννοιών «τουρισμός» και «τουρίστας» όπως αυτοί έχουν διαμορφωθεί από τον Παγκόσμιο Οργανισμό Τουρισμού (WTO). Τέλος, παρατίθεται το φαινόμενο του τουρισμού ως οικονομική δραστηριότητα, η πορεία του διεθνούς τουρισμού και η συμβολή του στην Ελληνική οικονομία. Στο *δεύτερο κεφάλαιο,* γίνεται αναφορά στους προσδιοριστικούς παράγοντες που επηρεάζουν την ζήτηση του τουρισμού καθώς και στα χαρακτηριστικά που την διακρίνουν. Έπειτα, στο *τρίτο κεφάλαιο* γίνεται μια εκτενής βιβλιογραφική επισκόπηση σε προηγούμενες έρευνες στα πλαίσια της ανάλυσης της διεθνούς τουριστικής ζήτησης. Πιο συγκεκριμένα, εκθέτουμε τα κυριότερα μοντέλα (χρονολογικά, οικονομετρικά και τεχνητής νοημοσύνης), τις μεθόδους εκτίμησης, τις εξαρτημένες και ανεξάρτητες μεταβλητές καθώς και τους δείκτες σφάλματος.

Στο τέταρτο κεφάλαιο πραγματοποιείται η εμπειρική ανάλυση της τουριστικής ζήτησης της Ελλάδας χρησιμοποιώντας στατικά και δυναμικά πάνελ δεδομένων. Στη συνέχεια μέσα από απαραίτητους στατιστικούς ελέγχους, γίνεται προσπάθεια για την επιλογή ενός κατάλληλου οικονομετρικού μοντέλου που επεξηγεί καλύτερα τα δεδομένα. Τέλος, παρουσιάζονται τα συμπεράσματα που εκπίπτουν από τη συγκεκριμένη ανάλυση.

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List of Abbreviations

Abbreviations	Meaning
AGARCH	Asymmetric Generalized Autoregressive Conditional Heteroskedasticity
AIDS	Almost Ideal Demand System
ANN	Artificial Neural Networks
APARCH	Asymmetric Power ARCH model
ARCH	Autoregressive Conditional Heteroskedasticity
ARDL	Autoregressive Distributed Lag
ARIMA	Autoregressive Integrated Moving Average
ARMA GARCH	Autoregressive Moving Average GARCH
ARMA-AGARCH	Autoregressive Moving Average AGARCH
CCC-MGARCH	Constant Conditional Correlation Multivariate GARCH Models
CEPII	Centre d' Etudes Prospectives et d' Informations Internationale
CPI	Consumer Price Index
EC-LAIDS	Error Correction - Linear Almost Ideal Demand System
ECM	Error Correction Model
EGARCH	Exponential Generalized Autoregressive Conditional Heteroskedasticity
ER	Exchange Rate
FE MODEL	Fixed Effect Model
GA	Genetic Algorithms
GARCH	Generalized Autoregressive Conditional Heteroskedasticity
GDP	Gross Domestic Product
GJR-GARCH	Glosten - Jagannathan - Runkle GARCH
GLS	Generalized Least Squares
GMM-DIFF	Generalized Method of Moments-Differences
GMM-SYS	Generalized Method of Moments-Systems
IMF	International Monetary Fund
LAIDS	Linear Almost Ideal Demand System
LM	Lagrange Multiplier
MA	Moving Average
MAD	Mean Absolute Deviation
MAPE	Mean Absolute Percentage Error
MSE	Mean Square Error
NGARCH	Nonlinear Asymmetric GARCH
OLS	Ordinary Least Squares
POOLED OLS	Pooled Ordinary Least Squares

RE MODEL	Random Effect Model
RMSE	Root Mean Square Error
RMSPE	Root Mean Square Percentage Error
SARIMA	Seasonal Autoregressive Integrated Moving Average
SEM	Structural Equation Model
SES	Simple Exponential Model
SMA	Simple Moving Average
SVM	Support Vector Machine
SVR	Support Vector Regression
TVP	Time Varying Parameter
VAR	Vector Autoregression model
VECM	Vector Error Correction Mechanism
WTO	World Tourism Organization
WTO	World Trade Organization
WTTC	World Travel and Tourism Council
GDP	Gross Domestic Product
UN	United Nations

CHAPTER 1 INTRODUCTION

1.1 Tourism

Tourism is not a new phenomenon that arose in modern industrial societies but existed from antiquity, the Roman period, the Middle Ages and the Renaissance.

The word "*tourist*" appeared for the first time in the United Kingdom at the beginning of the 19th century, coming from the French word "*tour*" and portraying the young English nobles who, for pleasure, were doing the "*great tour of France*". It originated and was first presented by Samuel Pegge in an English Athletic Magazine in 1811.

The 20th Century, with the great economic, social, technological and political evolutions that characterize it, transforms the tourism of the elite of the 19th century into a phenomenon of mass consumption. The substantial development of the international tourist phenomenon takes place after the end of the Second World War, especially in the last quarter of the 20th century and in the early 21st century, where it appears to have real industrial structures.

The Austrian economist Herman von Schullard (1910) defined tourism as: "*all economic enterprises directly related to the entry, stay and migration of foreigners inside and outside a particular country, city or region*".

N. Eginitis (1929) states that: "*Tourism is a country-to-country or a place-to-place transition of individuals into groups or individually, for the purpose of small or large, but not permanent, residence, generally for leisure, without the exercise of a profession*".

The International Tourism Academy defines tourism as "*the whole of human movements and the activities that emerge from them, which (movements and skills) are caused by the externalization and realization of the desire of each individual to escape and which is manifested in various levels and varying intensity for each individual*" (Varvaressos 1997).

N. Leiper (1979) divided the approaches to the definition of tourism into three categories: a) Economic type, which considers tourism as a branch of activities or industry. b) Technical type, who considers tourism as a subject of achieving a common base in order to implement a tourist information system. c) Integrated definitions that attempt to cover the entire spectrum of the phenomenon.

Similarly to Leiper, Bukhart and Medlik (1981), they suggested separating the definitions of tourism into a theoretical and technical context. The theoretical framework should encompass both the characteristics and the separation from other phenomena. On the other hand, the purpose of the visit should be included in the technical context. More specifically, they defined tourism as: "*Tourism is the set of phenomena and relationships arising from travel and residence of non-residents in a destination, provided they do not lead to permanent residence at the destination and are not linked to any gainful activity*".

Another definition according to the international literature is: "*The sum of the phenomena and relationships that arise from the interaction of tourists, businessmen and governments in the process of attracting and hosting these tourists and other visitors*" (Macintosh and Goeldner, 1986).

Tourism is a necessary part of the economic activity of each country that develops it, particularly in relation to the increase of foreign exchange, the production of additional income and the creation of employment opportunities and certainly contributes to the reduction of poverty and sustainable human development (Karagiannis and Exarchos 2006). According to the World Tourism Organization (WTO), tourism is the largest industry in the world. As we perceive, "*tourism*" is a broad concept and has many interpretations by various scholars during the 20th century and as a result it can be understood and defined in many different ways.

However, the definition that we will take into account in this study that is adopted by almost every writer, is proposed by the World Tourism Organization (WTO) and is used for statistical analysis. It defines "*tourism*" as "*the activities of persons traveling and residing in places outside their normal environment for no more than one consecutive year for recreational, professional and other purposes not related to the pursuit of their activity*".

Internationally, there are 6 distinctions of tourism in relation to the destination.

- Domestic tourism: refers to residents of a country who travel only within it.

- Outbound tourism: refers to residents of a country who travel to another country.
- Inbound tourism: refers to foreigners who travel to one country.
- Domestic tourism: refers to both domestic and inbound tourism.
- National tourism: refers to domestic and outbound tourism.
- International tourism: refers to outbound and inbound tourism.

The World Tourism Organization (WTO) also interprets the term "*tourist*" as "*temporary visitors residing in a place other than their habitual residence for a continuous period of at least 24 hours but less than one year for leisure, recreational, cultural, business or other purposes*".

Based on the above definition, tourists are divided into 2 categories based on their length of stay at the destination.

- An international tourist who travels and stays in a foreign country for more than 24 hours and less than a year.
- A domestic tourist who travels and resides in different areas within his country.

In March 1993, the United Nations Statistics Committee adopted the above definitions of the World Tourism Organization (WTO) for both tourism and the tourist. There is a clear distinction for both motivation and duration. Visitors with tourist incentives, that is people who travel for leisure, visits to friends and relatives for business or religious reasons, are included in tourism statistics, while visitors entering to practice such as frontier workers, diplomats, military or temporary migrants or transit passengers, are not included in the notion of "*tourist*". Also in terms of duration, tourists spend at least one overnight stay, otherwise they are called excursionists. The following figure illustrates the distinction between travelers accepted by the World Tourism Organization (WTO).

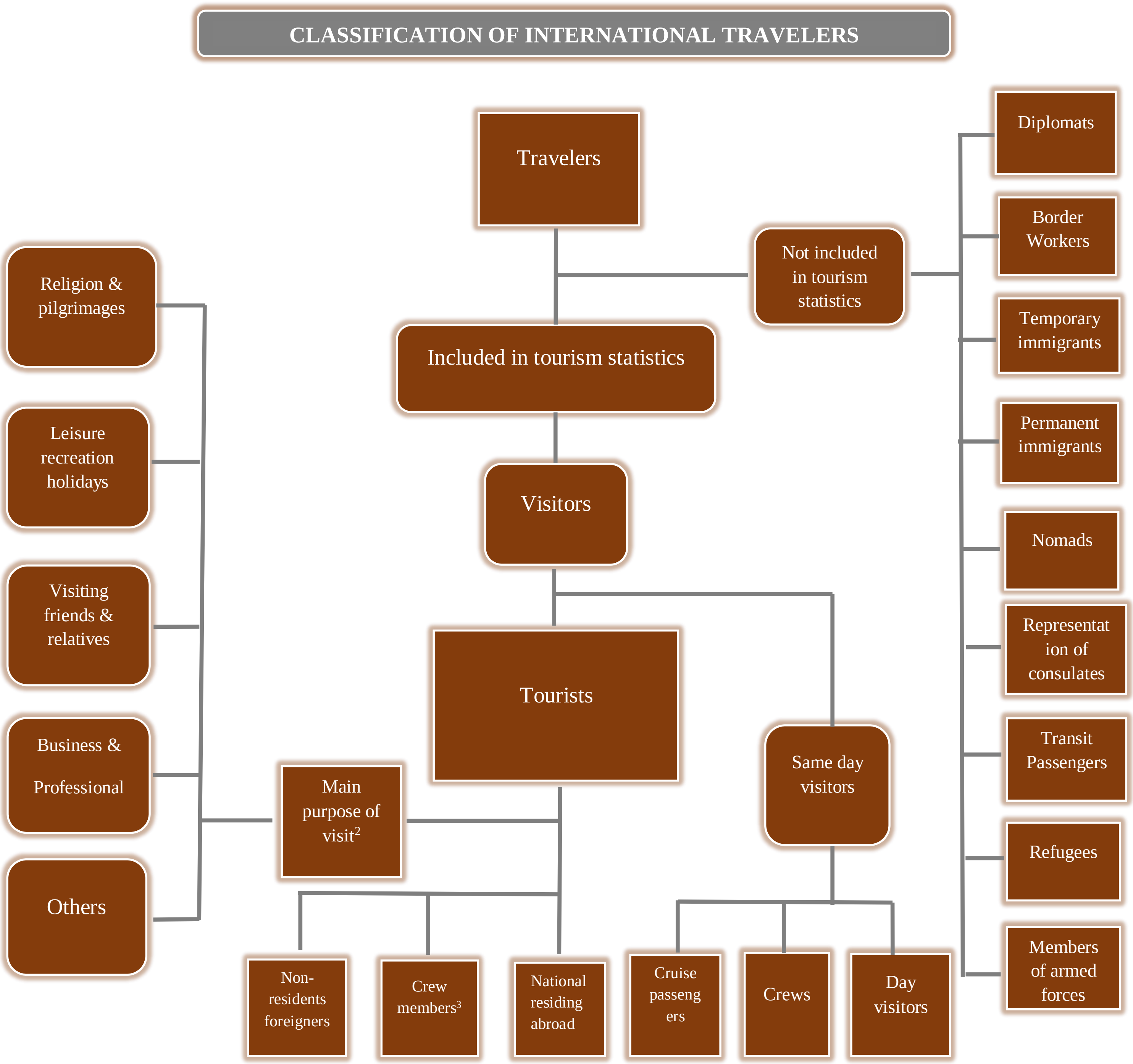

Figure 1 Classification of International Travelers

1.2 Tourism as Economic Activity

Tourism globally is a very large economic activity, whose dimensions over the last decade have pushed the tourist-generated World Gross Product of Goods and Services more than 4.5 trillion dollars and the total direct and indirect induced employment of more than 230 million workers.

The tourism industry plays a very significant role in the development of the economies of the countries by creating jobs, revenues, increasing production, exports and having a positive impact on the current account as one of the key foreign exchange flows. From 2000 to 2016 the tourist industry is constantly growing. The industry contributes 10.2% of global GDP and produces 1 in 10 jobs and is expected to continue to grow over the next decade.

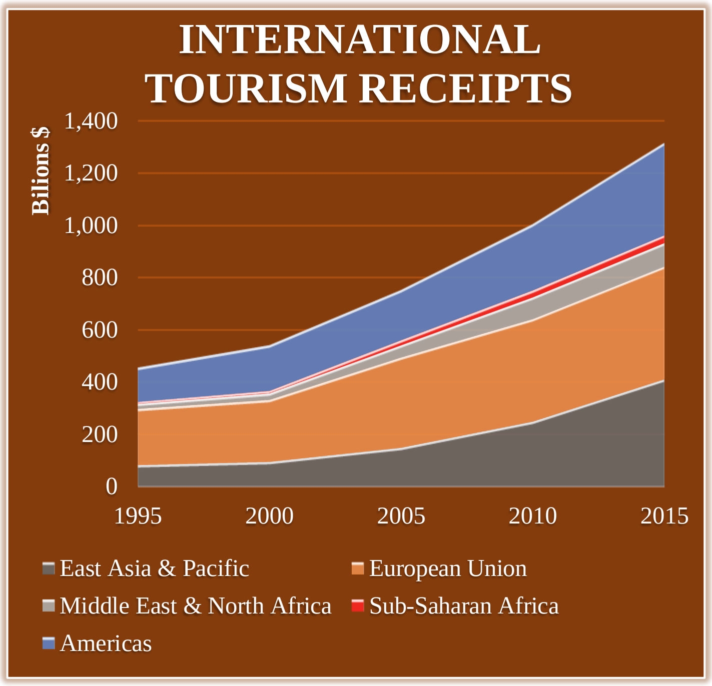

Figure 2 International Tourism receipts
Source: Author's calculations based on World Bank Organization statistics

Similarly, global tourism receipts worldwide have risen from $ 450 billion in 2000 to $ 1,220 billion in 2016 as shown in Figure 2. The European Union collects the largest tourist revenue. In addition, the East Asian and Pacific region shows a strong increase in the world market share. In addition to the above benefits, tourism generates substantial capital investment in tourism development projects such as ports, airports and roads that in turn bring multiple benefits to the economic development of a country.

It is obvious that the effects of economic impacts will vary from country to country, depending on circumstances, such as the tourism life cycle, local tourism promotion strategies and the use of adequate information systems and marketing strategies.

1.3 The progression of International Tourism

International tourism is vulnerable to global economic and political developments. This is recognized by the impact on international arrivals affected by 2001 terrorist attacks in America, the 2008 financial crisis and rising oil prices. It is even affected by disasters due to natural phenomena (such as floods, earthquakes, hurricanes, volcanic eruptions), technical disasters (nuclear accidents) or epidemics. However, tourism is recovering in a relatively short period of time, and thus, in spite of individual fluctuations, international tourism has a long-term positive and sustainable progression. As we can see in Figure 3, the evolution of international tourism has an increasing trend.

Figure 3 International Tourism Demand
Source: Author's calculations based on World Bank Organization statistics

On the basis of the above mentioned data from the World Tourism Organization, the total arrivals of tourists in 2000 amounted to 677.310.865 million, while they amounted to 677.515.947 million in 2001. In fact, they remained almost stagnant due to the political instability prevailing in the terrorist attacks in the United States. Similarly, we note that the 2008 financial crisis and the rise in oil prices have significantly affected international tourist arrivals, showing a decline of 4.20% compared to 2009.

International tourist arrivals in 1960, according to the World Tourism Organization, were 69 million. At that time, the tourist product was a luxury item and was targeted at the middle and upper income strata. Over the years, increased international flights, technology, reduced travel costs, and people's changing attitudes towards travel have increased international arrivals. Travel agents have also helped increase touristic activity, making it easier for tourists to prepare and organize their trips and, on the other hand, reduce travel costs by offering tourist packages. The rapid increase in global GDP and technology played an important role that led to the number of trips in millions.

Global GDP as shown in Figure 5, amounted to 1.3 trillion in 1960, while in 2016 it was 75.4 trillion. The number of people moving now is remarkable. Looking at Figure 4, in 2016 international tourist arrivals reached 1.23 billion approximately. Compared to 1960, tourist arrivals in 2016 increased by 16 times, while in the corresponding period the population of the land doubled.

Figure 4 World Gross Domestic Product
Source: Author's calculations based on World Bank Organization statistics

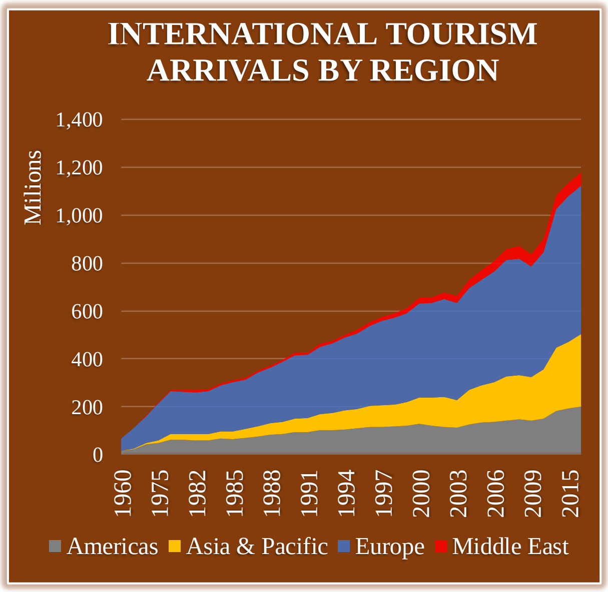

Figure 5 International Tourism Arrivals by region
Source: Author's calculations based on World Bank Organization statistics

The main bulk of tourists comes from developed countries. In 1995, tourists coming from developed countries accounted for 61.8% of total international arrivals (about 324.830.000 million). Accordingly, tourists coming from developing countries accounted for 27.6% (about 145.371.500 million). We notice that over the last 20 years, tourists from developed countries almost doubled to 638.591.000 million travelers. Similarly, tourists from developing countries showed a larger increase of about 217%

reaching 461.425.900 travelers. Perhaps, this is due to the resilience of international tourism or that the terrorist acts and the financial crisis we mentioned concerned mostly developed economies. In Figures 6 and 7, we notice that in the years 2008 and 2009, the decrease was higher in developed economies by 4.48% compared to the growth where there was a decrease of 2.89%.

In addition, Figure 7 shows that while tourists coming from developed economies have increased nominally, however, as shown in Figure 6, as a percentage of the total, they have experienced a decrease of approximately 8.65% over the last 20 years. Similarly, tourists from developing economies increased by 10.77% as a percentage of total arrivals during the same period.

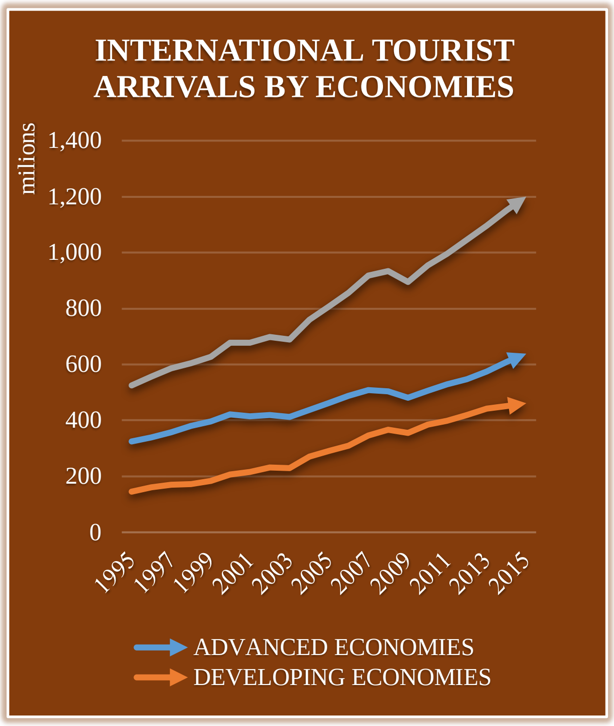

Figure 7 International Tourists Arrivals by Economies
Source: Author's calculations based on World Bank Organization statistics

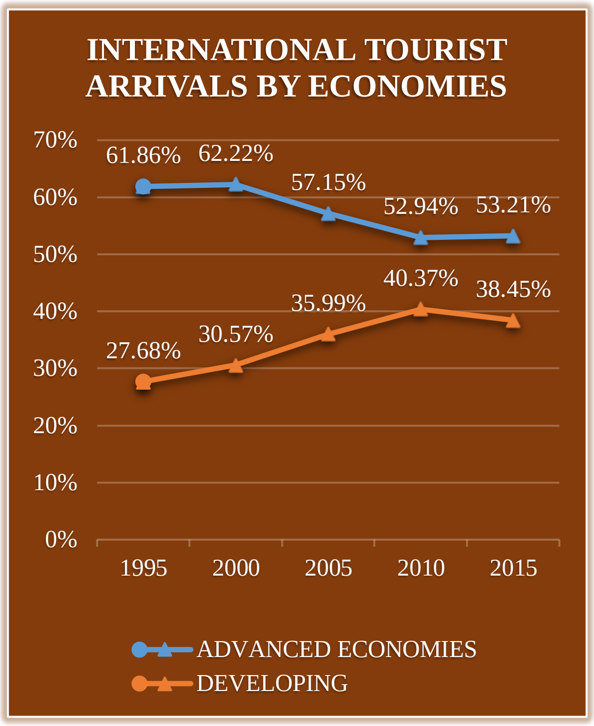

Figure 6 Share of International Tourist Arrivals by Economies
Source: Author's calculations based on World Bank Organization statistics

In general, developed economies come mainly from Europe by 72.50%, and if the region of America is included it then reaches 80%. In these developed economies, security is one of their priorities, as it is a prerequisite for democracy and freedom. This explains the large decline of tourists from developed economies as a percentage of total arrivals from 2001 to 2010 by approximately 9.28%. At this time, terrorist attacks increased, we had natural disasters at popular destinations such as the 2004 Phuket tsunami and the 2008 financial crisis in the United States, which later expanded to Europe.

Developing countries to a great extent come from areas mainly Asia-Oceania, Africa and the Middle East. In recent decades, regions have had a small share of world GDP and because of the exchange rates their citizens have been unable to travel internationally. Since 1980, tourists from the Asian and Oceans region have increased steadily their share of total international tourist arrivals from 8.2% to 24.5%.

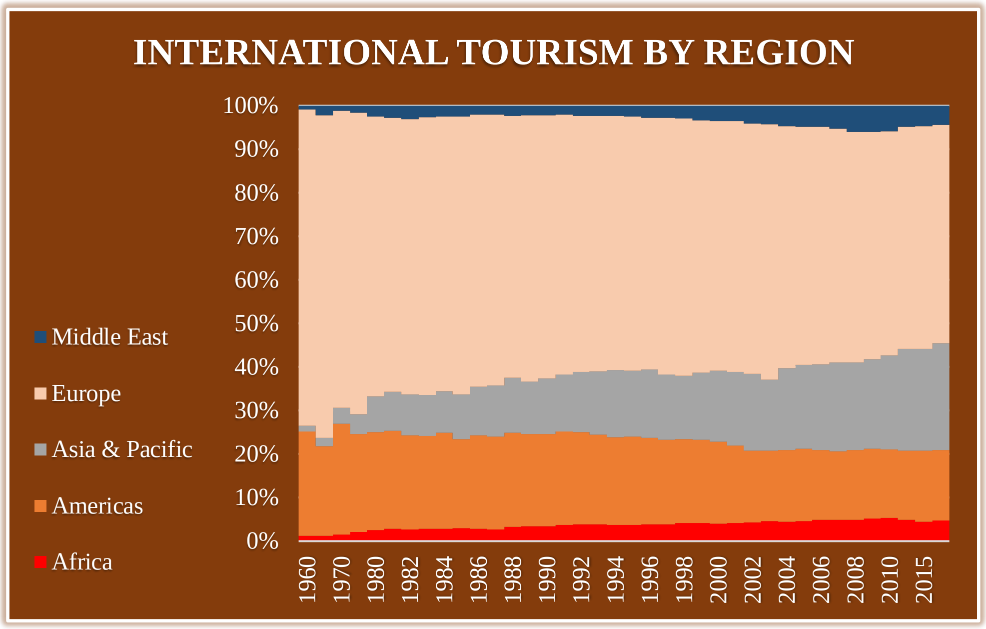

Figure 8 International Tourism by region
Source: Author's calculations based on World Bank Organization statistics

As a result, we expect to create more international tourist flows in these areas if we consider the economic development of some African countries such as Ethiopia, which in 2015 was the fastest growing economy in the world with a 9.6% increase in GDP and Côte d'Ivoire with Congo with an 8% increase in their GDP. Six out of ten fastest growing countries from 2016 until today are African according to the International Monetary Fund, as shown in Figure 9. Since 2005, direct investment in the region has increased more than 50%. This trend is expected to continue over the next decade.

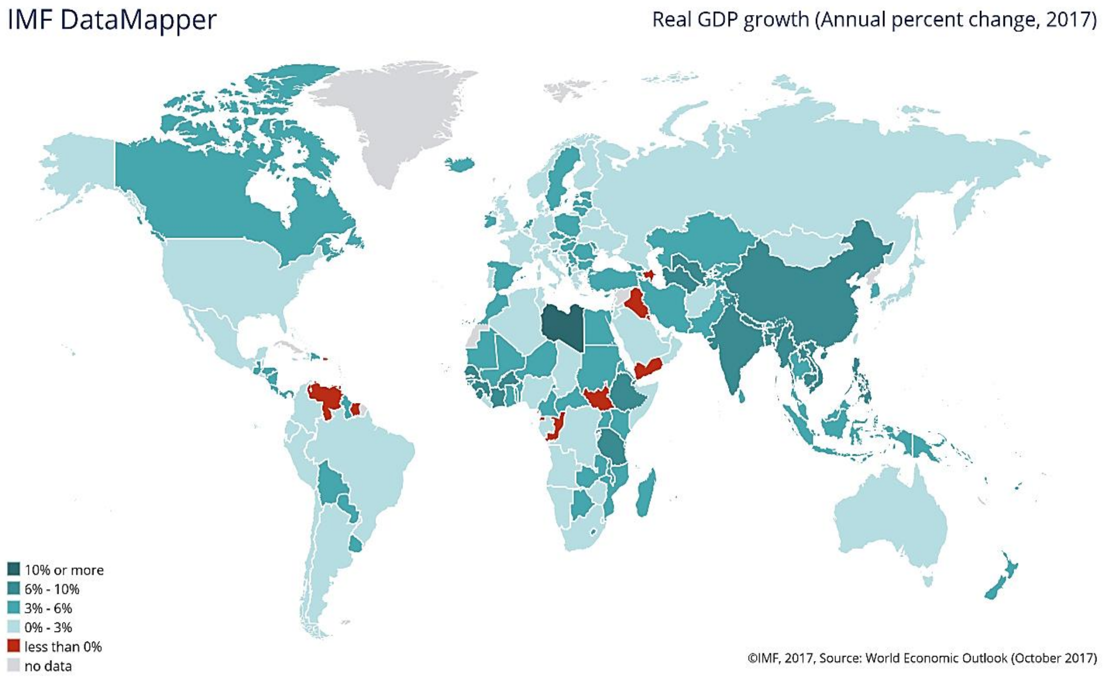

Figure 9 Real Gross Domestic Product (Annual percent change, 2017)
Source: International Monetary Fund

1.4 The contribution of Tourism in Greek Economy

In countries with intense inbound tourism, such as Greece, tourism plays an important role for the country's economy. Revenue from tourism, according to data of the Bank of Greece, accounts for the largest share of the country's total foreign exchange earnings, followed by export earnings from industrial and craft products.

The overall impact of tourism on the Greek economy is distinguished by direct, indirect and induced. The direct impact includes the initial costs of tourists. It concerns money spent by tourists on staying in hotels and various other accommodations, food and beverages, entertainment, transporting them by any means, various sports - cultural events. The above costs increase the income of the companies in these sectors, the employment and amount of the necessary supplies, wages and taxes to the state. The indirect impact of tourism on the economy stems from the money spent by tourists on other industries in the economy and the changes in production from suppliers of these products to meet extra demand. In order to make the most of the income from the indirect impact of tourism on the economy, it is important to have a central policy so that businesses directly involved in tourism can obtain products or services that are produced or manufactured domestically. The impact of tourism on the Greek economy stems from the level of household spending for various goods and services that are employed both in businesses directly involved in tourism and in businesses that have an indirect effect.

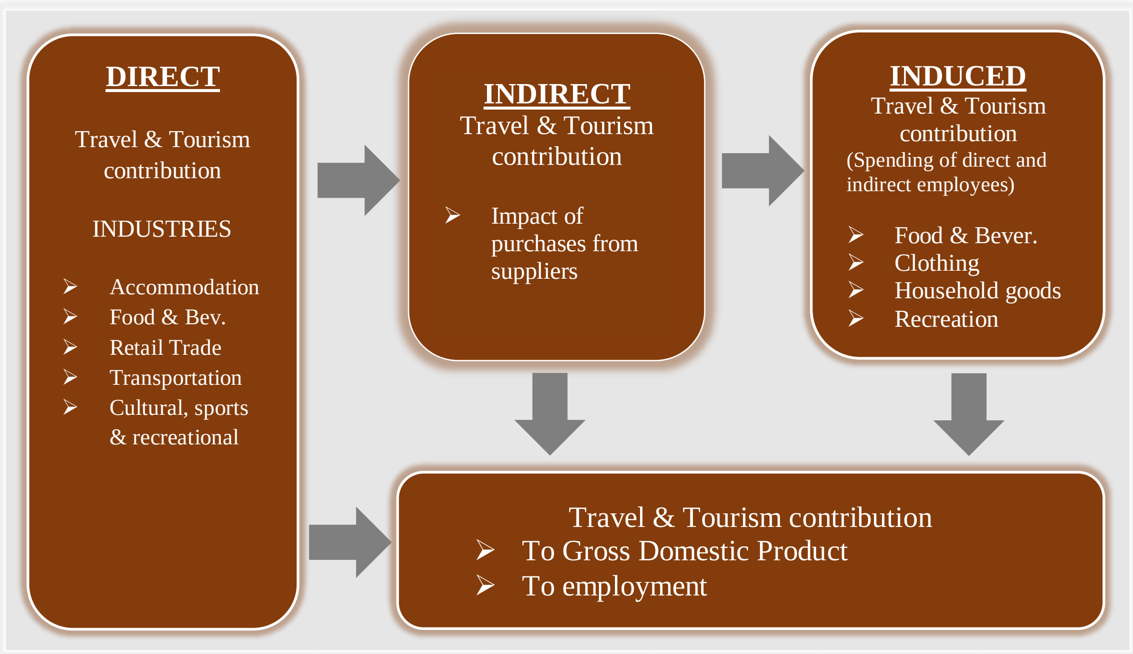

Figure 10 Components of Direct, Indirect & Induced tourism contribution to GDP
Source: WTTC 2012 based on Oxford Economics Travel & Tourism Economic Impact Research

In 2016, tourism's direct contribution to GDP (% of GDP) for Greece was 7.5% when the average direct impact of tourism at EU level was only 3.7%. Although the direct contribution of Greek tourism to GDP fluctuated in the decade 2000-2010, from 2010 onwards, it has risen to 7.5% in 2016 and 28th in the world as we see in Table 1 and Figure 11.

TRAVEL AND TOURISM DIRECT CONTRIBUTION TO GDP		2016 %share
19	Croatia	10,73
28	**Greece**	**7,5**
30	Cyprus	7,19
36	Portugal	6,42
49	Spain	5,12
56	Italy	4,62
64	Turkey	4,13
	European union	**3,7**
79	France	3,63
94	Egypt	3,25
	World	**3,1**
141	Israel	1,92

Table 1Travel & Tourism Direct contribution to GDP Source: World Atlas Data based on Oxford Economics

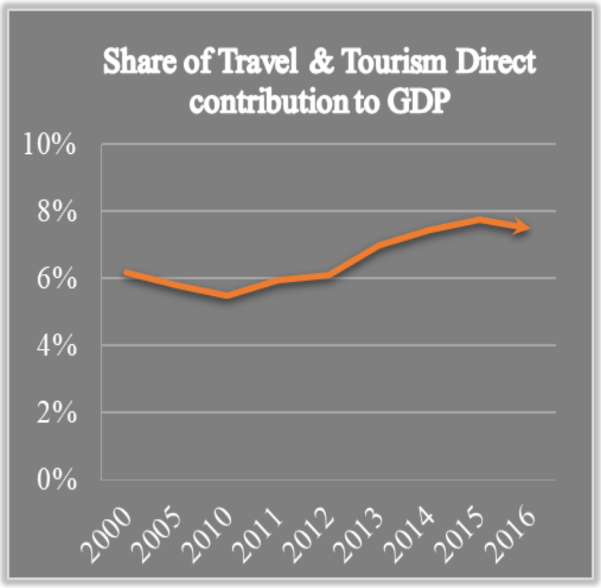

Figure 11 Share of Travel & Tourism Direct contribution to GDP Source: Author's calculations based on World Atlas Data

At the European Union level, the largest international tourism force, tourism contributes 10.2% to GDP. In Greece, the respective percentages appear to be well above the average of the European Union and all the Mediterranean countries. Specifically, as shown in Table 2, Greece ranks 32nd in the world with 18.6% of total GDP. Between 2000 and 2016, the overall impact showed increasing trends despite fluctuations in the period from 2007 to 2012 (Figure 12).

TRAVEL AND TOURISM TOTAL CONTRIBUTION TO GDP		2016 %share
21	Croatia	24,7
26	Cyprus	21,4
32	**Greece**	**18,6**
38	Portugal	16,6
45	Spain	14,2
57	Turkey	12,5
64	Italy	11,1
	European union	**10,2**
	World	**10,2**
97	France	8,9
114	Egypt	7,2
122	Israel	6,8

Table 2 Travel & Tourism Total Contribution to GDP
Source: World Atlas Data based Oxford Economics

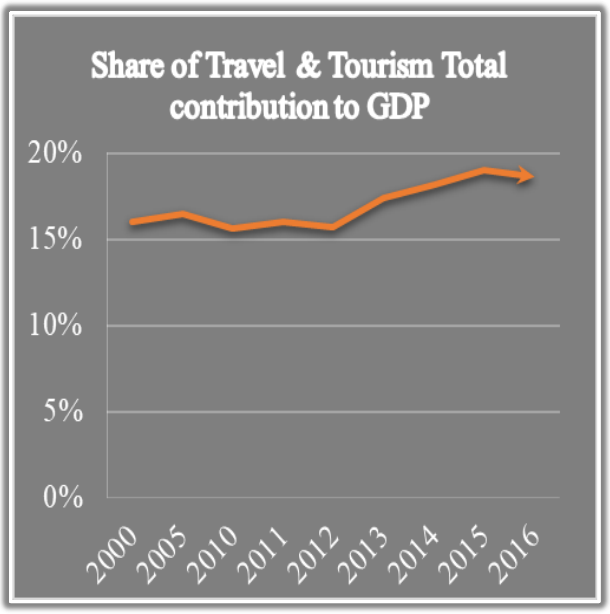

Figure 12 Share of Travel &Tourism Total contribution to GDP
Source: Author's calculations based on World Atlas Data

In addition to its contribution to GDP, tourism has made a significant contribution to the labor sector by giving a multiplier effect. According to the World Tourism Council (WTTC) data, slowly but steadily, the employment to direct employment ratio of tourism in the economy augmented from 2.64 in 2000 to around 3.0 in 2010. That means that for every Direct employment in tourism is also created, at least 2.6 to 3 jobs in the economy in general.

In 2016, tourism's direct contribution to employment (% of GDP) for Greece was 11.5%, occupying 15th place in the world and 2nd in Europe, when the average direct impact of tourism on work at EU level was 5 %. Despite the fall from 2000 to 2011, as shown in Figure 13, we see that from 2011 onwards it had enhancing trends reaching 11.5% in 2016.

	TRAVEL AND TOURISM DIRECT CONTRIBUTION TO EMPLOYMENT	2016 %share
15	Greece	11,5
19	Croatia	10
23	Portugal	8,1
27	Cyprus	7,2
44	Italy	5,5
45	**European union**	**5**
58	Spain	4,7
66	France	4,2
67	**World**	**3,6**
102	Egypt	2,9
127	Israel	2,2
148	Turkey	1,8

Table 3 Travel & Tourism Direct Contribution to Employment
Source: World Atlas Data based Oxford Economics

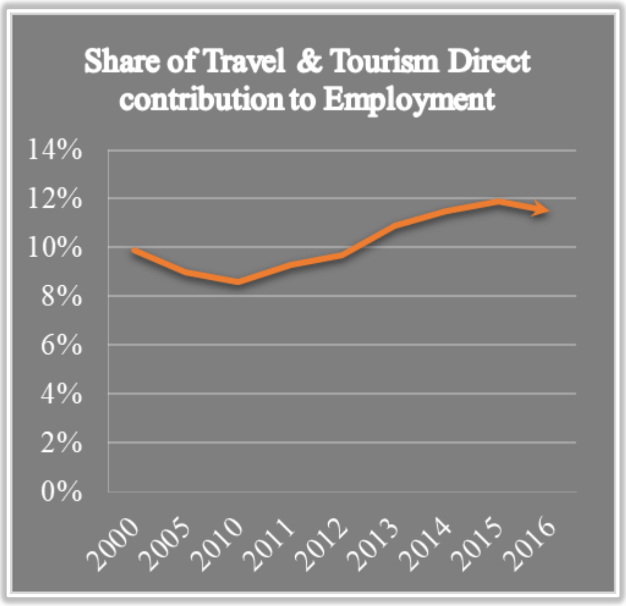

Figure 13 Share of Travel & Tourism Direct Contribution to Employment
Source: Author's calculations based on World Atlas Data

Tourism created 423.000 jobs directly in 2016 and grew more by 5.9% in 2017 to 448.000 (12.1% of total employment). That includes employment from hotels, travel agents, airlines and other passenger services. It also includes, for example, the activities of restaurants and leisure businesses directly supported by the tourist.

	TRAVEL AND TOURISM TOTAL CONTRIBUTION TO EMPLOYMENT	2016 %share
23	Croatia	23,4
22	Greece	23,4
34	Cyprus	21,4
26	Portugal	19,6
43	Spain	14,5
52	Italy	12,6
	European union	**11,6**
71	France	9,9
	World	**9,6**
100	Turkey	8,1
109	Israel	7,2
116	Egypt	6,6

Table 4 Travel & Tourism Total contribution to employment
Source: World Atlas Data based on Oxford Economics

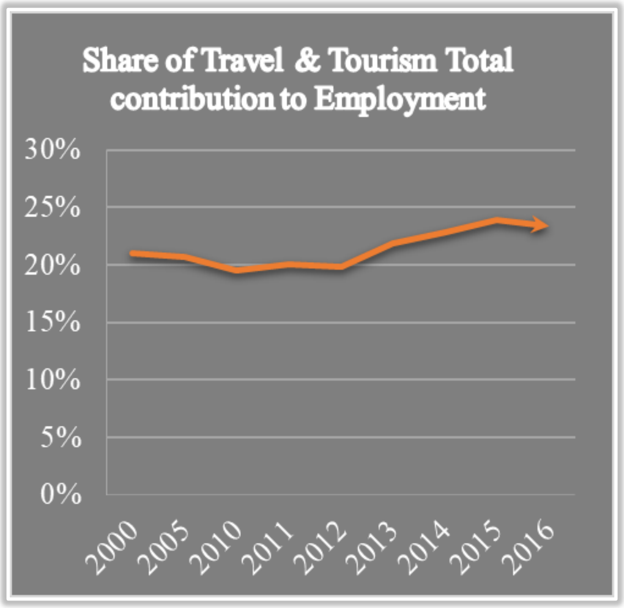

Figure 14 Share of Travel & Tourism Total Contribution to Employment
Source: Author's calculations based on World Atlas Data

The overall contribution of tourism to employment, including the wider impact of investment, supply chain and income impact, was 860.500 jobs in 2016 and accounted for 23.4% of total employment. In 2017, the jobs increased to 914.500 or 6.3%, according to the World Tourism Organization (WTO).

In addition to its contribution to the above indicators of the Greek Economy, tourism also contributes to regional development. The increase in jobs in tourist areas not only constrains the population in the region but receives an increasing number of seasonal workers from the rest of the country. The steadily growing impact of tourism on GDP and the mitigation of seasonality will cause demographic changes in Greece as the population moving to tourist areas will have a permanent character.

CHAPTER 2 TOURISM DEMAND

2.1 Introduction

The role of tourism in the economic development of a country is indisputable. The phenomenon of tourism has approached the interest of a large number of researchers in the last few decades and has dealt with the econometric literature for a better understanding and exploration of its demand. Most economic approaches to tourism demand are mainly concerned with the effects of consumer behavior on demand and are called theories of consumer behavior. A second economic approach, called economic behavior, interprets tourism demand from the point of view of the psychological and social influences caused by consumer behavior. Due to the fact that the tourist product is a complex and heterogeneous mixture, its knowledge, both quantitatively and qualitatively, is a prerequisite for a better understanding of the incentives that determine the tourist consumer behavior (Goodall and Ashworth, 1988).

The World Trade Organization (WTO) defines tourism demand as "the amount of tourist goods and services that tourists are willing to buy at specific prices in a given market and given time".

2.2 Determinants of Demand

2.2.1 Introduction

Understanding the international demand for tourism is of great importance. As a commercial and economic activity, tourism has attracted increasing attention. Balance of Payments, Strategic Planning, Forecasting Planning, and Marketing Programs of International Travel Agencies are based on an understanding of the factors affecting international tourism demand.

It is obvious that tourists' choices are shaped by the influence of a variety of factors. According to the literature, the theory that explains the tourist flows between the country of origin and the destination is based on the demand function. The product resulting from tourism demand is the desire of people to travel in a specific time period. On the host country side, tourist demand represents all the goods and services that visitors receive during the specific time period of their stay.

In recent years, a large number of empirical studies on tourism demand and the factors that determine it, have been carried out. Each of these studies provides a valuable contribution to identifying the factors that affect tourism demand to varying degrees. A plethora of determinants have been examined and the conclusions that have emerged differ greatly from one study to another (Crouch, 1992). Classical economic theory suggests that the most important determinants of tourism demand are economic factors such as tourist income and the prices of tourist products and services that are catalytically deterring the intention of a tourist trip. There are also other non-quantitative factors that affect tourists' preferences.

Each of these factors affects different people in different ways and intensity, which can be categorized as they are presented in the following subdivisions.

2.2.2 Economic Factors

Economic factors affect the size and quality of tourism demand. According to most researchers, the individual income level has been identified as the most important economic factor in tourism demand (Kwack, 1972, Proenca and Soukiazis, 2005). If a country has a high individual income, consumers are likely to buy travel services abroad.

The income elasticity of tourism demand, which is considered a luxury product, helps us to understand the choices of consumers in the various tourist products. If the tourism demand elasticity of income is negative then it is inferior tourism product such as camping, traveling to another country is by bus or train. For example, if the income increases then consumers will choose another tourism product and the demand for inferior products will decrease. On the contrary, if the elasticity of tourism demand in terms of income is positive, it is normal tourism products and if it is larger than the unit it is called luxury tourism product.

However, tourism has different forms, that is, the purpose of travel can be done for a variety of reasons. For example, a trip from Canada with a destination country to Greece can be done for different purposes, such as:

- Visit to relatives
- Professional trip

- Main vacation is Greece and its islands
- Secondary vacation in Greece, their main destination is Turkey
- Medical Conferences

As a result, the elasticity of tourism demand in terms of income has different values. We will consider that the Engels (1857) curve is a general formula. It is best described by Bull (1995), who illustrated the elasticity of tourism demand for income for various forms of tourism.

Another economic factor affecting tourism demand is the sensitivity of *tourism products prices* and their variances. In particular, the prices of tourism products are more fluctuating than those of other goods and services. The large variances are due to the unstable political-economic environment, the financial strength of a tourism accommodation or even the quality of the services offered. Apart from variance, the value of a tourism product is a variable that contains different components within it. Here, however, particular attention should be paid to the fact that the price of a tourism product may be regarded as a substitute or supplementary for others. A decrease in French domestic tourism prices may increase Spain's tourism demand because tourists coming from the United States may also visit Spain on the same voyage (Martin C. and Witt S.1988).

Exchange rates are an important economic factor because tourists have sufficient information about price changes and do not change easily in the short run. It mainly concerns middle income tourists who benefit from the difference of currencies and choose substitute tourist products with increased benefits. For example, a devaluation of the Turkish lira against the euro will increase Turkey's tourism demand because many consumers living in Greece will benefit from this change and will choose tourist packages to Turkey by reducing demand to other euro area countries.

2.2.3 Demographic Factors

Demographic factors that affect tourism demand reflect the characteristics of the population. According to Walsh (1996), factors such as urbanization, age, education level and household structure cause changes in the structure of tourism demand. The phenomenon of urbanization is linked to social and economic changes and developments in an area. It is a global and long-term phenomenon that affects both developed and developing countries. People living in urban centers meet needs such as easy access to university health care units, higher education, social recognition, art, and so on. On the contrary, they lose touch with the nature and tranquility they give to humans. The fast pace of urban life, increasing air pollution and increased noise levels affect human health (Laurent 1973). Thus, people in large urban centers feel compelled to "escape" for some time participating in travel activities (Tsartas, 1996). According to the United Nations (UN), 50% of the world's population lived in urban areas in 2010, and it is estimated that70% of the world's population will live in urban areas in 2050. As we can see in Figures 15 and 16, the trend of all countries in the world for urbanization is upward, with the slope of the relative curve in the less developed countries more pronounced. The degree of urbanization affects not only tourism demand but also various forms of tourism.

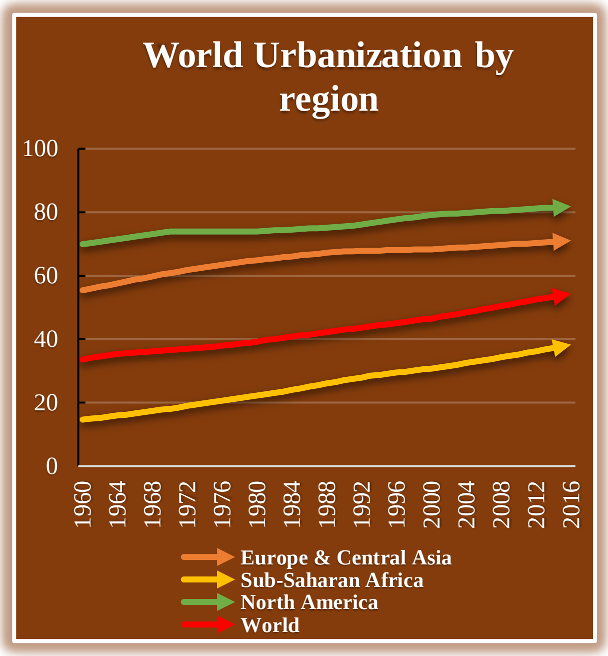

Figure 16 World Urbanization by Region
Source: Author's calculation based on World Bank Organization statistics

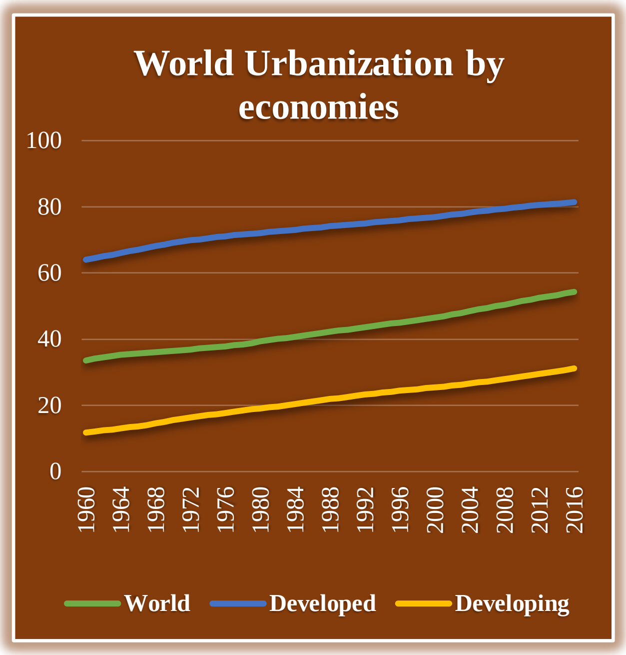

Figure 15 World Urbanization by Economies
Source: Author's calculation based on World Bank Organization statistics

Age is also an important demographic factor. Older people have difficulty engaging in tourist travel. More than half of Europe's population aged over 65 (52%) did not participate in tourist travel (Figure 17), which means that not having made any trip for personal purposes at least one overnight stay in 2014. It was by far the highest proportion of people who do not participate in tourism in any age group. Among the rest of the population (people aged 15-64), only 37% on average did not travel. The age groups from 15 to 64 choose to travel to far-off destinations by 11.6% to a greater extent than the age groups of 65 and older who choose distant destinations by 7%. Health issues led to failure of traveling 48% for ages 65 and over. While for the other age groups the most common reason they failed to travel was economic.

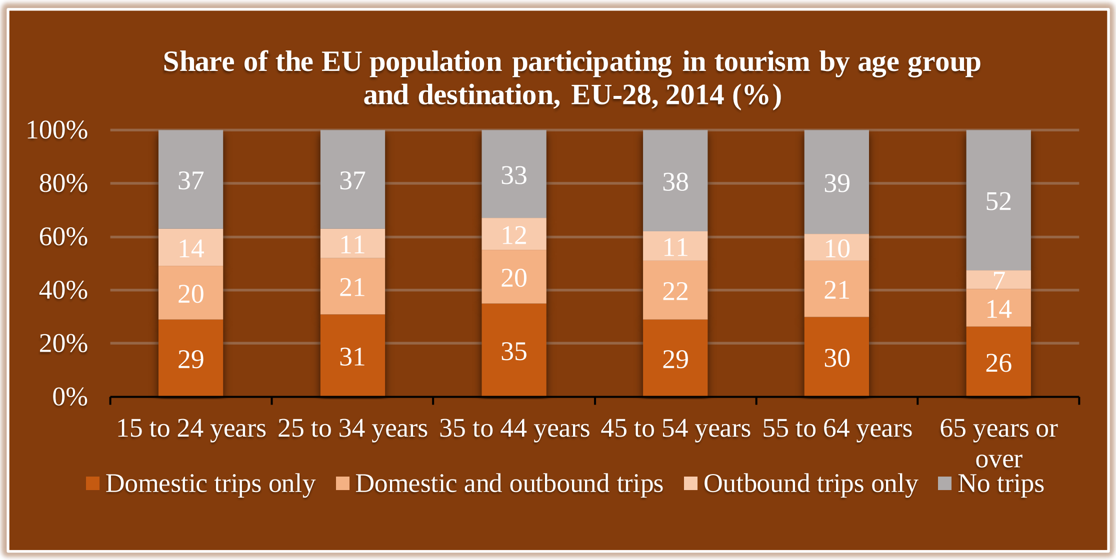

Figure 17 Share of the EU population participating in tourism by age group 2014
Source: Eurostat

Figure 18 Main reasons reported not participating in tourism by age group 2014
Source: Eurostat

Significant demographic factors in tourism demand but with less intensity, are the level of education as educated people have better information and different motivations to travel. The influence of the marital status could not be omitted, as the existence of children for example can act as a deterrent to international travel choices. In addition, the population influences tourism demand. As the population of origin country grows, the demand for tourism will be higher as it reflects the size of the market (Munoz and Amaral, 2000).

2.2.4 Psychological Factors

Psychological factors complement socioeconomic if we want to give a more dynamic approach to factors that influence tourism demand. They are considered vital and important in the study of tourism due to their impact on the decision making process (Callwood 2013). The tourism product is essentially a way out of everyday life. It is the product through which people seek to satisfy their various psychological needs (Kamau et al., 2015). These needs vary from person to person and depend on the characteristics of his personality, his wishes and interests. According to Gray (1970), tourism related to visiting cultural monuments, learning different cultures, social organizations and tastes is about international tourists.

Crompton (1979) found that the main psychological factor in a person's need for vacation was to escape from the routine both in the professional and family environment. The incentives concerned the need for respite, relaxation, prestige, discovery of ourselves, and the expansion of social relations. Motivation is a driving force that drives us to move and plays a decisive role in determining the decision-making process and the behavior of tourists (Snepenger et al., 2006). Yimsrisai and Khemarangsan (2012) named these motives as factors driving a person's adventure to stimulate his senses and feelings by doing different things, such as meeting different lifestyles and cultures, getting to know new places, being relieved by finding interesting people, escaping from routine, having fun, relaxing, increasing his knowledge, making new friendships, visiting places that have not visited before and then talking about the experienced their roles.

2.2.5 Political Factor

Political factors greatly influence a country's tourism demand (Neumayer, 2004). Political instability is a deterrent in shaping tourism demand. Tourists are turning their search into other safer destinations. Political instability is basically the situation of a country experiencing civil or international wars, coup d' etat, social riots and strikes.

There are many representative examples that prove the aforementioned. The war in Iraq in 1990 created a wider impact on the Middle East's tourism demand (McGheey, 2006).

A similar example is the war and the dissolution of Yugoslavia in 1992, which significantly reduced the tourist flows to Bosnia, Croatia and Serbia (Dincer et al., 2013). Also, terrorist acts are dissuasive. The tourist wants to feel secure. If we look closely at Turkey's tourist arrivals in 2015 amounted to 36.244.632 million. From the beginning of the year 2016 terrorist attacks began and lasted throughout the year (12/1, 12/2, 13/3, 19/3, 7 / 6, 28/6, 20/8, 26/8, 9/10, 4/11, 24/11, 10/12, 17/12) in various Turkish cities. As a consequence of the continuing terrorist actions, the total tourist arrivals of the country by 30%, which amounted to 25.352.213 million, were greatly reduced. In the following table we also see the individual changes in the main tourist arrivals by country of origin of Turkey for the years 2015-2016,

TURKEY TOURIST ARRIVALS		2015	2016	(%)
2	Poland	500.779	205.701	-58,92
3	Czech Republic	212.464	87.328	-58,90
4	Italy	507.897	213.227	-58,02
5	Japan	104.847	44.695	-57,37
6	Australia	225.762	97.626	-56,76
7	Spain	236.063	106.582	-54,85
10	Sweden	624.649	320.580	-48,68
11	Norway	282.210	156.215	-44,65
12	Switzerland	380.338	215.194	-43,42
13	Canada	187.615	106.285	-43,35
14	U.S.A.	798.787	459.493	-42,48
15	Finland	213.803	122.185	-42,85
16	Austria	486.044	310.946	-36,03
17	France	847.259	555.151	-34,48
19	United Kingdom	2.512.139	1.711.481	-31,87
20	Germany	5.580.792	3.890.074	-30,30
21	Netherlands	1.232.487	906.336	-26,46
22	Greece	755.414	593.150	-21,48

Table 5 Turkey's Tourist Arrivals 2015-2016
Source: Authors' calculation based on Turkish Ministry of Culture and Tourism

2.2.6 Cultural Factors

The cultural factor is just as important for the development of tourism demand in a country. Cultural attractions attract an ever increasing number of tourists and are used by countries as a comparative advantage for attracting tourists. Such places are archaeological and historical monuments such as the Acropolis in Greece, pyramids in Egypt, Taj Mahal in India, the ancient city of Petra in Jordan, etc., as well as museums such as the Louvre Museum in France, the National and Archaeological Museum in Athens and the Museum of Natural History in London. Various festivals such as the Brazilian Carnival in Rio de Janeiro, the famous music festival in Belgium and the beer festival in Germany.

2.2.7 Technological Factors

The technological factors affecting demand are expected to be the second most important factor after the financial ones over the next two decades. The enormous development of information systems, the Internet and mobile telephony has helped to provide potential tourists with quick and easy access to information on the right choice of tourist destinations while reducing costs, and not only. In recent years in many City Hotels, a tourist has the ability to verify his identification, make reservations, and execute his payments with just one credit/debit card.

With the development of new technologies that have also taken place in the transport sector since 1960, transport is becoming easier and cheaper, which raises the demand for tourism. In particular, it has driven tourism demand for long-distance destinations. With the emergence of low-cost airlines over the last decade, we have had a real "explosion" in aviation.

The main advantage of connecting regional airports with small aircraft was the activation of intra-regional tourism between urban centers. In the figure below, we notice that passengers who used an airplane for their journeys increased radically. From 2006 to 2016, European citizens and those in Central Asia increased their air travel by 68%, in Asia and the Pacific by 137%. Similarly, in the Middle East and North Africa the increase was rapid (255%). In this particular area, an important role was played by the effort to promote Dubai as a world trade center.

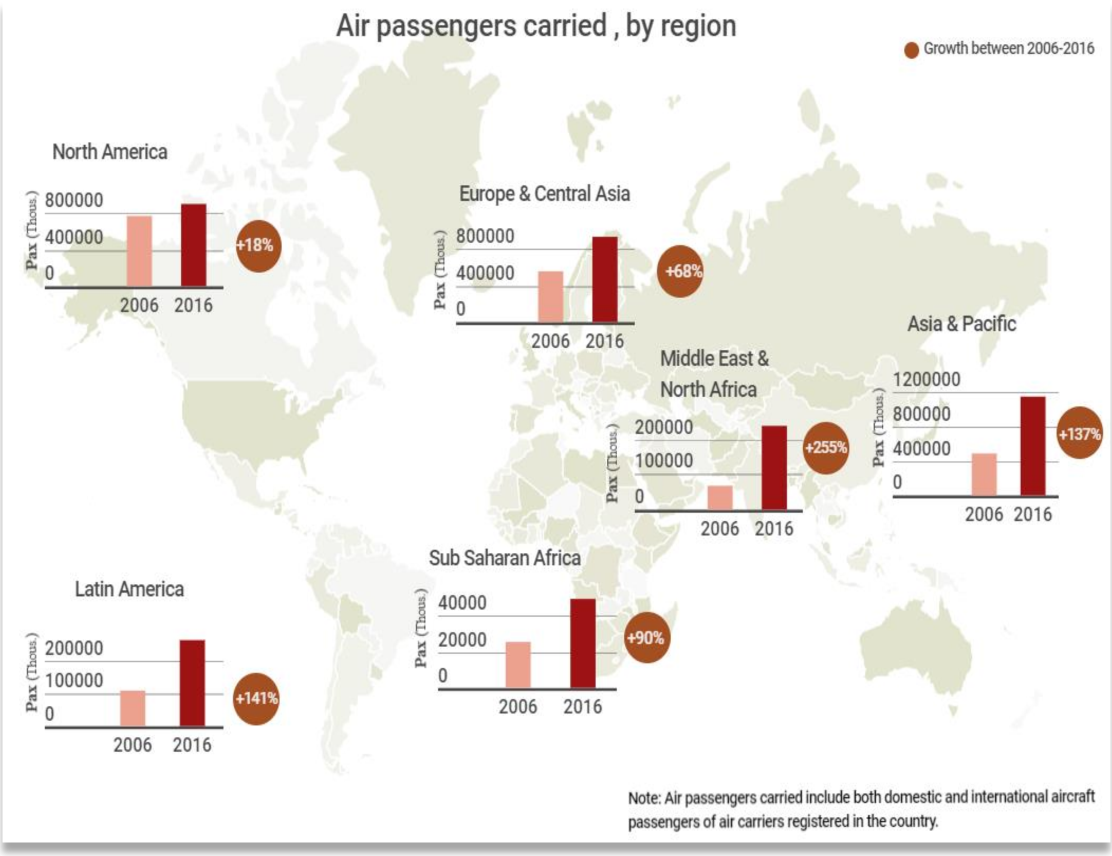

Figure 19 Air Passengers by Region 2006-2016
Source: Authors' calculations based on World Bank Organization statistics

2.3 Characteristics of Tourism Demand

2.3.1 Elasticity

The elasticity of tourism demand is the degree of demand response to price changes or changes in different economic conditions prevailing in the market. Determinants of price elasticity for a tourism product are:

- The availability of substitutes for tourist products. The more substitutes exist for a product, the more sensitive it will be to demand changes in prices.
- The price in relation to income. The elasticity of demand for a tourism product depends on the importance of the product reflected in the available consumer budget. Demand tends to be more flexible for more expensive products.
- If the product is in need or luxury. Demand tends to be more flexible for luxury products. For example, the demand for leisure travel is more flexible than the demand for business trips.

- Time. The price elasticity of demand is higher as time period available to consumers augments. In other words, in the long run, consumers have the option of replacing the tourism product they have chosen with another with a change in price upwards. On the contrary, consumers in the short term do not get to find other substitute products at a price increase, as the time period is relatively short, resulting in less demand elasticity.

Demand elasticity is of particular importance to those who make tourism decisions in host countries because they need to know the correlation factor between price increases and demand reduction, and vice versa.

Tourism demand has high elasticity in the case of a relatively new tourism destination. This elasticity is gradually decreasing as long as the destination is established in the preferences of tourists.

The income elasticity of demand helps us to distinguish between different types of products. As mentioned in previous chapter, each form of tourism has its own elasticity of tourism demand in terms of income.

Most studies, however, tend to show that tourism demand is elastic in terms of income and inelastic in terms of price. On the other hand, when the income is reduced, tourism demand is inelastic because it is not slowing down. Moreover, the increasing trend of tourism over the last 50 years shows that neither the level of prices nor the level of income is able to explain the changes in tourism demand.

2.3.2 Sensitivity

Tourism demand is sensitive to socio-political changes and travel. Destinations that have problems of political instability do not attract tourists as much as prices fall. This, of course, does not affect all tourists, but it primarily acts as a downward trend in demand, like Turkey's example mentioned in a previous chapter. The existence of a positive socio-political climate between the country that produces tourism and the one that receives it is usually a positive factor in the choice of the latter. Tourism demand is also sensitive to changes in travel fashion because tourists follow specific patterns of behavior. Fashion trends in travel are created either by large travel agents in conjunction with large hotel units or by famous people through the notification of their presence in the destination in various social media.

2.3.3 Seasonality

An important feature of tourism demand that greatly affects it, is the seasonality or periods of peak and recession of tourist flows. This is mainly due to climatic conditions in both the country of origin and the country of destination of tourists combined with the industrial organization of the countries of origin of tourists. Some examples are school holidays, summer holidays paid mainly by developed countries due to reduced production, pricing policies for travel agents and airlines. As a result, tourism demand will fluctuate greatly over the course of the year, and most destinations will suffer from peak periods, low traffic and periods of inactivity.

2.3.4 Growth Trend

Demand for tourism services is steadily rising despite small variances over time and showing strong resilience. This positive trend is due to a number of factors that have taken place over the last 50 years. Such factors are the technological and scientific progress that made the world seem smaller, the economic prosperity of the developed countries and the increase in leisure time in relation to the industrial way of life.

2.3.5 The Heterogeneity

By definition, tourism as we mentioned in chapter 1 is the total of human movements and the activities that emerge from them. This movement of people creates consumption in a range of services and goods such as transportation, accommodation, food and public services at the points of entry into the country. The satisfaction of this overall consumption involves a huge amount of different activities created by tourism demand. Therefore, we find that tourism demand is heterogeneous, resulting in the inadequacy of a definition that fully complies with the concept of "tourism industry" from an economic point of view.

CHAPTER 3 BIBLIOGRAPHIC OVERVIEW OF TOURISM DEMAND

3.1 Introduction

The increase in global tourism demand over the last five decades has boosted interest in tourism research in general. Until the 1980s, there were only a few academic journals publishing surveys related to tourism. There are now more than 80 scientific journals serving a prosperous research community covering more than 3.000 higher education institutions around the world. Articles for forecasting tourism demand have been published over the last 15 years in popular travel magazines such as Tourism Management, Tourism Economy, Journal of Travel Research, Annals of Tourism Research and Journal of Travel and Tourism Marketing. However, some financial and management journals, such as Applied Economics and the International Journal of Forecasting, have also published forecasts for tourism demand but at a lower frequency.

As one of the major areas in tourism research, modeling and forecasting tourism demand has attracted the interest of academics and professionals. According to an overall review by Ahmed (2015), based on previous reviews by Lim (1997), Norlida (2007), Song & Li (2008) combined with his own research examined the different methods and approaches applied to the total of 400 studies published in the period 1960-2014. The majority of these studies focus on applying different techniques, both qualitative and quantitative, to model and predict the demand for tourism in different destinations.

	Review of Tourism demand studies	Recognize
Lim (1997)	100	1960-1994
Norlida (2007)	109	1995-2000
Song and Li (2008)	121	2001-2007
Ahmed (2015)	70	2008-2014
Summarize of studies	**400**	**1960-2014**

Table 6 Number and Recognition of tourism demand publications Studies for the period 1960 to 2014

3.2 Types of Data

The modeling and forecasting of tourism demand depends to a large extent on the secondary data regarding the construction and the estimated of the models. Secondary data is those collected from an already available source of information such as State Public Service, Worldwide Organizations, Newspapers, TV Ads or any other institute that has collected data for the purposes of the investigator.

As research on modeling and forecasting tourism demand is based on secondary data, the availability, quantity and quality of data largely determine the creation of reliable models and forecasts.

As far as tourism is concerned in the first decades after the Second World War, the collection of the necessary data for the various tourism activities by the State Organizations was incomplete. Since the 1960s government agencies have found tourism to be an important part of the economy, they have begun collecting data to further analyze tourism demand.

According to Lim (1997) from 1960 to 1994, 56% of the studies used annual data, while studies with monthly and daily data were minimal. The number of sample observations using only annual data ranges from 5 to 28 years with an incidence rate of between 1 and 6. The highest incidence rate is 15 years, with an average and median of 16 years.

CATEGORIES OF DATA TYPE IN PREVIOUS STUDIES							
Time Period	Annually (A)	Quarterly (Q)	Monthly (M)	Daily (D)	Survey (S)	Others	Total Studies
1960-1970	13	5	1	-	6	2	27
1971-1980	40	4	3	-	1	3	51
1981-1990	74	7	2	-	-	3	86
1991-2000	29	6	4	-	1	4	44
2001-2014	98	44	36	1	9	4	192
Total Studies	254	66	46	1	17	16	400
Percentage	64%	17%	12%	0%	4%	4%	100%

Table 7 Categories of data type in previous studies

3.3 Models applied in previous studies

Methods of modeling and forecasting tourism demand can be divided into quantitative and qualitative. In their study, Song and Turner (2006) concluded that the majority of published studies use quantitative methods to predict tourism demand. The literature for quantitative prediction is dominated by two subclasses of methods: time series models and econometric models. The difference between these two is whether the model identifies any causal link between the tourism demand variable and the factors that affect it or not.

3.3.1 Time series models

Time series models are widely used to predict tourism demand. By the term "time series" we mean a series of observations that are taken at certain time or periods and are equal to each other, such as years, months, days, etc. Therefore, they examine a variable in relation to its own past and a random disruptive term. Since they only use historical observations makes them as the least costly to collect data.

Key features of time series by studying the plotting of their time-domain graphs are as follows:

- Trend: We call the trend a long-term change in the average of the time series. This change is usually estimated with a straight line or some other curve. A sufficient number of observations are needed and at the same time to estimate the appropriate length of a period within which to look for a certain trend, e.g. upward, steady or downward.
- Circularity: Circularity is defined as a "wavelet" change due to external factors and occurs at times. These periods are usually not stable and their length is longer than a year.
- Seasonality: Seasonality is defined as a periodic variation that is constant and less than a year long. It is found in time series that show seasonal excursions such as tourist arrivals.
- Randomness: These are the observations of a time series that remains if we isolate the trend, seasonality and circularity.

In the tourism literature, the following time series models are found:

3.3.1.1 Naïve 1 and Naïve 2 approaches

The Naïve1 method gives as a prediction for the next time period, the last available value Y_t, where t denotes the most recent time period. It is assumed that trends and turning points cannot be predicted and prediction is a horizontal line. Naïve2 is also widely used in simple time series models when there is a constant trend in data. The forecast for period t results from the multiplication of demand in period Y_{t-1} with the growth rate between the previous period Y_{t-2} and the current period Y_{t-1}.These simple self-regulating models were used by researchers such as Carey Gog, Rob Law (2002), Shuang Cang (2014), mainly after 2000. They are usually used as benchmarks for predicting accuracy over other time series models (Chu, 2004; Athanasopoulos et al., 2011).

Naïve1 $F_t = Y_{t-1}$

Naïve2 $F_t = Y_{t-1} * [1 + (Y_{t-1} - Y_{t-2})/Y_{t-2}]$

Where Y_{t-1}: the observation in period $t-1$ and F_t : the prediction in period t

3.3.1.2 Simple Moving Average

The Simple Moving Average is used to describe the process when a new observation is available, then the average of the last observations of the length selected is calculated, thus giving equal weights between the observations. It makes sense that the longer the length of the time lag values we have chosen, the more smooth the predictions we will have. (Frechtling, 1996; Makridakis et al., 1998). However, limiting the model to giving the same weight between observations may not be realistic because more recent observations may have a greater impact on the current period. Also, the Double Simple Moving Average model can be used if the trend is linear and systematic errors occur to further normalize the series (Hu et al., 2004; Lim and Mc Aleer, 2008).

Simple Moving Average $F_t = (Y_{t-1} + Y_{t-2} + Y_{t-3} + \ldots + Y_{t-n})/n$

Double Simple Moving Average $F''_t = (f_{t-1} + f_{t-2} + f_{t-3} + \ldots + f_{t-n})/n$

3.3.1.3 Exponential Smoothing models

Exponential smoothing method is used for short and medium-term forecasts in time series. With this method, we calculate the averages of observations, but weighing different weights in previous observations of the time series. Therefore, these methods adjust the normalization factors and reduce variances (Lim & Mc Aleer, 2001). Essentially, weights show an exponential decay, and observations closer to the prediction period are more important. Exponential smoothing models were initially classified by Pegels (1969) and later expanded by Gardner (1985). It was subsequently modified by Hyndman et al. (2002) and re-expanded by Taylor (2003), giving a total of fifteen methods. Thus, 5 trend models (fixed level, linear trend, decreasing linear trend, exponential trend and decreasing exponential trend) are combined with 3 seasonal models (non-seasonal, seasonal and multiplier seasonal) giving 15 categories shown in Table 8.

The most simple of the exponential smoothing methods is called Simple Exponential Smoothing. This method is suitable for predicting time series without trend or seasonality. As we can observe in Table 8, in a Single Exponential Smoothing model the prediction for period t is equal to the predicted period $t-1$ plus the smoothing constant multiplied by the prediction error of the $t-1$ period. This constant must be between 0 and 1 and is determined by each researcher. The smaller the constant, the more weight the model gives in the forecast of the previous period. (Witt and Witt 1992).

Holt (1957) extended the simple exponential smoothing to allow for predictive observations with trend. The linear trend model is described by the following equations as shown in Table 8.

Holt and Winters (1960) expanded Holt's linear trend model to include the seasonality that is a key feature of tourism demand. Depending on the type of seasonality, there is the additive seasonal model and the multiplier seasonal model. The multiplication model is appropriate when the range of seasonality is proportional to the average of the time series and in the case where the range of seasonality is independent of the average of the time series we use the additive model.

Forecasts resulting from the Holt linear method show a steady trend (increase or decrease) in the future. The linear trend model can be altered appropriately to accommodate non-linear trends. This is achieved by using a parameter that controls the growth rate of forecasting values. This is called a trend correction parameter and is denoted by φ.

Classification of exponential smoothing methods (adapted from Hyndman et al., 2002)			
	Non- Seasonal	Seasonal	
Trend	None (N)	Additive (NA)	Multiplicative (MA)
N	$l_t = ay_t + (1-a)l_{t-1}$ $\hat{Y}_{t+h\mid t} = l_t$	$l_t = a(y_t - S_{t-m}) + (1-a)l_{t-1}$ $S_t = \gamma(y_t - l_{t-1}) + (1-\gamma)S_{t-m}$ $\hat{Y}_{t+h\mid t} = l_t + s_{t-m+h_m^+}$	$l_t = a(y_t/S_{t-m}) + (1-a)l_{t-1}$ $S_t = \gamma(y_t/l_{t-1}) + (1-\gamma)S_{t-m}$ $\hat{Y}_{t+h\mid t} = l_t s_{t-m+h_m^+}$
A	$l_t = ay_t + (1-a)(l_{t-1} + b_{t-1})$ $b_t = \beta^*(l_t - l_{t-1}) + (1-\beta^*)b_{t-1}$ $\hat{Y}_{t+h\mid t} = l_t + hb_t$	$l_t = a(y_t - S_{t-m}) + (1-a)(l_{t-1} + b_{t-1})$ $b_t = \beta^*(l_t - l_{t-1}) + (1-\beta^*)b_{t-1}$ $S_t = \gamma(y_t - l_{t-1} - b_{t-1}) + (1-\gamma)S_{t-m}$ $\hat{Y}_{t+h\mid t} = l_t + hb_t + s_{t-m+h_m^+}$	$l_t = a(y_t/S_{t-m}) + (1-a)(l_{t-1} + b_{t-1})$ $b_t = \beta^*(l_t - l_{t-1}) + (1-\beta^*)b_{t-1}$ $S_t = \gamma(y_t/(l_{t-1} - b_{t-1})) + (1-\gamma)S_{t-m}$ $\hat{Y}_{t+h\mid t} = (l_t + hb_t)s_{t-m+h_m^+}$
A_d	$l_t = ay_t + (1-a)(l_{t-1} + \varphi b_{t-1})$ $b_t = \beta^*(l_t - l_{t-1}) + (1-\beta^*)\varphi b_{t-1}$ $\hat{Y}_{t+h\mid t} = l_t + \varphi_h b_t$	$l_t = a(y_t - S_{t-m}) + (1-a)(l_{t-1} + \varphi b_{t-1})$ $b_t = \beta^*(l_t - l_{t-1}) + (1-\beta^*)\varphi b_{t-1}$ $S_t = \gamma(y_t - l_{t-1} - \varphi b_{t-1}) + (1-\gamma)S_{t-m}$ $\hat{Y}_{t+h\mid t} = l_t + \varphi_h b_t + s_{t-m+h_m^+}$	$l_t = a(y_t/S_{t-m}) + (1-a)(l_{t-1} + \varphi b_{t-1})$ $b_t = \beta^*(l_t - l_{t-1}) + (1-\beta^*)\varphi b_{t-1}$ $S_t = \gamma(y_t/(l_{t-1} - \varphi b_{t-1})) + (1-\gamma)S_{t-m}$ $\hat{Y}_{t+h\mid t} = (l_t + \varphi_h b_t)s_{t-m+h_m^+}$
M	$l_t = ay_t + (1-a)l_{t-1}b_{t-1}$ $b_t = \beta^*(l_t/l_{t-1}) + (1-\beta^*)b_{t-1}$ $\hat{Y}_{t+h\mid t} = l_t b_t^h$	$l_t = a(y_t - S_{t-m}) + (1-a)l_{t-1}b_{t-1}$ $b_t = \beta^*(l_t/l_{t-1}) + (1-\beta^*)b_{t-1}$ $S_t = \gamma(y_t - l_{t-1}b_{t-1}) + (1-\gamma)S_{t-m}$ $\hat{Y}_{t+h\mid t} = l_t b_t^h + s_{t-m+h_m^+}$	$l_t = a(y_t/S_{t-m}) + (1-a)l_{t-1}b_{t-1}$ $b_t = \beta^*(l_t/l_{t-1}) + (1-\beta^*)b_{t-1}$ $S_t = \gamma(y_t/(l_{t-1}b_{t-1})) + (1-\gamma)S_{t-m}$ $\hat{Y}_{t+h\mid t} = l_t b_t^h s_{t-m+h_m^+}$
M_d	$l_t = ay_t + (1-a)l_{t-1}b_{t-1}^{\varphi}$ $b_t = \beta^*(l_t/l_{t-1}) + (1-\beta^*)b_{t-1}^{\varphi}$ $\hat{Y}_{t+h\mid t} = l_t b_t^{\varphi_h}$	$l_t = a(y_t - S_{t-m}) + (1-a)l_{t-1}b_{t-1}^{\varphi}$ $b_t = \beta^*(l_t/l_{t-1}) + (1-\beta^*)b_{t-1}^{\varphi}$ $S_t = \gamma(y_t - l_{t-1}b_{t-1}^{\varphi}) + (1-\gamma)S_{t-m}$ $\hat{Y}_{t+h\mid t} = l_t b_t^{\varphi_h} + s_{t-m+h_m^+}$	$l_t = a(y_t/S_{t-m}) + (1-a)l_{t-1}b_{t-1}^{\varphi}$ $b_t = \beta^*(l_t/l_{t-1}) + (1-\beta^*)b_{t-1}^{\varphi}$ $S_t = \gamma(y_t/(l_{t-1}b_{t-1}^{\varphi})) + (1-\gamma)S_{t-m}$ $\hat{Y}_{t+h\mid t} = l_t b_t^{\varphi_h} s_{t-m+h_m^+}$

Table 8 Formulas for recursive calculations and point forecasts

THE FIFTEEN EXPONENTIAL SMOOTHING METHODS			
Trend Component	N (None)	A (Additive)	M (Multiplicative)
N (None)	NN describes the Simple Eponential Smoothing (SES) method	NA	NM
A (Additive)	AN describes Holt's Linear method	AA describes the Additive Holt-Winters' method	AM describes the Multiplicative Holt-Winters' method
A_d (Additive damped)	A_dN describes the Damped Trend method	A_dA	AdM describes the Holt-Winters' Damped method
M (Multiplicative)	MN describes the Exponantial Trend method	MA	MM
M_d (Multiplicative damped)	M_dN describes the Multiplicative Damped Trend method	M_dA	M_dM

Table 9 Fifteen Exponential Smoothing Methods by Taylor (2003)

3.3.1.4 Auto Regression models

A simple statistical model of time series that has been used to predict tourism demand is the model of autoregression. It predicts the dependent variable using a linear combination of the previous values of the variable being considered. Its algebraic form is presented below:

$$Y_t = c + \varphi_1 y_{t-1} + \varphi_2 y_{t-2} + \cdots + \varphi_\mu y_{t-\mu} + \varepsilon_t$$

Essentially, it is like multiple regression, however, using for independent variables of the model, the time lag of the variable under consideration.

3.3.1.5 Moving Average

The title of this model, although it looks like the simple mobile average, is basically untrue, as it is a linear time lag in error values as we observe in the following algebraic form.

$$Y_t = \mu + \varepsilon_t + \theta_1 \varepsilon_{t-1} + \theta_2 \varepsilon_{t-2} + \cdots + \theta_\alpha \varepsilon_{t-\alpha}$$

Both Box & Jenkins (1976) and Pankratz (1983) have stated that the name of the "moving average" model is technically incorrect, since the coefficients may be negative and cannot be summed up in the unit. The model name is used metaphorically.

3.3.1.6 Autoregressive Moving Average models

The combination of simple autoregression and moving average gives us another model, which had been first described by Peter Whittle (1951).

$$Y_t = \varphi_1 y_{t-1} + \varphi_2 y_{t-2} + \cdots + \varphi_\mu y_{t-\mu} + \varepsilon_t + \theta_1 \varepsilon_{t-1} + \theta_2 \varepsilon_{t-2} + \cdots + \theta_\alpha \varepsilon_{t-\alpha}$$

3.3.1.7 Autoregressive Integrated Moving Average models

These models are the most widely used by researchers to predict tourism demand (Chu, 2008). Two-thirds of empirical studies using time series prediction techniques applied ARIMA models and their various versions. The algebraic expression of these models is as follows:

For the non-seasonal ARIMA model (p, d, q)

- p is the autoregression operator
- d is the order of differentiation $(d > 2)$
- q is the operator of the moving average process

$$(1 - B)^d \, Y_t = \mu + \frac{\theta(B)}{\varphi(B)} \alpha_t$$

Where,

- t is the time index ($1 \leq t \leq n$)
- μ is the average
- B is the operator of time lag
- $\varphi(B)$ is the autoregression operator presented as a polynomial with a time lag operator $\varphi(B) = 1 - \varphi_1 B - \cdots - \varphi_p B^p$
- $\varphi(\theta)$ is the operator of the moving average process presented as a time-lag polynomial $\varphi(B) = 1 - \varphi_1 B - \cdots - \varphi_q B^q$
- α is a random error

For the seasonal model SARIMA (p, d, q) × (P, D, Q)S

- P is the operator of the seasonal part of autoregression
- D is the operator of seasonal differentiation $(D > 1)$
- Q is the operator of the seasonal moving average process

- S is the length of the seasonal cycle

$$(1-B)^d\,(1-B^s)^D\,Y_t=\mu+\frac{\theta(B)\theta_s(B^s)}{\varphi(B)\varphi_s(B^s)}\alpha_t$$

Where,

- $\varphi_s(B^s)$ is the autoregression operator presented as a polynomial with a time lag operator $\varphi_s(B^s)=1-\varphi_{s,1}B^s-\cdots-\varphi_{s,P}B^{sP}$
- $\theta_s(B^s)$ is the operator of the moving average process presented as a polynomial with a time lag operator $\varphi_s(B^s)=1-\varphi_{s,1}B^s-\cdots-\varphi_{s,P}B^{sP}$

Especially, the Box & Jenkins models are very popular and are being applied with great success by the researchers. Indicatively we mention Bigovic, 2012; Chu, 2008; Coshall, 2005; Qu & Zhang, 1996; Kullendram & Han, 2002). They are used for estimation over a short time horizon.

Cho (2001) showed that the ARIMA model had better results to predict Japan's tourism demand than Holt & Winters Exponential Smoothing.

Goh and Law (2002) showed that the SARIMA seasonal model had the best predictive capacity compared to Naïve 1 and 2, Moving Average, Simple Exponential Smoothing, Holt Exponential Smoothing and Winter Exponential Smoothing in forecasting Hong's-Kong tourism demand from 10 major tourism destinations. From the findings of the same study, the simple ARIMA model was above the average of the models examined.

Of course, ratings in relation to other models are contradictory. According to Smeral and Wuger (2005), the seasonal model SARIMA could not surpass Naïve 1.

3.3.1.8 Autoregressive Conditional Heteroskedasticity models

ARCH-GARCH models were first introduced by Engle (1982) and expanded by Bollerslev (1986). They are widely used in financial models to investigate volatility. These models were developed to help explain volatility in the variance. Due to the fact that the time series are by nature non-stationary, therefore the variances change with time, they present the problem of heteroskedasticity. Essentially, models use previous variances and previous predicted variances to predict future variances. The algebraic expression of a single ARCH model and generalized GARCH is as follows:

GARCH (p , q) model

$$Y_t = \alpha + \beta' X_t + u_t$$

$$U_t \mid \Omega_t \sim iid\ N(0, h_t)$$

$$h_t = \gamma_0 + \sum_{i=1}^{p} \delta i\, h_{t-1} + \sum_{i=1}^{q} \gamma i\, u_{t-i}^2$$

ARCH (q) model

$$Y_t = \alpha + \beta' X_t + u_t$$

$$U_t \mid \Omega_t \sim iid\ N(0, h_t)$$

$$h_t = \gamma_0 + \sum_{i=1}^{q} \gamma i\, u_{t-i}^2$$

These models and their variants have been applied to small island economies due to their size and high dependency on tourism and are more vulnerable to external influences. Therefore, these countries are interested in understanding the characteristics of tourism variability and implement a system to adequately predict future volatility. Lorde and Moore (2008) assessed the variability models such as ARCH, GARCH, AGARCH, NGARCH, EGARCH, Log-GARCH, Thr.GARCH, A-PARCH, GJR-GARCH and evaluated the predictive capacity of these models using monthly data for the period 1977-2005 for the Barbados Islands.

Chan, Lim and McAleer (2005) examined the instability of monthly tourist arrivals from four major countries of origin (Japan, New Zealand, United Kingdom, USA) in Australia between 1975 and 2000. The researchers applied three multifactorial models of volatility: CCC-MGARCH by Bollerslev (1990), ARMA-GARCH by Ling and McAleer (2003) and ARMA-AGARCG by Chan, Hoti and McAleer (2002).

3.3.2 Econometric Models

The analysis of tourism demand through econometric models is advantageous over the time series we have previously examined because they have the ability to analyze the two-way relation of the dependent variable, which in our case is the tourist arrivals in Greece with the factors that affect it, namely the explanatory variables. They also better interpret the various changes in tourism demand and enable us to evaluate the results of existing policies for further improvement.

According to Clements and Henry (1998), analyzing tourism demand with econometric models in addition to forecasting combines empirical with theoretical knowledge of how economies operate and help explain their own failures.

Recent econometric studies show that tourists' income, relative home country prices compared to those of the destination country on the basis of their respective competitive destinations and exchange rates are the major determinants of tourism demand. Therefore, identifying key determinants and assessing their magnitude in tourism demand is of great interest in the choice of tourist destinations.

Therefore, using a suitable econometric model to predict tourism demand is very important not only for academic researchers but also for professionals working in the tourism industry.

3.3.2.1 Error Correction Model

Most static models developed up until the early 1990s had several problems as the coefficients of the variables were erroneous, as these variables may be imbalanced in the short run. The value of finding the elasticity of tourism demand and their analysis has attracted researchers for further research with dynamic econometric models since mid-1990, which have been applied to various empirical studies of tourism. However, the different dynamic approaches have varied in the effects of the elasticity of tourism demand by applying them to the same data. The fact that one of the dynamic models could not be qualified as the most appropriate is the error correction mechanism, which can combine the results of the short-term with the corresponding ones of the long-term period.

The estimation of an Error Correction Model can be done in two steps according to Engle and Granger (1987), after having checked the Cointegration. Then, they propose a process that involves two steps:

1st Step: The co-integration function with the least squares method, $Y_t = \alpha_0 + \alpha_1 X_t + \varepsilon_t$ where the residuals ε_t express deviations from the long-term equilibrium state, is estimated. Then we get the estimated residuals balances.

2nd Step: Imbalance errors ε_t are replaced with the estimated residuals $\hat{\varepsilon}_t$ whereby the equation $\Delta Y_t = lagged\,(\Delta Y_t, \Delta X_t) + \delta \hat{\varepsilon}_{t-1} + u_t$ with the least squares method is evaluated.

The Error Correction Models were used in the studies of Kulendran and Wilson (2000), Kulendran and Witt (2003b), Lim and McAleer (2001a).

3.3.2.2 Almost Ideal Demand System

The Almost Ideal Demand System (AIDS) was developed by Deaton and Muellbauer (1980) and first appeared in the tourism literature in the mid-1980s by O'Hagan and Harrison (1984), White (1985), Syriopoulos and Sinclair (1993) and Papatheodorou (1999). This is a new modeling technique recently applied to the analysis of tourism demand. Unlike other econometric models such as simple equation models, AIDS is an approach that is typically applied to analyze a country's tourism demand in relation to neighboring destinations by using tourism costs as dependent variables. Simple equalization models are not quite capable of analyzing how tourists will decide to allocate their costs to a change in the prices of other tourist products from substitute or complementary tourist destinations. It is essentially a model for analyzing the behavior of tourists.

Most studies used static patterns and mostly linear (Linear-AIDS). Since 2000, research has focused on the dynamic approach of tourism demand systems. For example, De Mello and Fortuna (2005), Durbarry and Sinclair (2003), Li et al. (2004), and Mangion, Durbarry and Sinclair (2005) combined ECM with the LAIDS linear model. Li et al. (2006) further coupled the Time Variability Model (TVP) with the LAIDS and EC-LAIDS linear models to create long-term TVP-LR-AIDS and TVP-EC-LAIDS models respectively.

3.3.2.3 Vector Autoregression model

The simple equation approach assumes that dependent variables are exogenous. If this case is violated then a system of equations will be appropriate to model economic relations. Such a system of equations is the VAR model, where all the variables are endogenous and each of them is determined as a function of the previous values of all other system variables. A characteristic feature of VAR model is that the number of time lags is determined by the system itself. More specifically, a model of vector autoregression is first-order when the value of the greater lag of its variables equals to one and is denoted as VAR (1). More generally, a model of autoregression is k order when the longest lag of its variables equals k time lags, and is denoted by VAR (k).

In the context of the analysis of tourism demand, there are about 10 studies using the VAR approach since the late 1990s. The latest approach incorporates Bayesian constraints into the original unstructured VAR model. The empirical study that conducted by Wong et al. in 2006, suggests that the Bayesian VAR model improves prediction accuracy as opposed to copies of unstructured models.

3.3.2.4 Panel Data Model

Panel data include both time series and cross sectional data that is, referring to more than one entity (countries, regions, corporations) at a given point in time. Panel data can consist of a small number of time periods and a large number of layered elements, so called short panel or a large number of time periods and a small number of layered elements, so called long panel. In case that data exists for all the interlayers in all time periods, ie $T_1 = T_2 = \cdots = T_n = T$, then the data panel is called a balanced panel and the sample size is equal to $N = n * T$. On the other hand, if the number of observations varies from unit to unit then the data panel is called unbalanced panel and sample size is equal to $T_1 + T_2 + \cdots + T_n$.

Data panel analysis has certain advantages such as giving more information, greater variability, providing more degrees of freedom in model estimation and reducing the problem of multi-collinearity. In addition, it allows heterogeneity among entities as well as the use of variables that cannot be measured or observed. With data panels, it is possible to study dynamic phenomena that change with time, as the cross sectional data cannot express dynamic relationships. The time series data on the other hand while generating dynamic relationships, however, their estimates are not very accurate due to the existence of multi-collinearity.

Ledesma-Rodriguez et al. (2001), used both static and dynamic data panel models to shape tourism demand in Tenerife. Moreover, Naude and Saayman (2005) and Roget and Gonzalez (2006) used the same approach to data for examining the demand for tourism in 43 African countries and the demand for rural tourism in Galicia Spain respectively. Since then, there have been several studies that have investigated the tourism demand using the method of panel data as Garin-Muñoz, 2006; Athanasopoulos and Hyndman, 2007; Saayman and Saayman, 2008; Leitão and Shahbaz, 2011; Vencovska, 2014 and Chasapopoulos et al., 2014).

3.3.2.5 Structural Equation Models

SEMs have been used by researchers mainly in social and behavioral sciences as well as in the analysis of tourism behavior and tourism marketing research. SEMs are models of simultaneous equations, in which variables can interact with each other. Since a SEM may represent causal relationships between variables, it is suitable for modeling tourism demand. Modeling Equation Models are particularly suited to tourism research, because factors influencing tourism demand are associated with individual determinants of consumer behavior (Smith, 1994). Differences in mood, perceptions and travel motives are crucial factors in travel decision making (Sirakaya & Woodside, 2005). These determinants when expressed in variables before SEM implementation were difficult to integrate into a single econometric model. Cooper and Wahab (2001) argued that given the volume-related difficulties in many variables at the same time, researchers attempted to isolate the most important set of variables and then link the volume of demand to changes in these key variables.

Turner and Witt (2001a) developed a SEM model to evaluate the relationships between all explanatory variables for three types of tourist flows (holidays, business visits, and visits to relatives and friends). The results of this study demonstrated the ability of structural equation models to broaden the variety of explanatory variables that collaborate in a complex way.

Zhang and Jensen (2007) argued that economic agents are the most determinant and largely related to the creation of tourism demand. These factors are easier to measure and so are widely used in tourism demand surveys. Consequently, the SEM model can use the specific determinants and explore their causal relationships to determine the inflow of tourists to a destination.

To date, the application of building Structural Equations Models to the analysis of tourism demand is limited due to the complexity of applying this statistical method. Therefore, a detailed examination of the application of the SEM model in the context of tourism demand will yield timely and guaranteed results.

3.3.2.6 Time Varying Parameter

Most economic time series are non-stationary. Conversely, converting variables into first-order differences or checking for a unique root to address the problem of non-stationary of data and then estimating the model using the least squares method resulted in the model losing its macroeconomic characteristics. For this reason, the TVP model, which is more useful in the analysis of non-stationary time series, was developed and subsequently applied to the tourism literature at the end of 1990 (Riddington, 1999), although it has been applied a few times since then. The studies were based on annual data and their main objective was the evolution of demand elasticities in a relatively long-term period.

The TVP model does not require the data to be stationary before the model is estimated, and then by applying the Kalman filtering algorithms, produces the right averages and variances in non-stationary time series.

This method, according to Song and Witt (2000), can simulate different kinds of unexpected events in the context of tourism demand such as political instability, change in tourism marketing policies and various economic reforms. Apart from the unexpected developments that may affect tourism demand, the time variability parameter also simulates external influences that gradually change consumer behavior. Finally, these gradual changes can be integrated into predicting future tourism demand through the TVP model.

3.3.3 Artificial Intelligence Models

In addition to time series models and econometric models, there is another category in anticipation of tourism demand. These are Artificial Intelligence models and its branches such as soft computing, machine learning, and data mining. Intelligence techniques, mainly derived from Artificial Neural Networks (ANN), SVM, Fuzzy Logic, Genetic Algorithms, and Swarm Intelligence, have been emerged in the tourist literature (Cancurt and Subasi, 2015).

On the other hand, mechanical learning, which is an important field of Artificial Intelligence, has been successfully applied to many applications of the tourism industry, including forecasting tourism demand.

3.3.3.1 Artificial Neural Networks

The Artificial Neural Network (ANN) method is a computational technique that attempts to mimic the learning process of a human brain (Taylor, 1998). As Law (2000) states, a neural network consists of many "nodes" operating in parallel without any central control. The connections between the nodes have numerous weights and can be adapted to the learning process. An advantage of this method with respect to classic regression models is its ability to adapt to a large volume of data.

The ANN method has been successfully applied for predicting time series in various fields such as Biology, Financial Sector, Energy Consumption, Medicine, Meteorology and Tourism (Palmer et al., 2008). In the tourism literature, it was presented for the first time in the late 1990s and since then some improved versions of the ANN method have been applied (Law, 2001; Tsaur et al., 2002; Cho, 2003; Kon and Turner, 2005; Palmer et al., 2006). Kon and Turner (2005) presented a review of the applications of this method in tourism and showed that the ANN method exceeds time series models to predict incoming tourism demand in Singapore such as Naïve 1 and Holt-Winters. However, despite the satisfactory performance of predictions, the ANN method does not have a specific process to construct a model and therefore a reliable predictive model is usually achieved through tests (Kon and Turner, 2005, Palmer et al., 2006).

Despite the unique features of the Neural Network Technique and certain high-precision predictions, artificial intelligence techniques lack the theoretical background and cannot interpret tourism demand economically. For this reason, the practical applications of artificial intelligence techniques in the analysis of tourism demand are limited (Song and Li, 2006).

3.3.3.2 Genetic Algorithms

Genetic Algorithms are adaptive heuristic search algorithms, which are based on the evolutionary ideas of genetics. They were introduced by Holland in the late 1960s and are quite simple to implement. They are generally recognized as an optimization approach and are mainly used in large-scale problems that contain many parameters.

However, Genetic Algorithms differ from traditional optimization approaches in 4 main points.

- ❖ Genetic Algorithms do not use their own parameters, but they work by encoding the interfering parameters.

- Genetic Algorithms are not only looking for a chain as a solution, but for a population composed of different chains.
- During their execution, Genetic Algorithms use the information of a relative value for each individual chain.
- Genetic Algorithms use probabilistic transition rules rather than deterministic, leading to solutions.

Genetic Algorithms have been used in econometrics (Green and Smith, 1987; Arifovic, 1994; Dawid, 1996), as well as in the tourism literature in forecasting tourism demand (Mahfoud and Mani, 1996; Hurley et al., 1998). Recent studies (Burger et al., 2001, Hernandez-Lopez, 2002; Hernandez-Lopez and Caceres-Hernadez, 2007) have shown that GA are well suited to explaining changes in the composition of tourism demand, however their application to real data is limited.

3.3.3.3 Support Vector Machines

SVM is a learning method derived from the theoretical basis of the theory of statistical learning and the minimization of structural risk developed by Vladimir Vapnik and used both for classification and regression problems. The basic concept of their construction is based on the principle of minimizing the construction risk that has been shown to outweigh the minimization of the empirical risk. They quickly became interested as they showed great generalization capability compared to other traditional grading methods. In addition, the categorization of data is based on finding an optimum super-level that separates the data by creating the maximum margin.

Support Vector Machines were initially implemented in forecasting tourism demand in the Barbados Islands, giving better results from the application of Artificial Neural Network (Pai and Hong, 2005; Pai et al., 2006). Empirical evidence suggests that SVM was superior to the ARIMA and SARIMA models in forecasting demand.

Initially, SVMs were developed to resolve standards recognition problems. However, with the introduction of the Vapnik Damage Loss Function, SVMs have been expanded to solve non-linear regression estimation problems, such as new techniques known as SVR, and have been shown to perform excellently (Vapnik, Golowich, & amp; Smola, 1997). Recently, SVR has emerged as an alternative and powerful technique to solve the problem of non-linear regression and is tantamount to maximizing the margin between the training examples and the regression function. Finally, it has enjoyed great success on both academic and industrial platforms, due to its many attractive features and high performance.

3.4 Methods of estimation in previous studies of tourism demand

The development of econometric methods has progressed unprecedentedly over the last 50 years, driven by rapid computer development, econometric theory and the availability of large volumes of data. Subsequently, various methods of assessment by researchers have been applied to the analysis of tourism demand. The main methods that have been used as shown in the following table, are the Ordinary Least Squares, Vector Error Correction Mechanism, Autoregressive Distributed Lag and Generalized Method of Moments.

To overcome the regression problem associated with the least squares method, new methods were introduced after 1990 as we see in the following Table. With the new estimation methods we can use the dependent variable with time lag.

METHODOLOGIES IMPLEMENTED IN PREVIOUS STUDIES						
TIME PERIOD	OLS	VECM	ARDL	GMM	OTHERS	TOTAL STUDIES
1960-1970	23	-	-	-	28	51
1971-1980	46	-	-	-	28	74
1981-1990	51	-	-	-	29	80
1991-2000	26	2	-	-	29	57
2001-2014	35	26	27	7	43	138
Total Studies	181	28	27	7	157	400
Percentage	45%	7%	7%	2%	39%	100%

Table 10 Methodologies implemented in previous studies

According to Table 10, 45% of a total of 400 tourism studies during the period of 1960-2014 used the least squares method. The error correction mechanism was first introduced by King et al (1991). Since then, it has been used in 7% of all tourism studies, but if we calculate the last timeframe from 2001 to 2014, it has been applied to 19% of tourism studies. This method is used to approximate the estimation of the combination of the short-term with the long-term period between two or more variables.

3.5 Dependent Variables

As mentioned in the previous section, researchers have used two main categories of dependent variables to interpret tourism demand despite the drawbacks they present. Tourist arrivals and tourist costs cover about 70% of the dependent variables used in previous studies from 1960 to 2014 as we see in the following Table. In cases where tourist expenditure and tourist arrivals are not available, the length of stay of tourists in the destination country is the most common dependent variable used (Habibi & Rahim 2009).

CATEGORIES OF DEPENDENT VARIABLES IN PREVIOUS STUDIES					
Time Period	Number of tourist Arrivals	Tourist expenditures	Lengh of stay	Others	TOTAL STUDIES
1960-1970	17	16	3	20	56
1971-1980	35	31	7	20	93
1981-1990	45	27	5	21	98
1991-2000	30	21	3	21	75
2001-2014	45	8	4	21	78
Total Studies	172	103	22	103	400
Percentage	43%	26%	6%	26%	100%

Table 11 Categories of Dependent Variables in previous studies.

3.6 Independent Variables

The explanatory variables defining tourism demand do not follow a specific pattern that is acceptable to all pairs of countries of origin and destination, according to Witt and Witt (1995). Although the demand for international tourism is affected and determined by many factors as previously mentioned in chapter 2, account should be taken of the geographical location of the country, the duration of the study and the nature of tourism in the country under consideration. Interpretative variables can be distinguished in different categories such as economic, demographic, environmental, geographic, social, etc.

From financial explanatory variables, *income* is the most commonly used (Lim and Mc Aleer, 2002; Dritsakis 2004; Muhoz, 2006). It is used to express the individual income of tourists in the country of origin and usually enters the demand per capita (GDP per capital). If a large proportion of tourist arrivals in the destination country results from business activities then a more general expression of income such as Gross Domestic Product and Exports - Imports to the respective countries should be used as shown in the following function to express the trade relations between the countries (Eliat and Einav, 2004; Phakdisoth and Kim, 2007; Leitão, 2010).

$$TRADE_{im} = \frac{X_i + M_i}{GDP_i + GDP_m}$$

- X_i: are the annual exports of the country of destination to each country of origin in year t
- M_i: are the annual imports of the country of destination to each country of origin in year t
- GDP_i: is the gross domestic product of the country of destination.
- GDP_m: is the gross domestic product of the country of origin.

Regarding *relative prices*, they are usually used to express either the cost of living in the country of origin or the cost of living in the country of destination. In the first case, the Consumer Price Index (CPI) is adjusted annually to ensure the representativeness of the goods and services that make up the 'shopping cart' supplied by an average household. In the latter case, the Consumer Price Index enters the demand function to reflect the cost of living in the country of destination. The index (CPI) is adjusted according to the country of origin - destination countries' respective exchange rates. Usually an index combines both cases.

$$RP_{it} = \frac{CPI_{it}}{CPI_{jt}} ER_{it}$$

Where,

- RP_{it}= Relative Price variable at destination i in year t .
- CPI_{it}= Consumer Price Index in the country of destination i in year t .
- CPI_{jt}= Consumer Price Index in the country of origin j in year t .
- ER_{it} = index of the currency price in the country of origin in relation to the country of destination i in year t (Indirect reporting method).

Exchange rates as an explanatory variable have been used in many studies. Although they are readily available and accurate when they enter the function of tourism demand as a separate variable, they can be misleading (De Vita and Kyaw, 2013). Although international tourists are well informed about current exchange rates by choosing destinations at an advantageous exchange rate, they do not take into account the level of inflation in their country and country of destination. A high inflation could offset any differences. According to Martin and Witt (1987), exchange rates should be adjusted to the Consumer Price Index otherwise as a separate variable is not acceptable.

Transport costs as an explanatory variable in relation to tourist demand refer to travel costs from the country of origin to the destination country, including the return. In most studies it is measured by the price of airline tickets. However, it is difficult to estimate the actual costs because airlines are applying different pricing policies.

According to Ahmed (2015), the main explanatory variables that have been used are economic, such as income, relative prices, exchange rates, travel costs and population, as seen in Table 12.

CATEGORIES OF INDEPENDENT VARIABLES IN PREVIOUS STUDIES						
Time Period	Tourist Income	Tourism Price	Excange Rate	Travelling cost	Population	Total Independent Variables
1960-1970	25	17	8	17	1	68
1971-1980	48	35	13	32	7	135
1981-1990	31	58	35	40	9	173
1991-2000	31	33	17	17	3	101
2001-2014	56	63	33	38	4	194
Total Studies	191	206	106	144	24	671
Percentage	28%	31%	16%	21%	4%	100%

Table 12 Categories of Independent Variables in previous studies

The 28% of a total of 400 studies examined used income as an explanatory variable, 31% related prices, 16% and 21% exchange rates and travel costs respectively.

Also, the above explanatory variables can be used with time lags such as income values and relative values in the previous time period. Apart from explanatory variables, dependent variables can be used with time lags as well.

In addition to the quantitative variables mentioned above, many researchers have used *qualitative* variables that affect tourism demand in various ways and at different levels.

Such examples of variables are the level of education, age, leisure time, marketing costs, and the trend of increasing popularity in the destination country.

The *geographical distance* is used by many researchers to express transport costs due to the misleading airline market data we have expressed above and is measured by the geographical distance between the capital of the destination country and the capital of tourists' countries of origin. Although the country of origin *population* enters the demand function to express the size of the market, it is usually rejected because it has a strong correlation with income and at the same time creates problems of autocorrelation and multi-collinearity.

Dummy Variables		
Time Period	**Number of Studies**	**Number of Dummies**
1960-1970	2	3
1971-1980	7	11
1981-1990	14	25
1991-2000	7	14
2001-2014	36	80
Total Studies	66	133
Percentage	17%	33%

Table 13 Number of Dummy Variables in previous studies

In recent decades, there has been an increase in the use of Dummy Variables in the context of tourism demand by many researchers in their attempts to include in their studies various events that either negatively or positively affect tourist demand. Negative events that were applied as Dummy Variables were the Asian crisis (Kim, Park, Lee, Jang, 2012), the terrorist attacks in Bali in 2002 (Athanassopoulos, Hyndman, 2008), the 11 September terrorist attack (Munoz, 2006), the outbreak of epidemics (Ratthawan and Kammonnut, 2015). Respectively, events that the researchers expect to positively influence tourism demand are the Olympics (Hyndman, 2008). Table 13 shows that in a total of 400 studies on tourism demand, 66 studies (17%) used Dummy Variables. During the last period of 2001 to 2014, a total of 36 studies applied 80 Dummy Variables. Despite the increase in crises, the financial crisis and political instability, the impact on tourism demand is small.

3.7 Error Metrics

According to the international literature, different predictive measures have been formulated and implemented, which are available. The error metrics that have been extensively used to measure accuracy and compare predictive methodologies are as follows:

ERROR METRICS	TYPES
Theil's U	$\frac{\sqrt{\sum (A_t - F_t)^2}}{\sqrt{\sum (A_t - A_{t-1})^2}}$
Mean absolute percentage error (MAPE)	$\frac{\sum \lvert (A_t - F_t) / A_t \rvert}{n}$
Mean square error (MSE)	$\frac{\sum (A_t - F_t)^2}{n}$
Root Mean Squared Percentage Error (RMSPE)	$\sqrt{\frac{\sum (A_t - F_t)^2 / F_t}{n}}$
Root mean square error (RMSE)	$\sqrt{\frac{\sum (A_t - F_t)^2}{n}}$
Mean absolute deviation (MAD)	$\frac{\sum \lvert A_t - F_t \rvert}{n}$

Table 14 Types of Error Metrics

The dominant measure is the mean absolute percentage error (MAPE), which is used 127 times in 155 different comparisons. It is a measure that examines the behavior of the absolute value of the prediction error in relation to the actual value of the time series. As can be seen from Table 14, the mean absolute percentage error is defined as the sum of the absolute values of the predictor errors to the corresponding real values of the time series divided by the number of time periods n predicted.

MSE is the mean square error of the predicted values of the time series from the actual ones. The unit of measurement of the MSE is expressed in the unit of measurement of the observations, but elevated to the square. For this reason, we sometimes use the positive value of the square root which is called Root Mean Squared Error (RMSE), expressed in the same unit of measurement as the time series value. The root mean squared error is the next most popular measure, which was used 91 times in 155 different comparisons.

RMSPE is the square root of the mean square error percentage. It is defined as the sum of the squares of the deviations of the predicted values of the time series from the respective real values to the respective real values divided by the number of time periods n. RMSPE and RMSE "punish" large bugs at a higher rate than small mistakes. Finally, it has been used 83 times in 155 different comparisons.

The Mean Absolute Deviation (MAD) represents the mean value of the absolute deviations of the predicted values of the time series from the corresponding real ones. Its unit of measurement is the same as that of the time series and so it is easy to interpret it. Also, the actual values of the errors are not taken into account when calculating, but only their absolute values. This means that the mean absolute deviation is independent of positive or negative error values. Finally, it is based on the assumption that the severity of the error or the cost created by the prediction error is linearly related to the magnitude of the error.

However, the existence of forecasts that are far from the corresponding real values is much more noticeable with the mean square error criterion than with the average absolute deviation criterion, because the predictive error values rise in the square. Therefore, the MSE criterion is statistically more reliable than the MAD criterion and is more often used to select the "appropriate" prediction method.

Another measure that provides information about the relative error is the Theil (1961) inequality coefficient U, with extreme values. The inequality factor U is independent of the units of measurement and is therefore more appropriate for comparing the predictive capacity of different models, unlike the other criteria that depend on the units of measurement.

CHAPTER 4 ESTIMATION METHODOLOGY AND EMPIRICAL ANALYSIS

According to the bibliographic review of Tourism made in the previous chapters, we will try to determine which socio-economic variables that affect Greece's international tourism demand should be included in the model and in what form. Before we present the results of our estimates, we will describe the explanatory variables and the model we will use according to the assumptions we have made.

4.1 Function of Tourism Demand

In the international tourism literature, when tourism demand is examined at national level, a number of variables such as arrivals, costs or revenues, overnight stays, exchange rates, distance, competing countries, cost of stay in the country of destination are used, political instability, various psychological parameters etc.

In this study and following the literature we consider that the function of Greece's tourism demand may include relative prices, tourist income, transport cost, population and bilateral trade.

The function of tourism demand can be expressed as follows:

$$\boldsymbol{TOUR_{it}} = \boldsymbol{f}(\boldsymbol{GDP}, \boldsymbol{TRADE}, \boldsymbol{RP}, \boldsymbol{POP}, \boldsymbol{DIST}) \qquad (4.1)$$

Where,

- $TOUR_{it}$ _ is the tourist arrivals from tourists' countries of origin to Greece.
- GDP _ is the tourists' income in the country of origin.
- $TRADE$ _ is the bilateral trade between Greece and the tourists' countries of origin.
- RP _ are the relative prices.
- POP _ is the tourists' total population in the countries of origin.
- $DIST$ _ is the geographical distance between Greece and the tourists' countries of origin.

4.2 Methods of Measurement

Tourism plays an important role in the economy of each country. For this reason, it is important to pay special attention to the measurement of tourism demand according to its determinants and characteristics as mentioned in the previous sections.

Tourism demand can be distinguished in 3 types:

- Inbound tourism, which includes the activities of foreign tourists in a given country.
- Outbound tourism, which includes the activities of domestic tourists traveling and residing in destinations outside their own country.
- Domestic tourism, which includes domestic tourists of a country who travel within their borders.

In this study we will focus on the measurement of incoming tourism, which can be measured in various ways. Kim (1998) ranked the measurement criteria for all types of tourism demand in 4 groups:

1. Number of tourist arrivals recorded at the borders of each country.
2. The amount of tourist expenditure in the country of destination.
3. The number of overnight stays of tourists in the destination country.
4. The distance between the country of origin and the country of destination.

Each mode of measurement has some disadvantages. Song et al. (2009) claimed that the registration of tourists at the border is disadvantaged, as the transit of residents residing at the border also goes to the neighboring country for non-tourist purposes. Regarding the recording of tourist expenses, it is done through qualitative surveys or by the Central Bank, resulting in the impossibility of collecting large volumes of data. Recordings in tourist accommodation do not count day visitors and those staying in unregistered accommodation or in relatives and friends' homes. Many accommodations are not recorded by state services as tourist accommodation lodgings (rooms to let, villas, apartments) operating illegally resulting in the failure to collect valid data.

Taking into account the statistical availability and the consistency between data sources, tourist arrivals and tourist expenditures are the most frequently used tourism demand measures in empirical studies despite the disadvantages they present. More recently, Li et al. (2005) over the period 1990-2004 found that 18 of the 84 published studies used more than one method of measuring tourism demand.

4.3 Econometric model and types of Data

In this empirical analysis, the assessment of Greece's tourism demand and the factors influencing it will be made through a balanced data panel consisting of 34 countries (Albania, Argentina, Australia, Austria, Belgium, Bulgaria, Brazil, France, Germany , Denmark, Switzerland, United Kingdom, United States, Japan, Ireland, Spain, Israel, Italy, Canada, Cyprus, Mexico, Norway, Holland, Hungary, Poland, Portugal, Romania, Russia, Serbia, Slovakia, Sweden, Czech Republic, Turkey, Finland) representing the majority of tourist arrivals. We will examine the period from 2000 to 2015. Due to the fact that Greece is mainly a summer destination, annual data were selected to avoid seasonality problems. As we can see in Figure 20, the countries selected cover 91.5% of Greece's total tourism demand.

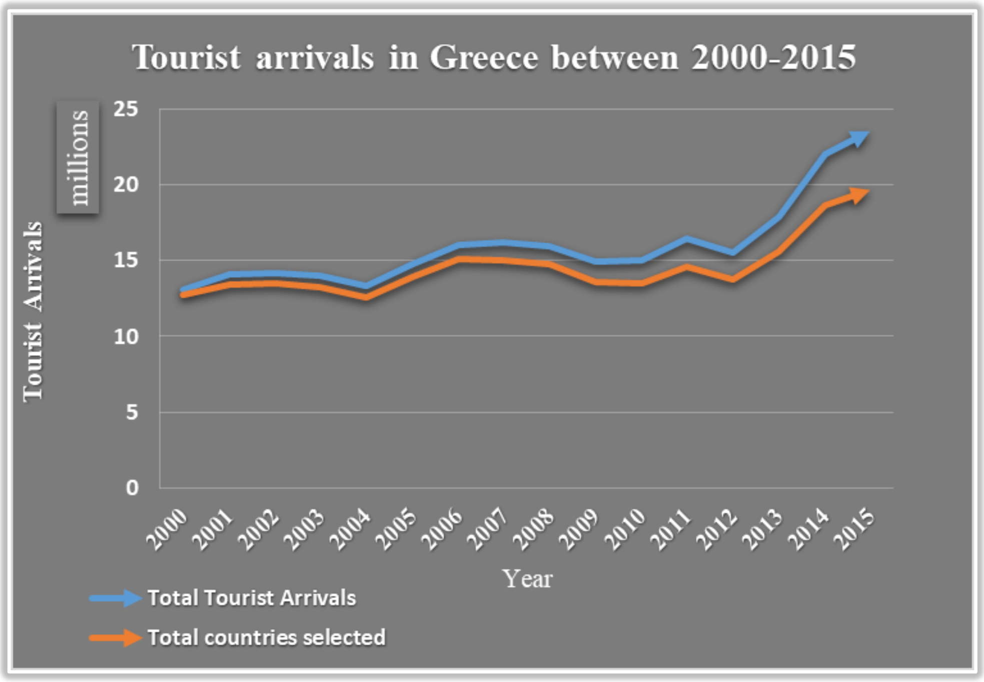

Figure 20 Tourist Arrivals in Greece between 2000 -2015

The reason why panel data was selected is because it allows the recording of heterogeneity in individual countries. It essentially implies that countries have different inherent characteristics, which is ignored by the use of only time series or cross-sectional data. It also provides us with more degrees of freedom, more variance and less multicollinearity among the variables. The use of data panels allows empirical analysis of complex models such as tourist demand.

4.3.1 Dependent Variable

The dependent variable used is the $TOUR_{it}$ and measures total tourist arrivals (non-residents) in Greece, from country i to year t .The data used have been drawn from the Hellenic Statistical Office and the Bank of Greece for the years 2000 to 2015. It is on an annual basis to avoid seasonality problems.

4.3.2 Independent Variables

As we mentioned in Chapter 2, based on classical economic theory, tourism demand is expected to be affected mainly by economic factors. In addition, various other geographic or demographic factors have proven to be important in meeting the volume of tourism demand. Based on an overview of the most used determinants of tourism demand we have reported and the availability of data, the following explanatory variables will be incorporated into our model.

4.3.2.1 Income

Hypothesis 1: Tourist demand will be affected by the income of tourists in the country of origin

Income, as we have mentioned, is the most commonly used interpretive variable. Researchers believe that income is particularly important as a determinant of tourism demand. It is understandable that the decision on whether to travel will depend on the level of individual income. In the case of international travel, tourism is considered a luxury product and the income elasticity is between 1 and 2 (Crouch, 1994; Smeral, 2003). In our analysis we will use GDP per capita (Purchasing Power Parity, constant prices 2011 US $) at constant US dollars in 2011, covering the years 2000 to 2015. The data drawn from the World Bank Organization. Income flexibility according to theory is expected to be positive. As an increase in individual income in the countries of origin is expected to increase tourist flows to Greece. Therefore, the point for the estimated coefficient of this variable is expected to have a positive sign (Garin-Muñoz and Amaral, 2000; Luzzi and Fluckiger, 2003; Narayan, 2004; Habibi et al, 2009; Hanafiah and Harun, 2010; Leitão, 2010; Camelia Surugiu and Nuno Carlos Leitão and Marius Răzvan Surugiu, 2011; Chasapopoulos et al., 2014).

4.3.2.2 Trade

Hypothesis 2: International trade plays an important role in increasing tourism demand.

Greece's geographical location makes it an important economic hub between 3 continents, Asia, Europe and Africa. Unlike other European countries such as Ireland, Portugal, Greece is close to countries with low economic growth, such as Albania and Bulgaria, which allows them to increase its economic penetration in these countries. The strong trade links between Greece and other countries increase professional tourism, such as participation in conferences, exhibitions, business obligations, which also leads to the reduction of seasonality. Therefore, in our model we will include the trade between Greece and each country as an explanatory variable of tourism demand and will be expressed in the following formula:

$$TRADE_{im} = \frac{X_i + M_i}{GDP_{GREECE} + GDP_m} \qquad (4.2)$$

Where,

- X_i : are Greece's annual exports to each country of origin of tourists in year t
- M_i : are Greece's annual imports to each country of origin of tourists in year t
- GDP_{GREECE} : is the per capital Gross Domestic Product of Greece based on the Purchasing Power Parity (PPP) at constant prices 2011 US dollars.
- GDP_m : is the per capital Gross Domestic Product of each tourists' country of origin, based on the Purchasing Power Parity (PPP) at constant prices 2011 US dollars.

The data are drawn from the World Integrated Trade Solution software (WIDS) developed by the World Bank in cooperation with the United Nations Conference on Trade And Development and a consultative role such as the International Trade Center and the World Trade Organization. An increase in trade between Greece and the tourists' countries of origin will increase tourist flows to Greece. Therefore, the point for the estimated coefficient of this variable is expected to have positive sign (Phakdisoth and Kim, 2007; Leitao, 2010; Chasapopoulos et al., 2014).

4.3.2.3 Relative prices

Hypothesis 3: The cost of living in Greece has a direct impact on tourist demand depending on the tourists' country of origin.

The prices of goods and services in the tourists' country of origin compared to the respective prices in Greece directly affect the decision of tourists to travel to Greece. If the cost of living in Greece is lower than the tourists' countries of origin, it will result in an increase in tourism demand. An important role, as mentioned in the theory, apart from the cost of living, is played by the respective exchange rates for which tourists have sufficient information. For this reason, we will use the relative prices with the effect of the exchange rate as an explanatory variable of the tourism demand as expressed by the following function:

$$RP_{it} = \frac{CPI_{it}}{CPI_{ij}} ER_{it} \tag{4.3}$$

Where,

- CPI_{it} : Consumer Price Index in Greece in year t
- CPI_{ij} : Consumer Price Index in country of origin j in year t
- ER_{it} : the Exchange Rate between Greece and the country of origin

Data on the Consumer Price Index (CPI) and the Exchange Rate (ER) for both Greece and the countries of origin have been drawn from the International Monetary Fund. The base year of the Consumer Price Index (CPI) is 2010 and it expresses how many units are needed by an average household to buy the same goods and services in different countries. Following the theory, the point for the estimated coefficient of this variable is expected to have a negative sign.

4.3.2.4 Distance

Hypothesis 4: Greece's international tourism demand is directly affected by the geographical distance from the tourists' countries of origin.

The cost of transporting tourists from their countries of origin to Greece and back again is an important parameter that can influence the decision of tourists if they choose Greece for their holidays. However, the calculation of transport costs is difficult because of the different means of transport that a tourist can use to travel, such as a car, a train, an airplane and fluctuating ticket prices in relation to the period and quality. Instead, we will use the geographical distance of Athens with the capitals of the tourists' countries of origin in kilometers to express the effect of the transport costs on the decision of the tourists to travel. The smaller the distance from Greece from the tourist's country of origin we expect to have a positive effect on the tourist demand and vice versa. Therefore, the point for the estimated coefficient of this variable is expected to have a negative sign. The data have been obtained from the French Institute for Research of the World Economy (CEPII).

4.3.2.5 Population

Hypothesis 5: An increase in the population in the tourists' countries of origin of tourists is expected to increase tourist flows to Greece.

The World Population in 2000 amounted to 6.118.075.293. In 15 years it increased to 7.355.220.412, ie we see an increase of 20.22%. In our sample countries, which are potentially tourist flows to Greece, their population increased by 9.4% on average over the 15 years we examine. It is therefore reasonable that we should include the population as an explanatory variable in our model because it determines the size of the market in order to examine its impact on the tourism demand of Greece. However, many surveys exclude it from the same as ours, because it has a high correlation with the income variable and creates problems of multi-collinearity (Leitão, 2009, 2010; Hanafiah and Harun, 2010). The point for the estimated coefficient of this variable is expected to have a positive sign. The data have been drawn from the World Bank.

4.3.2.6 Dummy Variables

Hypothesis 6: The economic and social conditions of the tourists' countries of origin influence their decision to travel.

It is reasonable that the individual income of tourists or the basket of an average household do not reflect all the economic conditions prevailing in a country. For example, while Qatar has the highest per capita Gross National Product (GDP) for 2016, the United Nations classifies it in the developing economies because of an extreme unequal distribution of individual income, lack of infrastructure and limited educational opportunities for citizens living below the poverty line. As a result, per capita Gross Domestic Product or Consumer Price Index are not comprehensive indicators that can accurately describe the country's economic, social and demographic situation. Therefore, we will use three dummy variables that will categorize countries according to the level of economic growth and how this is structured in their economy as a whole. The most appropriate segregation of countries is that developed by the United Nations. It distinguishes the countries in "Developed", "Developing" and those "In Transition". As a consequence, dummy variable $\boldsymbol{D}$ will refer UN-designated countries as "Developed" and will take the value 1, otherwise 0. Dummy variable $\boldsymbol{T}$ will refer to UN-designated countries "In Transition" and will take the value 1, otherwise 0. Finally, the dummy variable $\boldsymbol{DP}$ will refer to countries designated by the United Nations as "Developing" and will take the value 1, otherwise 0. The data has been drawn from the United Nations cooperation with the World Bank, United Nations Conference on Trade and Development, International Monetary Fund, United Nations World Tourism Organization and the Organization for Economic Cooperation and Development.

4.4 Appropriate model

The process through which we will select the appropriate model for anticipating the tourist demand of Greece is shown in the Figure 21.

In detail, the steps that we will take to arrive at the selection of the appropriate model are presented below.

<u>Step 1</u>: We will estimate a Pooled OLS model, assuming that there is no effect either over time or on the individual characteristics of countries between the explanatory and dependent variables.

<u>Step 2</u>: Next, we will evaluate the function with a Fixed Effect model, assuming that the unobserved heterogeneity is due to the individual characteristics of each country, and this effect correlates with any explanatory variable.

<u>Step 3</u>: We will use the F-test to examine which of the above two models of Pooled OLS or Fixed Effects is appropriate.

<u>Step 4</u>: Then we will evaluate the function with a Random Effect model, assuming that the unobserved heterogeneity of each country is expressed by the disruptive term and this effect is not correlated with any of the explanatory variables.

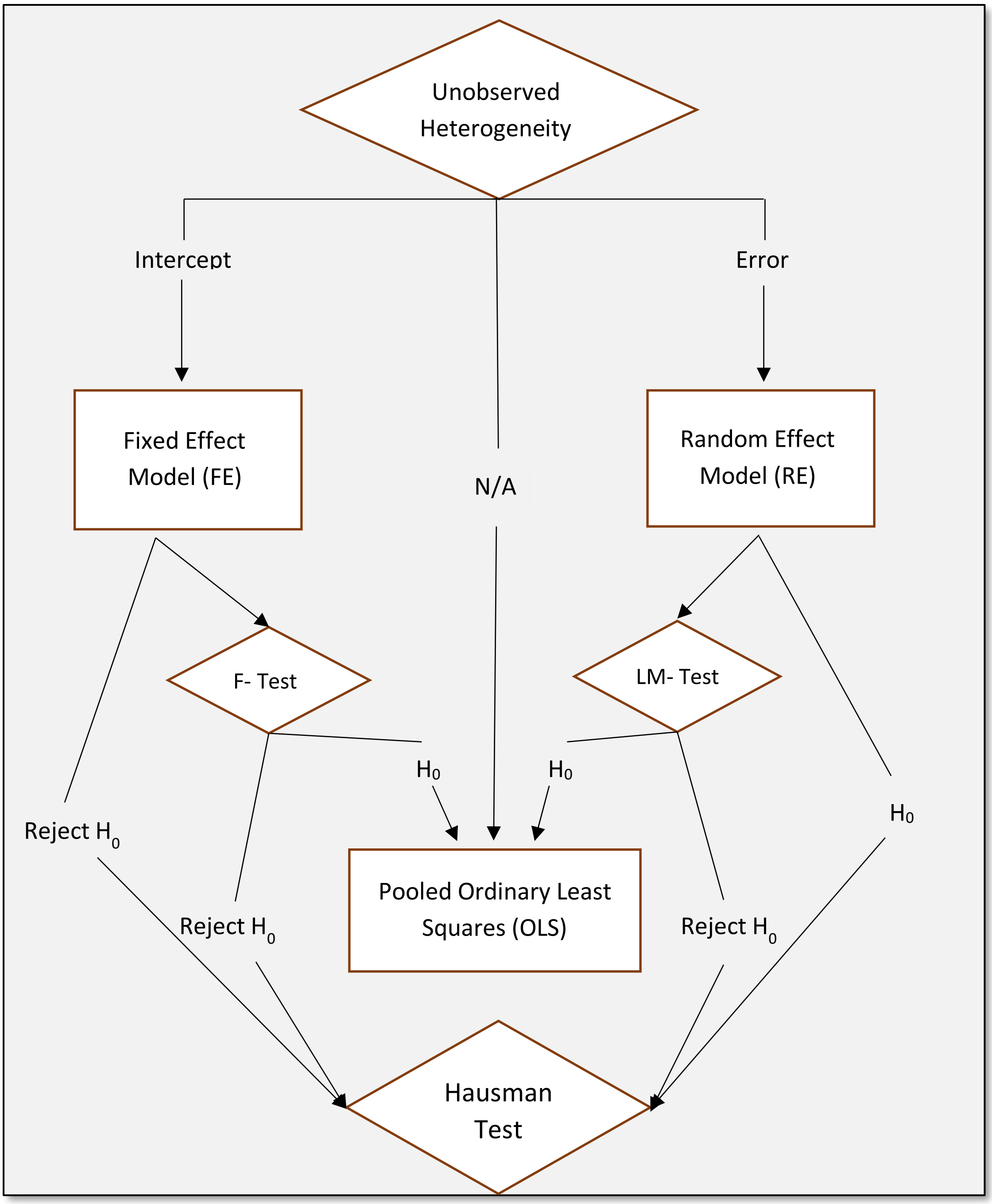

Figure 21 Steps for appropriate model in Panel Data analysis

Step 5: We will use the Breusch-Pagan Lagrange Multiplier (LM) test to examine which of the two above mentioned models Pooled OLS or Random Effects, is more appropriate.

Step 6: If the null hypothesis of both the F-test and the LM test are not rejected, then the model that is appropriate to express the tourism demand of Greece is the Pooled OLS. If the null hypothesis of the F-test is rejected and the null hypothesis of the

Breusch-Pagan LM test is not rejected, then the model best suited to express our data is Fixed Effects. If the F-test's null hypothesis is not rejected and the Breusch-Pagan LM test is rejected, then the most appropriate model for expressing our data is Random Effects.

Step 7: If the null hypothesis of both the F-test and the LM test are rejected and the Fixed and Random Effects model is statistically significant, then we will use the Hausman test to determine which of the two is appropriate. If the null hypothesis is rejected, then the model that is best suited to expressing our data is Fixed Effects, otherwise the most appropriate model is Random Effects.

The function we use is in logarithmic form. The coefficients of the explanatory variables except the dummy variables reflect the elasticity. Thus, function 4.1 is formulated as follows:

$$\log\_y = \boldsymbol{a} + \beta_1 * \log\_inc + \boldsymbol{\beta_2} * \log\_trade + \boldsymbol{\beta_3} * \log\_rp + \boldsymbol{\beta_4} * \log\_pop + \boldsymbol{\beta_5} * \log\_d + \beta_6 * \mathrm{D} + \boldsymbol{\beta_7} * \mathrm{T} + \varepsilon_{it} \quad (4.4)$$

4.4.1 Descriptive Statistics

Before we proceed to our data analysis through the Stata 12.0 statistical package, it is worth mentioning that we have created a new variable *Country1* which contains a unique country number because Stata cannot group data by country. Next, we need to declare the cross section and time variables using the «xtset Country1 YEAR» command. As we can see from the following Table, the panel is balanced (Strongly balanced).

Stata_SE	Command : xtset Country1 YEAR
panel variable :	Country1 (strongly balanced)
time variable :	YEAR, 2000 to 2015
delta :	1 year

Table 15 «xtset» command

Then, through the "describe" command, we give general information about the number of sample observations, number, name, description, format, and storage type of the variables in Stata.

Stata_SE	Command : describe		
obs :	544		
vars :	11		
size :	38,624		

variable name	storage type	display format	variable label
COUNTRY	str18	%18s	34 Countries
YEAR	int	%ty	2000 to 2015
log_y	double	%10.0q	Inbound Tourism
log_inc	double	%10.0q	Income
log_rp	double	%10.0q	Relative Prices
log_trade	double	%10.0q	Trade
log_pop	double	%10.0q	Population
log_d	double	%10.0q	Distance
D	byte	%10.0q	Developed Countries
T	byte	%10.0q	In Transition
Country1	byte	%9.0q	group (COUNTRY)

Table 16 Description of Variables

With the "tabstat" command we get information about the descriptive statistics of our variables. In particular, the following table shows the mean, median, min and max values, the standard deviation, the skewness and the kurtosis of the dependent and the independent variables.

Summary Statistics							
variable	mean	p50	min	max	sd	skewness	kurtosis
log_y	5,2767	5,3560	3,1644	6,4783	0,6430	-0,7194	3,5074
log_inc	4,4515	4,5324	3,7535	4,8135	0,2186	-0,7272	2,7148
log_rp	-0,0873	-0,1224	-0,2453	0,6082	0,1038	2,8215	14,3998
log_trade	4,1514	4,0737	2,8701	5,3052	0,5263	0,1339	2,2310
log_pop	7,2902	7,1271	5,9746	8,5064	0,5813	0,1706	2,2236
log_d	3,3753	3,3307	2,6937	4,8907	0,4673	1,1395	4,4708
D	0,6176	1	0	1	0,4864	-0,4842	1,2344
T	0,2647	0	0	1	0,4416	1,0667	2,1378

Table 17 Summary Statistics

In addition, we will use scatter plots between each independent variable individually in dependence on the dependent variable to graphically represent the dispersion of observations, their slope, correlation and any divergent values.

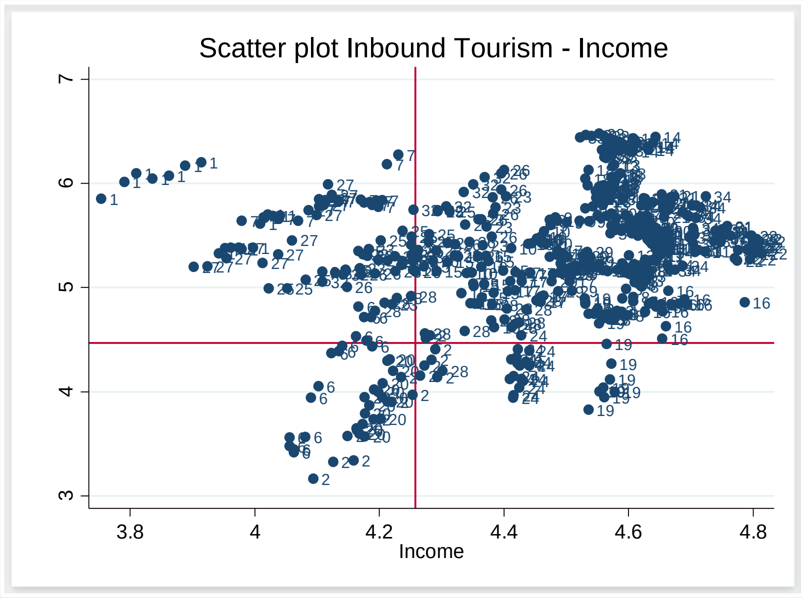

Figure 22 Scatter plot Inbound Tourism-Income

Figure 22 shows that the dispersion of observations is rather small, indicating that there is probably a high correlation between these variables. As the tourists' per capital income of the countries of origin increases, tourist arrivals in Greece are increasing. Therefore, we understand that the per capital income of tourists in the countries of origin has a positive effect on tourist arrivals. In particular, we can say that low-income countries such as Argentina (2), Brazil (6) and Mexico (20), the level of tourist arrivals from these countries in Greece is quite low as illustrated in above figure, and in particular the values enclosed in the lower left-hand rectangle. In contrast, high income countries such as Germany (14), Norway (22) and the United States (34), the level of tourist arrivals from these countries to Greece is quite high. However, we also find countries that are geographically close to Greece deviate from the rest, such as Albania (1), Bulgaria (7) and Serbia (27), which despite the low per capital income we observe that the level of tourist arrivals to Greece is quite high.

Figure 23 illustrates the impact of Greece's trade relations with the tourists' countries of origin on the tourist arrivals of Greece. The dispersion of observations is rather small, indicating that there is a rather large correlation between the above-mentioned variables. As stated in theory, trade relations are the expression of professional tourism among countries. It is conceivable that as the bilateral trade between Greece and another country increases, this results in an increase in tourist flows to Greece from this country. We therefore conclude that bilateral trade has a positive effect on the tourist arrivals of

Greece. More specifically, countries that have not developed trade relations with Greece such as Argentina (2) and Mexico (20), the level of tourist arrivals from these countries to Greece is quite low. This is illustrated in the Figure below and is located at the values encompassing the lower left-hand rectangle. On the other hand, countries which have developed high commercial relations with Greece, such as Germany (14), Russia (26) and the United Kingdom (33), the level of tourist arrivals from these countries to Greece is quite high.

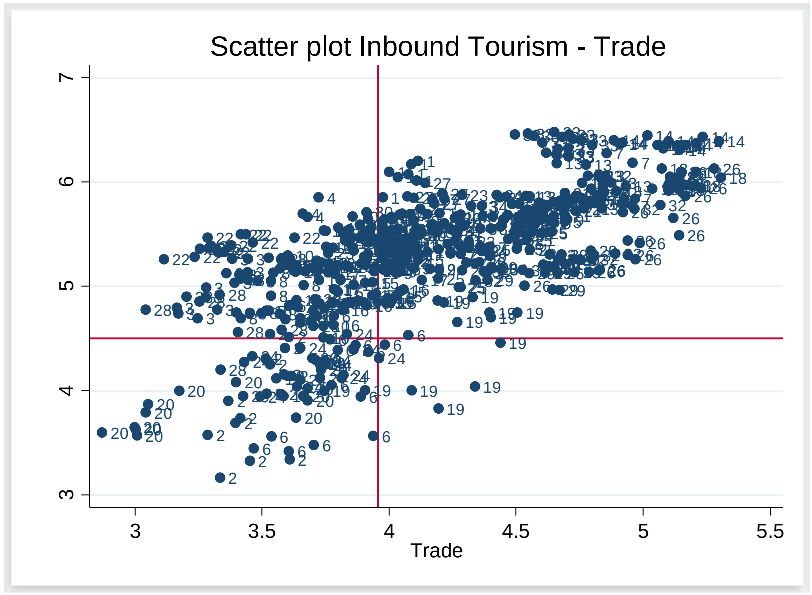

Figure 23 Scatter plot Inbound Tourism-Trade

As we can see in Figure 24, the dispersion of observations is relatively small, which may indicate that there is a strong correlation between the variables.

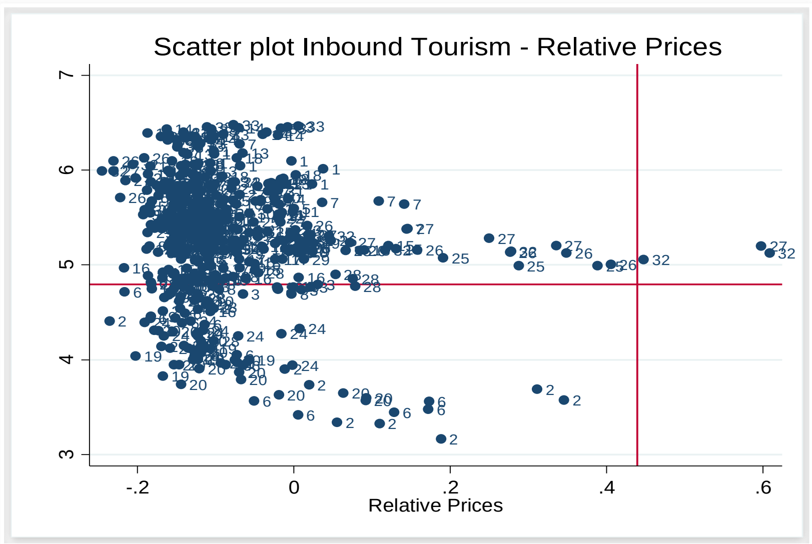

Figure 24 Scatter plot Inbound Tourism-Relative Prices

The lower the level of relative prices, the higher the level of tourist arrivals in Greece is expected to be. Therefore, we observe that there is a negative relationship between the relative prices of Greece and the country of origin in connection with the exchange rates in tourist arrivals in Greece. This negative effect of relative values is more pronounced in Argentina (2) and Brazil (6), observing the lower left-hand rectangle in the above Figure. We also observe some strongly divergent prices, such as those of Russia (26), Serbia (27) and Turkey (32), for a relatively short period of time.

Figure 25 shows that as the geographical distance of the country of origin increases from Greece, the smaller the tourist arrivals in Greece from these countries are expected to be. For example, in the lower right-hand side we see countries such as Argentina (2), Brazil (6), (10) and Mexico (20) because of the geographical distance from Greece, the level of tourist arrivals is lower than in other Countries.

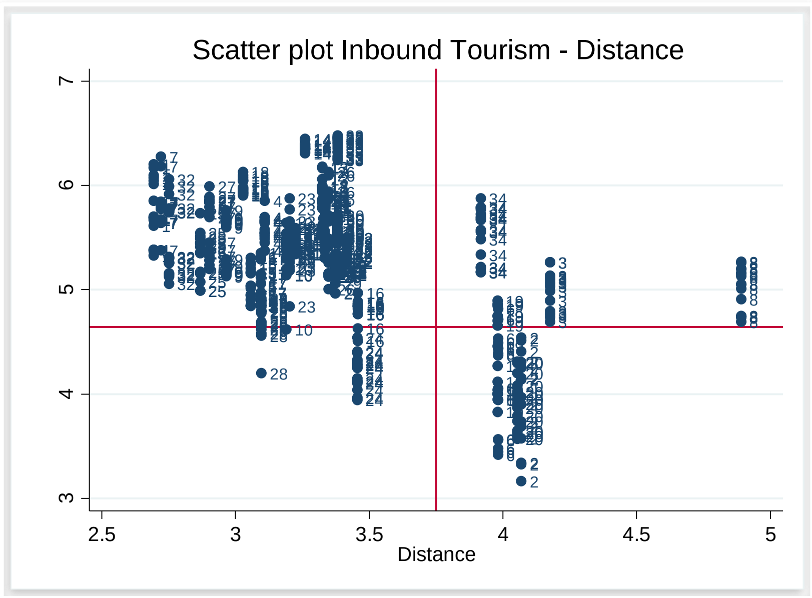

Figure 25 Scatter plot Inbound Tourism – Distance

On the other hand, the closer a country in Greece is, the higher the level of tourist arrivals, with the example of Albania (1), Bulgaria (7), Serbia (27) and Turkey (32). We find that there is a negative relation between the distance of a country from Greece and the tourist arrivals. Notwithstanding the above, we can say that the above negative relation does not apply to all countries, because countries such as Australia (3), Canada (8) and the United States (34) despite the high geographical distance present a high level of tourism arrivals.

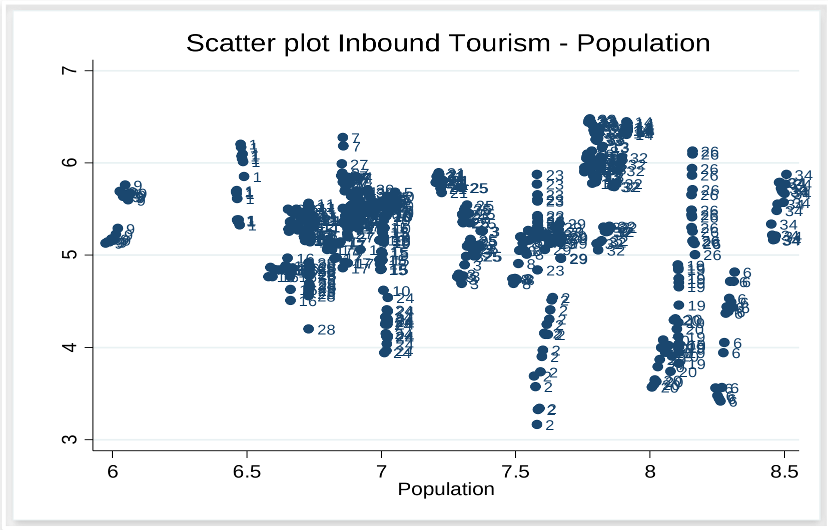

Figure 26 Scatter plot Inbound Tourism-Population

The Figure above shows the positive impact the population has on the tourist arrivals of Greece. In particular, as the population of a country increases from year to year, we observe that tourist arrivals in Greece are increasing. This positive effect is expected as the population determines the size of the market.

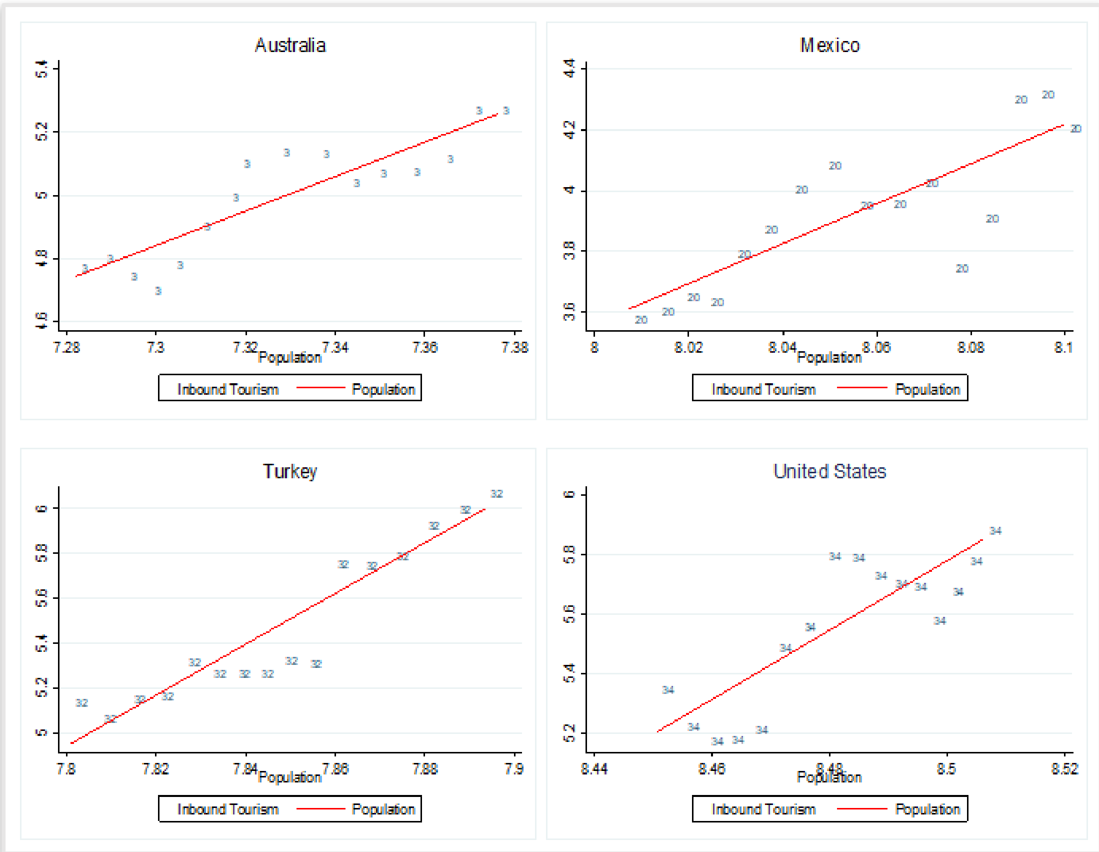

Figure 27 Scatter plot Inbound Tourism-Population from Australia, Mexico, Turkey and United States

According to Figure 27 we see that the effect of the population depending on the incoming tourism in Greece is more pronounced in countries where there was greater population change in the period from 2000 to 2016. These countries are Australia (3) the Mexico (20), Turkey (32) and the United States (34), with a population change of 25.97%, 25.38%, 25.73% and 14.52% respectively.

At the same time, another important parameter in the context of incoming tourism that is worth mentioning is the percentage of participation of the population of each country of origin during the period 2000-2015 in the tourist arrivals of Greece. More specifically, in Table 18 are presented the five countries with the largest and lowest population share of tourist arrivals in Greece. In general, we can conclude that countries that are geographically close in Greece, such as Cyprus, Albania, Bulgaria and Serbia, are the countries with the largest percentage of their population in tourist arrivals during the period under review. An important observation that could be said is that while Norway is geographically remote from Greece, it is ranked fifth in tourist arrivals in Greece. On the other hand, we notice that Mexico, Brazil, Argentina, Japan and the United States are the five countries with the lowest population share of tourist arrivals in Greece.

Population share of Tourist Arrivals in Greece between 2000 and 2015				
	Top 5		Lowest 5	
Rank	Country	Average (%)	Country	Average (%)
1.	Cyprus	30,55%	Mexico	0,01%
2.	Alvania	24,66%	Brazil	0,01%
3.	Boulgaria	9,44%	Argentina	0,03%
4.	Servia	6,55%	Japan	0,03%
5.	Norway	5,10%	United States	0,13%

Table 18 Population share of tourist arrivals in Greece between 2000 and 2015

The countries with the highest and lowest corresponding tourist flows to Greece are presented in Table 19. European countries such as the United Kingdom, Germany, Italy, France and Albania show the highest average tourist arrivals in Greece per year for the period 2000-2015. Similarly, Mexico, Argentina, Portugal, Brazil and Japan are the countries with the lowest averages of tourist flows per year to Greece over the same period.

Tourist Arrivals in Greece between 2000 and 2015				
Top 5			Lowest 5	
Rank	Country	Average	Country	Average
1.	United Kingdom	2.405.535	Mexico	9.379
2.	Germany	2.355.514	Argentina	13.123
3.	Italy	997.016	Portugal	17.729
4.	France	924.119	Brazil	23.361
5.	Albania	730.708	Japan	34.125

Table 19 Tourist arrivals in Greece between 2000 and 2015

In detail, Figure 28 shows a graphical representation of tourist arrivals per year from the 34 countries of origin of the tourists to Greece. In particular, in most countries, we are seeing an upward trend, most of which has been seen in Latin America, especially in recent years. We see a downward trend in the Scandinavian countries (Sweden, Norway), Denmark and Japan where the biggest decline is observed. Portugal, Poland and Hungary show great fluctuations, while tourist arrivals from Belgium, Germany, Switzerland and Finland remain relatively unchanged throughout this period.

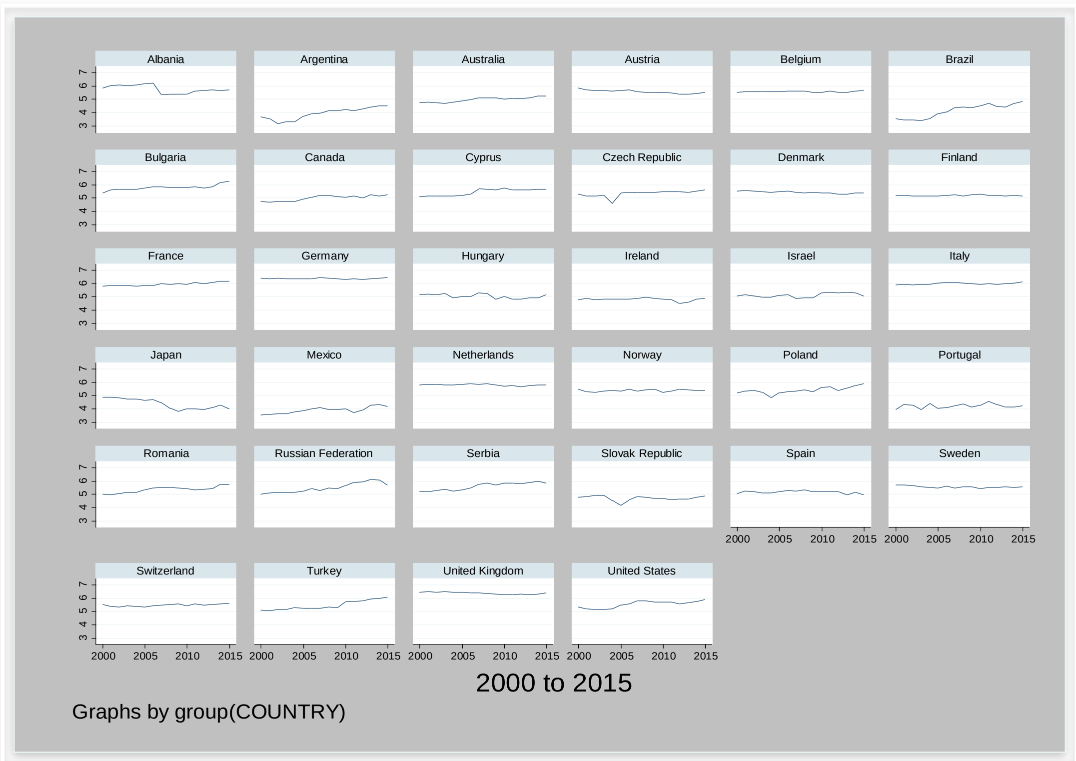

Figure 28 Greece's Inbound Tourism Line Graph of each Country

4.4.2 Ordinary Least Squares (Pooled OLS)

The estimation of a regression in data panels with the OLS method ignores the dimensions of space and time. In fact, the impact on both per countries and per year is equal to zero. So our function has the following form:

$$y_{it} = a + \beta X'_{it} + u_{it} \qquad (\varepsilon_{it} = 0) \tag{4.4}$$

This estimation method assumes that all 34 countries in our sample are reacting the same at any price level of the explanatory variables. So our function will have the following form:

$$\log\_y_i = \beta_0 + \beta_1 \log\_inc + \beta_2 \log\_trade + \beta_3 \log\_rp + \beta_4 \log\_d + \beta_5 \log\_pop + \beta_6 \mathrm{D} + \beta_7 \mathrm{T} + u_i \tag{4.5}$$

The regression analysis with the Least Squares Method conducted with the statistical package Stata 12.

Stata_SE	Pooled OLS					
	Command : regress log_y log_inc log_rp log_trade log_pop log_d D T					
					Number of obs	544
Source	SS	d f	MS		F (7, 536)	150,81
Model	148,918	7	21,274		Prob > F	0,000
Residual	75,609	536	0,141		R-squared	0,663
Total	224,526	543	0,413		Adj R-squared	0,659
					Root MSE	0,376
log_y	Coef.	Std. Err.	t	P > t	[95% Conf.	Interval]
log_inc	0,765	0,153	4,99	0,000	0,464	1,067
log_rp	-0,048	0,179	-0,27	0,787	-0,401	0,304
log_trade	0,684	0,056	12,27	0,000	0,574	0,793
log_pop	-0,071	0,052	-1,37	0,171	-0,172	0,031
log_d	-0,265	0,068	-3,87	0,000	-0,399	-0,130
D	0,368	0,091	4,05	0,000	0,190	0,547
T	0,522	0,067	7,76	0,000	0,390	0,654
_cons	0,072	0,673	0,11	0,915	-1,251	1,395

Table 20 Pooled Ordinary Least Squares Regression Results

As we can see from the results, the regression fits the data well and is statistically significant at a significance level of 5% (F-stat = 150.81 and p <0.000) R-square = 0.663 meaning that the explanatory variables (log_inc, log_rp, log_trade, log_pop, log_d, D, T) interpret 66.3% of the log_y variability, the remaining 33.7% is due to the error.

The log_inc variable is statistically significant at the 0.05 significance level, as the p-value = 0.000. If the per capita Gross Domestic Product of tourists increases by 1%, tourist arrivals to Greece will increase by 0.765% on average. Since the variable is in logarithmic form, the coefficient of log_inc gives the elasticity. The variable log_rp is statistically insignificant as the p-value = 0.787. The log_trade variable is statistically significant at the 0.05 significance level as the p-value = 0.000. If the bilateral trade between Greece and the tourists' countries of origin increases by 1%, then tourist arrivals to Greece will increase by an average of 0.684%. The log_pop variable is statistically insignificant as the p-value = 0.171. The log_d variable is statistically significant at the 0.05 significance level as the p-value = 0.000. If the distance between Greece and the tourists' countries of origin increases by 1%, then tourist arrivals to Greece will decrease by 0.265% on average. The dummy D is statistically significant at the 0.05 significance level as the p-value = 0.000. If the tourists' country of origin is developed, then the tourist arrivals to Greece increase by 0.368% more than in a developing country of origin. The dummy T is statistically significant at the 0.05 significance level as the p-value = 0.000. If the tourists' country of origin is In Transition, then Greece's tourist arrivals are growing by 0.522% more than a Developing country of origin.

Therefore, the final regression equation is the following:

$$\log\_y = \mathbf{0,072} + \mathbf{0,765} * \log\_inc + \mathbf{0,684} * \log_{trade} * -\mathbf{0,048} * \log_{rp} * -\mathbf{2,65} * \log_{d} * -\mathbf{0.071} * \log_{pop} * +\mathbf{0,368} * \mathrm{D} + \mathbf{0,522} * \mathrm{T} \quad (4.6)$$

4.4.3 Fixed Effect Model

The fixed-effect method is used when a problem is to analyze the effect of variables that change in time. In our model, these are log_inc, log_trade, log_rp, and log_pop. In addition, it is assumed that the characteristics that remain unchanged over time for each entity in the model are only associated with it. Therefore, in our study it is understood that each country is different from the others, that is, it has its own particular characteristics which are attributed to its fixed term, which, like the disruptive term, does not correlate with the rest.

In our case, we will examine a two-way fixed-effect panel, as we want to investigate for independent constants for each country (individual effects) as well as constants for each period (time effects), which is expressed by the following equation:

$$y_{it} = \alpha_i + \gamma_t + \beta X_{it} + u_{it}, \; i = 1,\dots,N, \quad t = 1,\dots,T \qquad (4.7)$$

Every explanatory variable that is persistently constant such as logarithms, **D** and **T** for all i is eliminated by the Fixed Effect method in order to evaluate the real effect of the estimators on the dependent variable.

Using the "xtreg, fe" command we only get results on space effects because the Stata 12 statistical package has no command to examine the effects in terms of time. Instead, we have created dummy variables to our model for each time period so that the estimate takes the effects both in space and time. In this case, $T - 1$ dummy variables are introduced. The results are shown in the figure below.

Stata_SE	Two-way Fixed Effect Model					
Group Variable: Country1	Command : xtreg log_y log_inc log_rp log_trade log_pop i.YEAR, fe					
				Number of obs		544
R-sq:	within = 0,4887			Number of groups		34
	between = 0,0025			Obs per Group	min	16
	overall = 0,0011				avg	16
					max	16
Corr (u_i, Xb) =	-0,9747			F (19,491)		24,700
				Prob > F		0,000
log_y	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
log_inc	1,1702	0,3050	3,84	0,000	0,5710	1,7694
log_rp	-1,3449	0,1489	-9,03	0,000	-1,6375	-1,0524
log_trade	0,2558	0,0656	3,90	0,000	0,1269	0,3846
log_pop	4,5797	0,5766	7,94	0,000	3,4468	5,7125
_cons	-34,1930	4,8987	-6,98	0,000	-43,8180	-24,5680
sigma_u	2,8301					
sigma_e	0,1636					
rho	0,9967	(fraction of variance due to u_i)				
F-test that all u_i = 0		F (33,491) = 77,90		Prob > F = 0,000		

Table 21 Two-way Fixed Effect Model Results

In order to examine the effect of the variables across time when using the Fixed Effect method, we execute the command "testparm i.YEAR", where i.YEAR is the dummy variables mentioned above. It is a test to investigate if all dummy variables are equal to zero. If this hypothesis is not rejected, then there is no time-effect of the variables when using the Fixed Effect method and we will only control the effect of the variables on the space. From Table 22 we see that Prob> F = 0.00 <0.05, so we reject H_0. This means that the parameters for all years are not equal to zero, so we correctly added the dummy variables to estimate the effects of the variables both in space and time.

Command :	testparm i.YEAR
(1)	2001.YEAR = 0
(2)	2002.YEAR = 0
(3)	2003.YEAR = 0
(4)	2004.YEAR = 0
(5)	2005.YEAR = 0
(6)	2006.YEAR = 0
(7)	2007.YEAR = 0
(8)	2008.YEAR = 0
(9)	2009.YEAR = 0
(10)	2010.YEAR = 0
(11)	2011.YEAR = 0
(12)	2012.YEAR = 0
(13)	2013.YEAR = 0
(14)	2014.YEAR = 0
(15)	2015.YEAR = 0
F (15, 491)	= 10,00
Prob > F	= 0,000

H_0: $i.YEAR = 0$

H_1: $i.YEAR \neq 0$

Table 22 Test Parameter

The results of the regression of the 2-way Fixed Effect model are shown in Table 21. The table shows the total number of observations (544) and the number of groups that the panel is divided, that is, 34 countries. The observations per country used are 16, of which the minimum, the mean but also the maximum are equal to 16 observations because as mentioned at the beginning it is a strongly balanced panel data. Regression fits the data well and is statistically significant at the 0.05 significance level (F-stat = 24.70 and p <0.000). The errors are correlated with the coefficients of regression as, corr (u_i, Xb) = - 0.9747. The high correlation rate may indicate that the Random Effect model that we will examine below may not be appropriate.

The log_inc variable is statistically significant at the 0.05 significance level as the p-value = 0.000. It has a positive impact on tourist arrivals to Greece as we expected from theory. If the per capita Gross Domestic Product of tourists grows by 1%, then tourist arrivals to Greece will increase by an average of 1.17%. Since the variable is in logarithmic form, the coefficient of log_inc gives the elasticity. As the income elasticity is between 1 and 2 we conclude that in this model the tourist product of Greece is luxury for most of the countries under consideration. The log_rp variable is statistically significant at the 0.05 significance level as the p-value = 0.000. It has a negative sign and goes hand in hand with the theory. If the relative price level increases by 1%, then tourist arrivals will decrease by approximately 1.34% on average. The log_trade variable is statistically significant at the 0.05 significance level as the p-value = 0.000. It has a positive impact on tourist arrivals as we expected from theory. If the bilateral trade between Greece and the countries of origin of tourists increases by 1%, then tourist arrivals to Greece will increase by an average of about 0.256%.

The log_pop variable is statistically significant at the 0.05 significance level as the p-value = 0.000. It has a positive sign as we expected from theory and reflects the size of the market. If the population in the countries of origin of tourists grows by 1%, then tourist arrivals to Greece will increase by an average of 4.58%. Rho explains the fraction of variance due to u_i . The formula resulting rho is as follows:

$$rho = \frac{sigma\_u^2}{sigma\_u^2 + sigma\_e^2} \tag{4.8}$$

Where,

$sigma\_u$: standard deviation within group, u_i

$sigma\_e$: standard deviation of all residuals, e_i

From the Table below, rho = 0.996. 99.6% of the variance is due to the effect of countries' diversity, despite the diversity of each country due to the change across time. The results of the coefficients of regression according to the 2-way Fixed Effect method are the following:

$$\log\_y = \mathbf{-34,192} + \mathbf{1,17} * \log\_inc + \mathbf{0,255} * \log_{trade} * \mathbf{-1,344} * \log\_rp + \mathbf{4,579} * \log\_pop \tag{4.9}$$

4.4.4 F-Test: OLS or 2-way Fixed Effects model

The regression equation we examine is 4.7 of the Fixed Effects model. Our hypothesis are as follows:

H_0: The parameters of the dummy variables except the missing one, are equal to zero.

H_1: At least one parameter of the dummy variables is not equal to zero.

F-test that all u_i = 0	F (33,491) = 77,90	Prob > F = 0,000

Table 23 F- Test

From the results of the above Table the null hypothesis is rejected as Prob> F = 0.000 and the p-value <0.05. Therefore, we can conclude that there is a significant stable effect. For this reason, the 2-way Fixed Effects model is more appropriate than the Ordinary Least Square model.

4.4.5 Random Effect Model

In the Fixed Effects model we saw that each country has its own constant value. In the model we examine, this constant in Random Effects represents the average of all countries and ε_i the deviation of the individual constant from the mean value. Therefore, this constant is a random variable. In order for a Random Effect model to be considered reliable, it should not be associated with one or more explanatory variables, and the variance between entities is considered random. The Random Effects model is:

$$y_{it} = \beta X'_{it} + u_{it} \qquad (4.10)$$

where,

$$u_{it} = \alpha_i + \varepsilon_{it} \qquad (4.11)$$

while assuming that there are not only cross sectional but also time effects, then:

$$u_{it} = \delta_t + \alpha_i + \varepsilon_{it} \qquad (4.12)$$

Also, an advantage of the Random Effects method is that we can include independent variables that do not change across time. Thus, the **log_d**, **D**, **T** variables will now be included in our model. Because variations in components of the distraction term are not known, they should be evaluated. From the viewpoint of the large number of our countries, we ca not make a proper estimation using the least squares (OLS) method but with the Generalized Least Squares (GLS) method.

As with the Fixed Effects method, we also want the estimation to take on the long-term effects mentioned above. For this reason, the model we will use is two-way Random Effect. The results of this method are shown in Table 24.

Stata_SE	Two-way Random Effect Model			
Group Variable: Country1	Command: xtreg log_y log_inc log_rp log_trade log_pop log_d D T i.YEAR, re			
GLS regression				
		Number of obs		544
R-sq:	within = 0,4338	Number of groups		34
	between = 0,6507	Obs per Group	min	16
	overall = 0,6255		avg	16
			max	16
Corr (u_i, X) =	0 (assumed)	Wald chi2 (22)		431,09
		Prob > chi2		0,000

log_y	Coef.	Std. Err.	z	P > |z|	[95% Conf.	Interval]
log_inc	0,2464	0,2634	0,94	0,350	-0,2699	0,7627
log_rp	-1,4300	0,1517	-9,43	0,000	-1,7272	-1,1327
log_trade	0,3354	0,0660	5,08	0,000	0,2061	0,4648
log_pop	0,3943	0,1400	2,82	0,005	0,1199	0,6686
log_d	-0,6960	0,1874	-3,71	0,000	1,0633	-0,3286
D	0,8248	0,2466	3,34	0,001	0,3414	1,3082
T	0,7152	0,2639	2,71	0,007	0,1980	1,2324
_cons	1,6414	1,4986	1,10	0,273	-1,2958	4,5786
sigma_u	0,3598					
sigma_e	0,1636					
rho	0,8288	(fraction of variance due to u_i)				

Table 24 Two-way Random Effect Model Results

Regression fits the data well and is statistically significant at the 0.05 significance level (p <0.000). The errors are not correlated with the coefficients of regression as, corr (u_i, X) = 0.The **log_inc** variable is not statistically significant at the 0.05 significance level as the p-value = 0.350. The **log_rp** variable is statistically significant at the 0.05 significance level as the p-value = 0.000. It has a negative sign and goes hand in hand with the theory. If the relative price level increases by 1%, then tourist arrivals will decrease by approximately 1.42% on average. The **log_trade** variable is statistically significant at the 0.05 significance level as the p-value = 0.000. It has a positive impact on tourist arrivals as we expected from theory. If the bilateral trade between Greece and the countries of origin of tourists increases by 1%, then tourist arrivals to Greece will increase by an average of about 0.335%. The **log_pop** variable is statistically significant at the 0.05 significance level as the p-value = 0.005. It has a positive sign as we expected from theory and reflects the size of the market. If the population in the countries of origin of tourists grows by 1%, then tourist arrivals to Greece will increase by an average of 0,394%. The log_d variable is statistically significant at the 0.05 significance level as the p-value=0.000. If the distance between Greece and the tourists' countries of origin increases by 1%, then tourist arrivals to Greece will decrease by 0.695% on average. The dummy **D** is statistically significant at the 0.05 significance level as the p-value = 0.001. If the tourists' country of origin is developed, then the tourist arrivals to Greece increase by 0.824% more than in a developing country of origin. The dummy **T** is statistically significant at the 0.05 significance level as the p-value = 0.007. If the tourists' country of origin is In Transition, then Greece's tourist arrivals are growing by 0.715% more than a Developing country of origin. From the Table 24, rho = 0.828. 82,8% of the variance is due to the effect of countries' diversity, despite the diversity of each country due to the change across time. The results of the coefficients of regression according to the 2-way Random Effect method are the following:

$$\log\_y = \mathbf{1,641} + \mathbf{0,246} * \log\_inc + \mathbf{0,335} * \log\_trade - \mathbf{1,429} * \log\_rp + \mathbf{0,394} * \log\_pop - \mathbf{0,695} * \log\_d + \mathbf{0,824} * D + \mathbf{0,715} * T \quad (4.13)$$

4.4.6 Breusch-Pagan Lagrange Multiplier Test (LM)

We will use the Lagrange Multiplier test as presented by Baltagi (2001) to decide which model between the two-way random effect and the Ordinary Least Squares (OLS) model is best suited.

$$LM_u = \frac{nT}{2(T-1)}\left[\frac{\Sigma_i(\Sigma_t e_{it})^2}{\Sigma_\iota \Sigma_t e_{it}^2} - 1\right]^2 \sim x^2 \quad (4.14)$$

<u>Hypothesis</u>

$H_0: \sigma_u^2 = 0$

$H_1: \sigma_u^2 \neq 0$

The null hypothesis in the LM test is that variance of residuals is homoscedasticity. That is, there is no significant difference between countries. The alternative hypothesis is that there is heteroskedasticity between residuals. After running the Random Effects model in the Stata statistical package, we will execute the command "xttest0". In Table below are shown the following results

Stata_SE	Breusch and Pagan Langrangian multiplier test for random effects	
Command : xttest0		
	log_y[Country1,t] = Xb + u[Country1] + e[Country1,t]	
Estimated results :		
	Var	sd = sqrt (Var)
log_y	0,4134925	0,6430339
e	0,0267535	0,1635649
u	0,129485	0,3598402
Test : Var (u) = 0		
	chibar2 (01) = 2338,00	
	Prob > chibar2 = 0,000	

Table 25 Breusch and Pagan LM test for Random Effects

According to the above results, Prob> chibar2 = 0.000 which is small enough to reject the null hypothesis. So, we conclude that the two-way Random Effect model is more appropriate than the Ordinary Least Squares (OLS) model. Therefore, there are significant differences between the characteristics of each country.

4.4.7 Hausman Test

Hausman (1978) proposed the application of a test which examines the existence of a correlation or not between the term of the error of the cross sectional entities and the coefficients of the independent variables. If there is correlation, then the appropriate model is the Fixed Effects. Otherwise if there is no correlation then the appropriate model is Random Effects. The Hausman test is defined as follows:

$$m = q'\left(Var\hat{\beta}_{FE} - Var\hat{\beta}_{RE}\right)^{-1} q \qquad (4.15)$$

Where,

$$q = \hat{\beta}_{FE} - \hat{\beta}_{RE} \qquad (4.16)$$

Under the Random Effect method, the difference of the Table in the brackets, as an estimator of the Random Effects model, is effective and any other estimator has greater variance. The distribution used for statistical m is x^2.

The Hypotheses made are as follows:

H_0: Coefficient β of Random Effects model is consistent and efficient, while coefficient β of Fixed Effect model is consistent and ineffective.

H_1: Coefficient β of Random Effects model is inconsistent, while coefficient β of Fixed Effect model is consistent.

From the results of the Hausman test in Table 26, Prob> chi2 = 0.0004 which is small enough to reject the null hypothesis. The coefficient β of Random Effects model is a consistent and effective as p-value<0.05. So, we conclude that the Two-way Fixed Effect model is more appropriate than the Two-way Random Effects model.

Stata_SE	Hausman Test			
Command :	hausman fe re			
	- Coefficients -			
	(b)	(B)	(b-B)	sqrt (diag (V_b-V_B))
	fe	re	Difference	S.E.
log_inc	1,1702	0,2464	0,9238	0,1537
log_rp	-1,3449	-1,4300	0,0850	-
log_trade	0,2558	0,3354	-0,0797	-
log_pop	4,5797	0,3943	4,1854	0,5593

b = consistent under H_0 and Ha ; obtained from xterg

B = inconsistent under Ha, efficient under H_0 ; obtained from xterg

Test : H_0 : difference in coefficients not systematic

chi2 (19) = (b-B) ' [(V_b-V_B) ^ (-1)] (b-B)

= 46,98

Prob > chi2 = 0,0004

(V_b-V_B is not positive definite)

Table 26 Hausman Test

Even if the results of the above analysis have shown that the Fixed Effect Model fits the data well against the Random Effect Model, it may present some problems, such as serial correlation, heteroskedasticity and endogenous in the independent variables. This results the independent variables being biased and inconsistent, which means that the changes in X are not only linked to the changes in Y but also to the u error and to violate strict exogeneity of the model. It is therefore advisable to test heteroskedasticity with the "xttest3" command in the Fixed Effect model. The null hypothesis in the Modified Wald test is that we have homoscedasticity, that is, constant variance.

From the results of the Modified Wald test according to Table 27 it appears that Prob> chibar2 = 0.000, which is small enough to reject the null hypothesis. Therefore, in the Fixed Effect model (FE) we have heteroskedasticity.

Stata_SE	Modified Wald test for groupwise heteroskedasticity
Command :	xttest3
	H_0: sigma(i)^2 = sigma^2 for all i
	chibar2 (116) = 7215,88
	Prob > chibar2 = 0,0000

Table 27 Modified Wald test for GroupWise Heteroscedasticity

For the above reasons, in the next section, we will attempt to evaluate our model to solve the problems of endogenous, autocorrelation and heteroskedasticity. This is achieved through the use of the Generalized Method of Moments-Differences (GMM-DIFF) or using the Generalized Method of Moments - Systems (GMM-SYS).

4.5 Dynamic Panel model

The use of panel data to estimate tourism demand of Greece, apart from the application of statistical models, we previously examined, allows us to extend to the analysis of a dynamic model. However, in a dynamic model when the dependent variable is used as a time-lag independent variable, it may create an autocorrelation problem. One way to overcome this problem is to find a valid auxiliary variable for the value of the dependent variable with time lag. This was achieved by Arellano and Bond (1991) through the Generalized Method of Moments-Differences. The dependent variable with a two-time period lagged, provides a valid instrumental variable. Also, this estimator is designed for datasets of several entities (N) and a few periods (T) as we look at. Finally, this method assumes that there is no autocorrelation with the first differences of the dependent variable.

The Generalized Method of Moments was developed by Hansen (1982) and applies to several branches of economics. It can be used in time series, cross sectional as well as panel data. Therefore the equation of the Generalized Method of Moments- Difference is the following:

$$y_{it} = \delta y_{i,t-1} + X'_{it}\beta + \varepsilon_{it} \tag{4.17}$$

Where,

- δ : shows the degree of correlation of the dependent variable with the value of its lag for a period of time.
- $y_{i,t-1}$: is the value of the lagged of the dependent variable for a period of time
- X'_{it}: is a vector $1 \times K$ of independent variables with $i = 1,2,\dots,N$ και $t = 1,2,\dots,T$
- β : is a vector $K \times 1$ of the estimation parameters
- ε_{it}: is the random error which includes non-observed effects $\mu_i$and original random error condition u_{it}, where u_{it}~IID $(0,\sigma_u^2)$

So the Random error in the Generalized Method of Moments- Difference is the following:

$$\varepsilon_{it} = \mu_i + u_{it} \tag{4.18}$$

The GMM System has been shown to lead to better results compared with the GMM Difference, because the GMM System increases the effectiveness of the estimators in terms of autocorrelation and effects across time (Arestis et al., 2012). Arellano and Bover (1995) and Blundell and Bond (1998) to take into account the effects of atomic effects across time extended the systematic part of equation (4.17) by adding a constant term α_i, as shown in the equation below.

$$y_{it} = \alpha_i + \delta y_{i,t-1} + X'_{it}\beta + \varepsilon_{it} \tag{4.19}$$

The GMM System attempts to detect those instrumental variables associated with the lagged dependent variable, but not with the fixed term (Arestis et al., 2012). The evaluation of the results both the application of the Generalized Method of Moments-Difference and the application of the Generalized Method of Moments-System is initially achieved by Sargan test (1958) and then by Arellano-Bond test.

Sargan test

Sargan's test investigates the appropriateness of the instrumental variables used to estimate econometric models. The null hypothesis and the alternative examined in this test are the following:

H_0: Instrumental variables are not correlated with the residuals and are valid instruments.
H_1: Instrumental variables are correlated with the residuals and are invalid instruments.

Arellano-Bond test

The Arellano - Bond test investigates the first and second order serial relationships between the residues of the model under consideration. The null hypothesis and the alternative examined in this test are the following:

H_0: There is no autocorrelation between the residuals of the model.
H_1: There is autocorrelation between the residuals of the model.

The statistical test AR (1) examines the first-order serial correlation between residuals and mostly rejects the null hypothesis. On the other hand, AR (2) examines the second order autocorrelation between residuals and is considered more significant because it has the ability to detect autocorrelation at levels. If the null hypothesis is not rejected in this test, the estimators are considered reliable (Roodman, 2009).

In this empirical analysis we will estimate the dynamic model using the Generalized Method of Moments (two step-system) method. In order for our estimates to be consistent and reliable, both the Sargan statistical test should be performed to demonstrate that Instrumental Variables are appropriate, as well as the Arellano-Bond statistical test to examine the existence of autocorrelation between residuals mentioned above.

Table 28 presents the results from the estimation of the basic regression model of our research using the two-stage Generalized Method of Moments - System (GMM-SYS) method.

Stata_SE	System dynamic panel-data estimation					
	Command: xtdpdsys log_y L.log_y log_inc log_trade log_rp log_pop log_d D T, lags(1) twostep artests(2)					
Group Variable:	Country1					
Time variable:	YEAR			Number of obs		510
				Number of groups		34
				Obs per Group	min	15
					avg	15
					max	15
Number of Instruments = 123				Wald chi2 (8)		4818,72
				Prob > chi2		0,000
Two-step results						
log_y	Coef.	Std. Err.	z	P > |z|	[95% Conf.	Interval]
L.log_y	0,3929	0,2823	13,92	0,000	0,3376	0,4483
log_inc	1,3441	0,1384	9,72	0,000	1,0730	1,6153
log_trade	0,0004	0,0138	0,03	0,979	-0,0266	0,0273
log_rp	0,1234	0,0736	1,68	0,093	-0,0208	0,2677
log_pop	0,4938	0,0847	5,83	0,000	0,3278	0,6598
log_d	-0,5768	0,1230	-4,69	0,000	-0,8179	-0,3358
D	0,2337	0,0722	3,24	0,001	0,0921	0,3753
T	0,6260	0,0808	7,75	0,000	0,4677	0,7844
_cons	-4,7117	0,8164	-5,77	0,000	-6,3118	-3,1117
Instruments for differenced equation						
	GMM-type: L(2/.).log_y					
	Standard: LD.log_y D.log_inc D.log_trade D.log_rp D.log_pop					
Instruments for level equation						
	GMM-type: LD.log_y					
	Standard: _cons					

Table 28 1st GMM-System Dynamic Panel data estimation

According to the above results the regression fits the data well and is statistically significant at a significance level of 5% (Prob> chi2 = 0.000).

The lagged depended variable **L.log_y** is statistically significant, as the p-value = 0.000. Furthermore, it has a positive impact on tourism demand. More specifically, if tourist arrivals in Greece increase by 1% in the previous period, tourist arrivals will increase by approximately 0.39% on average.

The explanatory variable **log_inc** is statistically significant at a 5% significance level as the p-value = 0.000. It has a positive impact on tourist arrivals to Greece as we expected from theory. More specifically, if the Per capita Gross Domestic Product of tourists increases by 1%, tourist arrivals to Greece will increase by an average of 1.34%. The variable is in logarithmic form, meaning that the coefficient of this variable shows the elasticity. As the income elasticity is between 1 and 2 we conclude that in this particular dynamic model, the tourist product of Greece is luxury for most of the countries concerned.

The explanatory variables **log_trade** and **log_rp** are not statistically significant as the p-value is equal to 0.979 and 0.093 respectively.

The explanatory variable **log_pop** is statistically significant at a 5% significance level as the p-value = 0.000. It has a positive sign and goes hand in hand with the theory as it reflects the size of the market. If the population in the countries of origin of tourists increases by 1%, tourist arrivals to Greece will increase by an average of 0.49%.

The explanatory variable **log_d** is statistically significant at a 5% significance level as the p-value = 0.000. It has a negative sign and goes hand in hand with the theory. If the distance between Greece and the countries of origin of tourists increases by 1%, tourist arrivals to Greece will decrease 0.57% on average.

Dummy variable **D** is statistically significant at a 5% significance level as p-value = 0.001. It has a positive impact on tourism demand. More specifically, if the country of origin of tourists is Developed, then Greece's tourist arrivals are increasing by 0.23% more than a Developing country of origin.

Dummy variable **T** is statistically significant at a 5% significance level as the p-value = 0.000. It has a positive impact on tourism demand. If the country of origin of the tourists is In Transition, then Greece's tourist arrivals are increased by 0.62% more than a Developing country of origin.

The equation will have the following form:

$$log\_y = \mathbf{-4,7117} + \mathbf{0,3929} * L.\log\_y + \mathbf{1,3441} * \log\_inc + \mathbf{0,0004} * \log\_trade + +\mathbf{0,1234} * \log\_rp + \ \mathbf{0,4938} * \log\_pop - \mathbf{0,5768} * \log\_d + \mathbf{0,2337} * D + \mathbf{0,6260} * T$$

Then, with regard to checking the validity of the instrumental variables used to estimate the dynamic regression model, we will implement the Sargan statistical test by entering the "estat sargan" command. As previously mentioned, Sargan's statistical test examines whether the instrumental variables used in the dynamic model are correlated with residuals, the results of which are shown in Table 29.

Stata_SE	Sargan test of overidentifying restrictions
Command : estat sargan	
	H_0: overidentifying restrictions are valid
	chi2 (116) = 27,96439
	Prob > chi2 = 1,0000

Table 29 1st Sargan test of overidentifying restrictions

From Table 29 it follows that Prob> chi2 = 1,000, which is not small enough to reject the null hypothesis. Therefore, the instrumental variables we used for the dynamic model with the Generalized Method of Moments- System are not correlated with residuals and are valid instruments.

Then we will apply the Arellano - Bond test and investigate if there is a serial correlation of first, second, third and fourth order among the residuals of the model. The null hypothesis examined is that there is no autocorrelation between the residuals of the model. Executing the command "estat abond", we get the results shown in Table 30.

We note that Prob> z = 0.0018 is small enough to reject the null hypothesis, ie the absence of first-order serial correlation. However, in a system of Generalized Method of Moments (GMM-SYS), the presence of first-order serial correlation is not a problem according to Blundell and Bond (1998). In contrast, since Prob> z is 0.3424, 0.1313, and 0.8562 for a second, third and fourth order correlation respectively, the null hypothesis is not rejected. Therefore, there is no serial correlation between the residuals of the model and our estimates are reliable and effective.

Stata_SE	Arellano-Bond test for zero autocorrelation in first-differenced errors		
Command :	estat abond		
	H_0: no autocorellation		
	Order	z	Prob > z
	1	-3,1291	0,0018
	2	-0,9495	0,3424
	3	1,5090	0,1313
	4	-0,1813	0,8562

Table 30 1st Arellano-Bond test for zero autocorrelation in first-differenced errors

In addition to the above two tests, the "steady state" hypothesis proposed by Roodman (2009) for checking the appropriateness of the instrumental variables should be investigated. This hypothesis requires a relatively steady state, ie deviations from long-term values will not be related to fixed effects. Therefore, the lagged dependent variable estimator should indicate a form of convergence where its values will be less than one unit. Otherwise, the dynamic system (GMM-SYS) is inappropriate. From Table 28 we can see that the estimated values of **L.log_y** are below the unit at a 95% significance level which demonstrates the appropriateness of the dynamic system.

Therefore, in order to obtain more reliable and consistent results from our dynamic model according to the estimates we received from the two-step Generalized Method of Moments- System (GMM-SYS), we should deduct those variables that are statistically insignificant. Initially, we will estimate our model again without the **log_rp** variable, the results of which are shown in Table 31.

According to the results of Table 31, regression fits the data well and is statistically significant at a significance level of 5% (Prob> chi2 = 0.000).

The lagged depended variable **L.log_y** is statistically significant, as the value p = 0.000. In addition, it has a positive impact on tourism demand. More specifically, if tourist arrivals in Greece in the previous period increase by 1%, tourist arrivals will increase by approximately 0.41% on average.

The explanatory variable **log_inc** is statistically significant at a 5% significance level as the p-value = 0.000. It has a positive impact on tourist arrivals to Greece as we expected from theory. More specifically, if the Per capita Gross Domestic Product of tourists increases by 1%, tourist arrivals to Greece will increase by an average of 1.21%. In addition, the variable is in logarithmic form, meaning that the coefficient of this variable shows the elasticity. As income elasticity is between 1 and 2, we conclude that in this particular dynamic model, the tourist product of Greece is luxury for most of the countries concerned.

The explanatory variable **log_trade** is not statistically significant as the p-value is equal to 0.182.

The explanatory variable **log_pop** is statistically significant at a 5% significance level as the p-value = 0.000. It has a positive sign and goes hand in hand with the theory as it reflects the size of the market. More specifically, if the population in the countries of origin of tourists increases by 1%, tourist arrivals to Greece will increase by an average of approximately 0.49%.

The explanatory variable **log_d** is statistically significant at the 5% significance level as the value p = 0.000. It has a negative sign and goes hand in hand with the theory. Therefore, if the distance between Greece and the countries of origin of tourists increases by 1%, tourist arrivals to Greece will decrease by approximately 0.60% on average.

Dummy variable **D** is statistically significant at a 5% significance level as p-value = 0.018. It has a positive impact on tourism demand. More specifically, if the country of origin of tourists is Developed, then Greece's tourist arrivals are increased by 0.26% more than a Developing country of origin.

Finally, the dummy variable **T** is statistically significant at a 5% significance level as the p-value = 0.000. It has a positive impact on tourism demand. If the country of origin of the tourists is In Transition, then Greece's tourist arrivals are increased by 0.61% more than a Developing country of origin.

Stata_SE	System dynamic panel-data estimation					
	Command: xtdpdsys log_y L.log_y log_inc log_trade log_pop log_d D T, lags(1) twostep artests(2)					
Group Variable:	Country1					
Time variable:	YEAR			Number of obs		510
				Number of groups		34
				Obs per Group	min	15
					avg	15
					max	15
Number of Instruments = 124				Wald chi2 (7)		7794,68
				Prob > chi2		0,000
Two-step results						
log_y	Coef.	Std. Err.	z	P > |z|	[95% Conf.	Interval]
L.log_y	0,4108	0,0280	14,65	0,000	0,3558	0,4657
log_inc	1,2143	0,1066	11,39	0,000	1,0053	1,4234
log_trade	-0,2981	0,0224	-1,33	0,182	-0,0736	0,0140
log_pop	0,4928	0,1318	3,74	0,000	0,2345	0,7511
log_d	-0,6084	0,1415	-4,30	0,000	-0,8857	-0,3310
D	0,2600	0,1095	2,38	0,018	0,0454	0,4745
T	0,6196	0,0714	8,68	0,000	0,4796	0,7596
_cons	-4,0230	0,7847	-5,13	0,000	-5,5610	-2,4849
Instruments for differenced equation						
	GMM-type: L(2/.).log_y					
	Standard: LD.log_y D.log_inc D.log_trade D.log_pop					
Instruments for level equation						
	GMM-type: LD.log_y					
	Standard: _cons					

Table 31 2nd GMM-System Dynamic Panel data estimation

Therefore, the equation will take the following form: (4.21)

$$\log\_y = -\mathbf{4,0230} + \mathbf{0,4108} * L.\log\_y + \mathbf{1,2143} * \log\_inc - \mathbf{0,2981} * \log\_trade + \mathbf{0,4928} * \log\_pop - \mathbf{0,6084} * \log\_d + \mathbf{0,2600} * D + \mathbf{0,6196} * T$$

We will then implement the Sargan statistical test as before, the results of which are presented in Table 32.

Stata_SE	Sargan test of overidentifying restrictions
Command :	estat sargan
	H_0: overidentifying restrictions are valid
	chi2 (116) = 29,57077
	Prob > chi2 = 1,0000

Table 32 2nd Sargan test of overidentifying restrictions

Table 32 shows that Prob> chi2 = 1,000, which is large enough to reject the null hypothesis. Consequently, the instrumental variables we used for the dynamic model with the Generalized Method of Moments- System are not correlated with residuals and are valid instruments.

Then we will apply the Arellano - Bond test and we will investigate in this case whether there is a serial correlation of first, second, third and fourth order among the residuals of the model. The results obtained are shown in Table 33.

Stata_SE	Arellano-Bond test for zero autocorrelation in first-differenced errors	
Command :	estat abond	
	H_0: no autocorellation	
Order	z	Prob > z
1	-3,1537	0,0016
2	-0,9434	0,3455
3	1,3882	0,1651
4	-0,1212	0,9035

Table 33 2nd Arellano-Bond test for zero autocorrelation in first-differenced errors

We note that Prob> z = 0.0016 is small enough to reject the null hypothesis, ie the absence of first-order serial correlation. However, in a System of Generalized Method of Moments (GMM-SYS), the presence of first-order serial correlation is not a problem according to Blundell and Bond (1998). In contrast, since Prob> z is 0.3455, 0.1651, and 0.9035 for a second, third and fourth order correlation respectively, the null hypothesis is not rejected. Therefore, there is no serial correlation between the residuals of the model and our estimates are reliable and effective.

By continuing, we will estimate our model again by removing the **log_trade** variable this time. The results of the estimation are presented in Table 34.

According to the results of Table 34, regression fits the data well and is statistically significant at a 5% significance level (Prob>chi2=0.000).

Stata_SE	System dynamic panel-data estimation					
	Command: xtdpdsys log_y L.log_y log_inc log_rp log_pop log_d D T, lags(1) twostep artests(2)					
Group Variable:	Country1					
Time variable:	YEAR			Number of obs		510
				Number of groups		34
				Obs per Group	min	15
					avg	15
					max	15
Number of Instruments = 124				Wald chi2 (7)		6085,92
				Prob > chi2		0,000
Two-step results						
log_y	Coef.	Std. Err.	z	P > |z|	[95% Conf.	Interval]
L.log_y	0,3942	0,0291	13,54	0,000	0,3371	0,4513
log_inc	1,3416	0,1469	9,13	0,000	1,0537	1,6295
log_rp	0,1228	0,0660	1,86	0,063	-0,0065	0,2521
log_pop	0,5088	0,0915	5,56	0,000	0,3294	0,6882
log_d	-0,5914	0,1147	-5,16	0,000	-0,8162	-0,3666
D	0,2476	0,0895	2,77	0,006	0,0722	0,4231
T	0,6350	0,0948	6,70	0,000	0,4492	0,8208
_cons	-4,7772	0,7613	-6,28	0,000	-6,2693	-3,2851
Instruments for differenced equation						
	GMM-type: L(2/.).log_y					
	Standard: LD.log_y D.log_inc D.log_rp D.log_pop					
Instruments for level equation						
	GMM-type: LD.log_y					
	Standard: _cons					

Table 34 3rd GMM-System Dynamic Panel data estimation

The lagged depended variable **L.log_y** is statistically significant, as the value p = 0.000. In addition, it has a positive impact on tourism demand. More specifically, if tourist arrivals in Greece in the previous period increase by 1%, tourist arrivals will increase by approximately 0.39% on average.

The explanatory variable **log_inc** is statistically significant at a 5% significance level as the p-value = 0.000. It has a positive impact on tourist arrivals to Greece as we expected from theory. More specifically, if the Per capita Gross Domestic Product of tourists increases by 1%, tourist arrivals to Greece will increase by an average of 1.34%. In addition, the variable is in logarithmic form, meaning that the coefficient of this variable shows the elasticity. As income elasticity is between 1 and 2, we conclude that in this particular dynamic model, the tourist product of Greece is luxury for most of the countries concerned.

The explanatory variable **log_pop** is statistically significant at a 5% significance level as the p-value = 0.000. It has a positive sign and goes hand in hand with the theory as it reflects the size of the market. More specifically, if the population in the countries of origin of tourists increases by 1%, tourist arrivals to Greece will increase by an average of approximately 0.50%.

The explanatory variable **log_d** is statistically significant at the 5% significance level as the value p = 0.000. It has a negative sign and goes hand in hand with the theory. Therefore, if the distance between Greece and the countries of origin of tourists increases by 1%, tourist arrivals to Greece will decrease by approximately 0.59% on average.

Dummy variable **D** is statistically significant at a 5% significance level as p-value = 0.006. It has a positive impact on tourism demand. More specifically, if the country of origin of tourists is Developed, then Greece's tourist arrivals are increased by 0.24% more than a Developing country of origin.

Finally, the dummy variable **T** is statistically significant at a 5% significance level as the p-value = 0.000. It has a positive impact on tourism demand. If the country of origin of the tourists is In Transition, then Greece's tourist arrivals are increased by 0.63% more than a Developing country of origin.

Therefore, the equation will have the following form:

$$\log\_y = \mathbf{-4,7772} + \mathbf{0,3942} * L.\log\_y + \mathbf{1,3416} * \log\_inc + \mathbf{0,1228} * \log\_rp + \mathbf{0,5088} * \log\_pop - \mathbf{0,5914} * \log\_d + \mathbf{0,2476} * D + \mathbf{0,6350} * T$$

Then, we will perform the Sargan statistical test as above, the results of which are presented in Table 35.

Stata_SE	Sargan test of overidentifying restrictions	
Command :	estat sargan	
	H_0: overidentifying restrictions are valid	
	chi2 (116) =	27,97538
	Prob > chi2 =	1,0000

Table 35 3rd Sargan test of overidentifying restrictions

Table 35 shows that Prob> chi2 = 1,000, which is large enough to reject the null hypothesis. Consequently, the instrumental variables we used for the dynamic model with the Generalized Method of Moment- System are not correlated with the residuals and are appropriate instruments. Then we will apply the Arellano - Bond test and we will examine in this case whether there is a serial correlation of first, second, third and fourth order among the residuals of the model. The results obtained are shown in Table 36.

Stata_SE — Arellano-Bond test for zero autocorrelation in first-differenced errors

Command : estat abond

H_0: no autocorellation

Order	z	Prob > z
1	-3,1130	0,0019
2	-0,9466	0,3438
3	1,5009	0,1334
4	-0,1828	0,8549

Table 36 3rd Arellano-Bond test for zero autocorrelation in first-differenced errors

As we can see from the above Table, Prob> z = 0.0019 is small enough to reject the null hypothesis, namely the absence of first-order serial correlation. However, as we have mentioned in previous tests, in a Generalized Method of Moments-System (GMM-SYS), the presence of first-order serial correlation is not a problem according to Blundell and Bond (1998). In contrast, since Prob> z is 0.3438, 0.1334 and 0.8549 for second, third and fourth order, respectively, the null hypothesis is not rejected. Therefore, there is no serial correlation between the residuals of the model and our estimates are reliable and effective.

By doing the above tests, we can then estimate our model without the log_rp and log_trade variables, as in the three above cases these variables are considered to be statistically insignificant. Therefore, Table 37 presents the results of the estimated model without the variables mentioned.

Stata_SE	System dynamic panel-data estimation					
	Command: xtdpdsys log_y L.log_y log_inc log_pop log_d D T, lags(1) twostep artests(2)					
Group Variable:	Country1					
Time variable:	YEAR			Number of obs		510
				Number of groups		34
				Obs per Group	min	15
					avg	15
					max	15
Number of Instruments = 123				Wald chi2 (8)		8462,78
				Prob > chi2		0,000
Two-step results						
log_y	Coef.	Std. Err.	z	P > |z|	[95% Conf.	Interval]
L.log_y	0,4490	0,0199	22,61	0,000	0,4100	0,4879
log_inc	1,0713	0,1083	9,89	0,000	0,8589	1,2836
log_pop	0,5671	0,1212	4,68	0,000	0,3295	0,8046
log_d	-0,7485	0,1489	-5,03	0,000	-1,0404	-0,4565
D	0,2601	0,1320	1,97	0,049	0,0014	0,5189
T	0,5438	0,1133	4,80	0,000	0,3217	0,7659
_cons	-3,7592	0,7493	-5,02	0,000	-5,2278	-2,2905
Instruments for differenced equation						
	GMM-type: L(2/.).log_y					
	Standard: LD.log_y D.log_inc D.log_pop					
Instruments for level equation						
	GMM-type: LD.log_y					
	Standard: _cons					

Table 37 4th GMM-System Dynamic Panel data estimation

According to the results of Table 37, regression fits the data well and is statistically significant at a 5% significance level (Prob>chi2=0.000).

The lagged depended variable **L.log_y** is statistically significant at a 5% significance level as the value p = 0.000. In addition, it has a positive impact on tourism demand. If tourist arrivals in Greece in the previous period increase by 1%, tourist arrivals will increase by approximately 0.44% on average. The statistical significance of this variable confirms the theory of the dynamic nature of tourism.

The explanatory variable **log_inc** is statistically significant at a 5% significance level as the p-value = 0.000. It has a positive impact on tourist arrivals to Greece as we expected from theory. More specifically, if the Per capita Gross Domestic Product of tourists increases by 1%, tourist arrivals to Greece will increase by an average of 1.07%. In addition, the variable is in logarithmic form, meaning that the coefficient of this variable shows the elasticity. As income elasticity is between 1 and 2, we conclude that in this particular dynamic model, the tourist product of Greece is luxury for most of the countries concerned.

The explanatory variable **log_pop** is statistically significant at a 5% significance level as the p-value = 0.000. It has a positive sign and goes hand in hand with the theory as it reflects the size of the market. More specifically, if the population in the countries of origin of tourists increases by 1%, tourist arrivals to Greece will increase by an average of approximately 0.56%.

The explanatory variable **log_d** is statistically significant at the 5% significance level as the value p = 0.000. It has a negative sign and goes hand in hand with the theory. Therefore, if the distance between Greece and the countries of origin of tourists increases by 1%, tourist arrivals to Greece will decrease by approximately 0.74% on average.

Dummy variable **D** is statistically significant at a 5% significance level as p-value = 0.049. It has a positive impact on tourism demand. More specifically, if the country of origin of tourists is Developed, then Greece's tourist arrivals are increased by 0.26% more than a Developing country of origin.

Finally, the dummy variable **T** is statistically significant at a 5% significance level as the p-value = 0.000. It has a positive impact on tourism demand. If the country of origin of the tourists is In Transition, then Greece's tourist arrivals are increased by 0.62% more than a Developing country of origin.

So, the equation will have the following form:

$$\log\_y = \mathbf{-3,7592} + \mathbf{0,449} * L.\log\_y + \mathbf{1,0713} * \log\_inc + \mathbf{0,5671} * \log\_pop - \mathbf{0,7485} * \log\_d + \mathbf{0,2601} * D + \mathbf{0,5438} * T \qquad (4.23)$$

Then, we will perform the Sargan statistical test as above, the results of which are presented in Table 38.

Looking at the results comes of that Prob> chi2 = 1,000, which is large enough to reject the null hypothesis. Consequently, the instrumental variables we used for the dynamic model with the Generalized Method of Moments - System are not correlated with the residuals and are appropriate instruments.

Stata_SE	Sargan test of overidentifying restrictions
Command :	estat sargan
	H_0: overidentifying restrictions are valid
	chi2 (116) = 32,68224
	Prob > chi2 = 1,0000

Table 38 4th Sargan test of overidentifying restrictions

Then we will apply the Arellano - Bond test and we will examine in this case whether there is a serial correlation of first, second, third and fourth order among the residuals of the model. The results obtained are shown in Table 39.

Stata_SE	Arellano-Bond test for zero autocorrelation in first-differenced errors
Command :	estat abond
	H_0: no autocorellation

Order	z	Prob > z
1	-3,2484	0,0012
2	-0,8964	0,3700
3	1,3987	0,1619
4	-0,1667	0,8676

Table 39 4th Arellano-Bond test for zero autocorrelation in first-differenced errors

As we can see from the above Table, Prob> z = 0.0012 is small enough to reject the null hypothesis, namely the absence of first-order serial correlation. However, as we have mentioned in previous tests, in a Generalized Method of Moments - System (GMM-SYS), the presence of first-order serial correlation is not a problem according to Blundell and Bond (1998). In contrast, since Prob> z is 0.3700, 0.1619, and 0.8676 for second, third and fourth order sequential correlation respectively, the null hypothesis is not rejected. Therefore, there is no serial correlation between the residuals of the model and our estimates are reliable and effective.

After explaining the variables of our final model in Table 40 as it follows, we summarize the results of all tourism demand equations in Greece.

In particular, in the first column of the Table, we see the results corresponding to the pooled OLS, which limits the coefficient to the same value for each country of origin of the tourists. This model assumes that all countries react in the same way after a change in the values of the explanatory variables and that the non-observed individual characteristics of the countries are the same. This hypothesis is too restrictive to reject this particular model. Also the negative sign of the explanatory variable of the population is against the theory.

In the second column we observe the results of the 2-way-Random Effect model. In this model the effects are considered random and are part of the error term. Our analysis was rejected against the 2 Way-Fixed Effect model through the Hausman test. Apart from this, the independent variable of Income is statistically insignificant, which contradicts the theory and the previous empirical studies on tourism demand as it is the most important independent variable that has been observed.

In the third column we see the results of the 2-way Fixed Effect model. From our previous analysis the 2-way Fixed Effect model qualified against both the Pooled OLS model through the F-test and the 2-way Random Effect model through the Hausman test. Explanatory variables are statistically significant at a 1% significance level. As it is a static model, its coefficients express elasticity over the long term. The signs of the coefficients are as expected from the theory.

Two drawbacks are observed in this model. Firstly, the independent variables of Distance, Developed and In Transition countries that are stable throughout the ages are not included in this method and secondly the influence of the population variable on the dependent variable is quite large (4.57), something that has not been observed in previous studies and makes us doubt the appropriateness of the model.

In columns 4, 5, 6 and 7 are summarized the results with Generalized Method of Moments – System (GMM-SYS).

Stata_SE	Comparative Table of Equations in Tourism Demand of Greece						
Explanatory variable	OLS	RE (2W)	FE (2W)	GMM-SYS(1)	GMM-SYS(2)	GMM-SYS(3)	GMM-SYS(4)
L.log_y	-	-	-	0,3929 (13,92)***	0,4108 (14,65)***	0,3942 (13,54)***	0,4490 (22,61)***
log_inc	0,7653 (4,99)***	0,2464 (0,94)	1,1702 (3,84)***	1,3441 (9,72)*** {2,2142}	1,2143 (11,39)*** {2,0609}	1,3416 (9,13)*** {2,2146}	1,0713 (9,89)*** {1,9441}
log_rp	-0,0484 (-0,27)	-1,4300 (-9,43)***	-1,3449 (-9,03)***	0,1234 (1,68)* {0,2033}	-	0,1228 (1,86)* {0,2027}	-
log_trade	0,6836 (12,27)***	0,3354 (5,08)***	0,2558 (3,90)***	0,0004 (0,03) {0,0006}	-0,2981 (-1,33) {-0,5059}	-	-
log_pop	-0,0708 (-1,37)	0,3943 (2,82)***	4,5797 (7,94)***	0,4938 (5,83)*** {0,8134}	0,4928 (3,74)*** {0,8364}	0,5088 (5,56)*** {0,8399}	0,5671 (4,68)*** {1,0291}
log_d	-0,2647 (-3,87)***	-0,6960 (-3,71)***	-	-0,5768 (-4,69)*** {-0,9502}	-0,6084 (-4,30)*** {-1,0326}	-0,5914 (-5,16)*** {-0,9762}	-0,7485 (-5,03)*** {-1,3583}
D	0,3682 (4,05)***	0,8248 (3,34)***	-	0,2337 (3,24)*** {0,3850}	0,2600 (2,38)** {0,4413}	0,2476 (2,77)*** {0,4087}	0,2601 (1,97)** {0,4721}
T	0,5220 (7,76)***	0,7152 (2,71)***	-	0,6260 (7,75)*** {1,0312}	0,6196 (8,68)*** {1,0516}	0,6350 (6,70)*** {1,0482}	0,5438 (4,80)*** {0,9868}
_cons	0,0718 (0,11)	1,6414 (1,10)	-34,1930 (-6,98)	-4,7117 (-5,77)	-4,0230 (-5,13)	-4,7772 (-6,28)	-3,7592 (-5,02)
F - test	150,81 [0,000]	-	24,7 [0,000]	-	-	-	-
Wald test	-	431,09 [0,000]	-	4818,72 [0,000]	7794,68 [0,000]	6085,92 [0,000]	8462,78 [0,000]
Sargan test	-	-	-	27,964 [1,000]	29,570 [1,000]	27,975 [1,000]	32,682 [1,000]
AR (1)	-	-	-	-3,129 [0,002]	-3,154 [0,002]	-3,113 [0,002]	-3,2484 [0,001]
AR (2)	-	-	-	-0,949 [0,342]	-0,943 [0,346]	-0,944 [0,344]	-0,8964 [0,370]
AR (3)	-	-	-	1,509 [0,131]	1,388 [0,165]	1,501 [0,133]	1,3987 [0,162]
AR (4)	-	-	-	-0,181 [0,856]	-0,121 [0,904]	-0,183 [0,855]	-0,1667 [0,868]
Observations	544	544	544	510	510	510	510
Parameters	7	7	4	8	7	7	6
Number of Countries	34	34	34	34	34	34	34

• Dependent variable - Number of tourist arrivals. All variables are converted in their logarithmic form (except the dummy variable D and T)

• AR() is Arellano and Bond test for first,second,third and fourth-order autocorrelation

• Sargan test of overidentifying restrictions

• T-statistics and Z- statistics are in round brackets ( )

• P-values are in square brackets [ ]

• ***/**/* statistically significant respectively at the 1% , 5% and 10%

• Long-run elasticities in { }

Table 40 Comparative Table of Equations in Tourism Demand of Greece

The use of dynamic models has three major advantages. First, we can use the dependent variable as independent with time lag to capture the dynamic nature of tourism. Secondly, as the variables are in logarithmic form, their coefficients express elasticity in the short term.

A third advantage over static models is that if we multiply each coefficient of the explanatory variables with the following formula 1 / (1-β), where β is the coefficient of the dependent variable with time lag, we will take the elasticities for the long period to make it possible in order to have feasible comparison with the signs of static models.

Specifically, in our first dynamic model in column 4, the explanatory variables we used are statistically significant except for *relative prices* and *bilateral trade*. Also, the sign of *relative prices* is positive and does not conform with theory, which leads us to the conclusion that this model is inappropriate.

In the second dynamic model, as we observe in column 5, after the evaluation of our model without the explanatory variable of *relative prices*, which was statistically significant in our previous estimation. *Bilateral trade* still remains not statistically significant and additionally with opposite sign than we expect according to theory and other empirical studies (Einav et al., 2004; Naude and Saayman, 2005; Leitão, 2010).

Then, in the third dynamic model, after the *bilateral trade* was removed, the results we obtained were not appropriate, because the sign of the *relative prices* did not conform to the theory and was significant at a 10% level as in previous empirical studies (Munoz, 2006; Chasapopoulos et al., 2014).

So, we came to the dynamic model whose results are shown in the last column. It confirms the theory of the dynamic nature of tourism as the dependent variable with time lag is statistically significant at a 1% significance level with the greatest impact (0.45) than the other three dynamic models. Also, *income*, *distance*, *population* and the level of economic development of both *developed* and *in transition* countries are statistically significant. The signs of all coefficients are as expected from theory.

In terms of income elasticity, it is between 1.07 in the short run and 1.94 in the long run, which suggests that for the examined countries, Greece constitutes a luxury tourism product. Also, the Sargan test showed that there is no correlation between the instrumental variables and the residuals, so the instrumental variables are appropriate. Moreover, the Arellano and Bond test showed that there is no correlation between second, third and fourth order condition. Therefore, the appropriateness of the dynamic model against the fixed-effect model is as follows:

- In the short test period, the fixed effect estimator is inconsistent (Nickell, 1981).
- The existence of endogeneity and heteroskedasticity between the explanatory variables in the Fixed Effects model leads to biased and inconsistent coefficients (Roodman, 2009).

CONCLUSIONS

This empirical study examined the key determinants of International Tourism Demand in Greece. The analysis was based on a large sample of 34 countries in the period 2000-2015 and covered 91.5% of tourism demand.

The dynamic model chosen to be appropriate for the analysis of Greece's tourism demand provides short and long term elasticities of the selected variables. Therefore, it is advantageous over static models that only calculate long term elasticities. The statistical significance of the dependent variable with time lag and its high impact on tourist arrivals (0.45) is one of the main conclusions of this study. This is due to two main reasons. First, when tourists visit Greece for first time, they have an uncertainty about what they will encounter and when they visit Greece for second time, they are getting more familiar. Secondly, Greece is a country with rich natural and cultural heritage and developed infrastructure, and as a consequence when tourists return to their own countries, they talk about their experiences to other people which results in advertisement of Greece as a remarkable tourism destination.

In addition, the empirical analysis of this study showed that the individual *income* of tourists is statistically significant. International Tourism Demand in Greece is a luxury product for our sample countries both in the short and long term. *Bilateral trade* between Greece and countries of origin of tourists is not a remarkable factor that can affect tourism demand. This is due to the fact that the industrial production of Greece is relatively small and is mainly directed towards the domestic market. Business size is basically small and is characterized by very low productivity.

Relative prices are not statistically significant in most of the models we tested and their impact is sometimes negative and some others positive. Moreover, *distance* seems to be one of the most significant determinants of tourism demand in Greece. Therefore, in order to attract more tourists from countries whose geographical position is great compared to Greece, it would be useful to offer economical vacation packages, which apart from accommodation they also include transport costs.

Population of tourists' countries of origin is statistically significant in almost every static and dynamic model. Market size has a significant impact on Greece's tourism demand, although it is in contradiction with many surveys that exclude it because it has a high correlation with the *income* variable and creates multi-collinearity problems.

An important finding is the level of economic development of tourists' countries of origin and the role it has in this study. Dummy variables that concern both tourists from *Developed* economies and economies *in Transition* were statistically significant in all the models used. As the per capita income of tourists does not fully reflect the economic and social conditions prevailing in their countries of origin, the use of these dummy variables comes to cover the unequal distribution of income.

Finally, further investigation of this study would be to include other determinants in the analysis of international tourism demand, such as marketing and advertising expenses, culture, given that Greece has a large cultural (physical and intangible) and natural heritage.

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