Transportation And Tourism: An Economic Quantitative Analysis

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Abstract

This article aims at the estimation of a trends model for the Greek tourist flow by different modes of transport (land, sea, air). In order to form the structure of this modal split trends model, first there is a data record and analysis of the tourist flow in Greece as well as the arrivals by each transport mode and nationality. A special reference is made to the cruising sector and yachting, their character and importance for the Greek tourism and consequently National Economy. Taking into consideration all the statistical data, there is a trends models estimation using regression analysis methods so as to explain and forecast the arrivals by each mode of transport using time as an independent variable. The article ends with some observations regarding the relation between the two sectors and the results of the econometric analysis.

1.   Generally

Tourism constitutes by itself a specific subject in the field of National Economy, however it is connected straightway with other activities and sectors, especially with the transport industry. There is no doubt that the transportation sector contributes essentially to the tourism development through the quick increasing rhythms of the services that it offers. The increase of income that is accompanied by a parallel increase in the demand for transport services, is the basic characteristic of our modern society.

Taking statistics into account, we shall consider the significant contribution of transportation that occurs from the different transport modes (road, railway, airplane, ships), as far as the tourist sector is concerned. The data exposed underneath, show the arrivals of tourists by mode and most of them are resulted from the statistic tourist department of the National Statistic Service. A special reference will be made to the sections of Yachting and Cruises, both of which are the most important of the Greek tourism.

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2.   The dependence of tourism on the transportation

The transport modes used by the tourists traveling from a country to another, give useful statistical numbers and conclusions, concerning the infrastructure use in our country and the tourist flow.

In Greece, results like the above, can come out easily, since thousands of tourists are coming every year from all over the world, because of the natural beauties and the archaeological treasures, using all the transport modes.

The data that is exposed below (Table 1) are referring to the tourist flow to Greece from 1980 to 1994, the arrivals by each transport mode, and the contribution of each mode to the achievement of the transportation.

Table 1:   *Tourist Flow to Greece*

YEAR	Airplane	Railway	Sea	Road	TOTAL
1980	61,5	3,2	19,2	16,1	100%
1981	62,9	3	18,3	15,8	100%
1982	64,9	2,6	18,5	14	100%
1983	66,6	2,3	20,9	10,2	100%
1984	67,7	2,3	18,6	11,4	100%
1985	69,5	1,5	16,5	12,5	100%
1986	66,8	3	13,6	16,6	100%
1987	62,3	2,6	19,7	15,4	100%
1988	64,6	2,5	15,3	17,6	100%
1989	70	3	11,8	15,2	100%
1990	71	3,2	11	14,8	100%
1991	71,8	1,8	11,2	15,2	100%
1992	78,3	0,8	12,3	8,6	100%
1993	79,6	0,6	10,4	9,4	100%

Source: ESYE (National Statistics Service)

Observing the progress of the arrivals, statistically, we could notice that the **airplane** is the basic choice of the passengers coming to Greece. Almost 60 - 70% of those tourists have visited our country by plane in the period of the 80's, while this percentage has increased periodically to the 80%, by the middle of the 90's and it is foreseen to increase, even more the other transport due to the inability of modes, especially the railway, effectively with compete the airplane.

The railway has been confined into a low level of offered services and a limited network. Statistics prove that fewer tourists use the railway as a mode of transport and as a result the next years the situation will be aggravated. At the beginning of the 80's the railway had the smallest share in the Greek market. Just the 3% of tourists preferred the railway during that decade, and this percentage is not about to be reviled, since Greece is not connected by rail with the other countries of the European Union, which is the basic source of tourists. In

1992 the railway traffic falls in 1%, that means a 47% decrease compared to the last year 1991, year when the civil war in Yugoslavia began. This is verified by the fact that Greece and generally speaking the Balkan region, is not part of the development plan concerning the fast service trains (High Speed Trains), which would give a different aspect to the transport of tourists.

Concerning **road transport** tourist flow, we can observe that during the same period, it were about 15%. But the Yugoslavian war, made this percentage fall under 10%.

The **sea tourist flow** fluctuates between 10 to 20% of the total arrivals We note that in our data cruises are not included. It is necessary to take into account that, against the fluctuations, the sea transport shall be increased due to the reduce of the railway and road transport. It is not unrelated to the fact that new boats (ferry-boats) were bought offering high level services.

Table 2:   *Tourist Flow to Greece (Arrivals)*

	1980	1981	1982	1983	1984	1985	1986	1987
Airplane	3243213	3506902	3547025	3502215	4077970	4849480	4902462	5017052
Railroad	167358	169389	143393	118981	137832	104885	220171	209379
Sea	1010532	1018996	1009260	1101211	1122573	1151266	998106	1586451
Road	850012	881822	764182	535965	688891	873797	1218276	1240170
Total	5271115	5577109	5463860	5258372	6027266	7039428	7339015	8053052

Tabel 2 (Continues):

1988	1989	1990	1991	1992	1993	1994
5345062	5659472	6304864	5772557	7305312	7496435	8751906
205366	239691	279810	144969	76708	56814	42936
1265557	955324	973140	897755	1143034	978258	930084
1458444	1227364	1315496	1220846	806306	881316	977016
8274429	8081851	8873310	8036127	9331360	9412823	10641942

Source: ESYE (National Statistics Service)

It is obvious that, air transport has no competitor in the transportation of tourists to and from Greece, keeping in mind that, the total tourist traffic appears to have an increase of 10% to 20%.

Therefore, it is clear, that, tourism is directly connected with the present state of the transport system. Tourists could be encouraged or discouraged, to visit a country, influenced by factors such as

the state of transport infrastructure,

the supplied quality,

and the punctuality.

According to this, it's reasonable the fact that the investments in the transport sector are affected by the tourist traffic of the country. Greece has the right position to this direction, because the new airport of Spata, and the improvement of Patra - Athens - Thessaloniki motor way and railway are expected to contribute to the increase of the tourist traffic, through the assistance of the best

and most qualitative services. The European Community provides an important amount of help, through the financing of a big part of those constructions.

In addition, there is an extra interest in attending the statistical tables of foreign visitors' arrivals per citizenship and per mode of transport (table 3).

Table 3:   *Foreign Visitors' Arrivals per citizenship and per mode of transport. (1993)*

COUNTRY	Airplane	Railway	Sea	Road	TOTAL
EUROPE	6.870.723	50.305	847.406	702.182	8.470.616
Austria	269.111	1.198	16.583	1.744	288.630
Belgium	189.336	310	30.700	3.690	224.036
Bulgaria	3.423	2.195	7.106	131.810	144.534
France	461.220	1.680	83.374	8.370	554.644
Germany	1.827.960	5.950	216.278	19.190	2.069.379
Yugoslavia	13.395	18.264	4.777	155.356	191.792
Denmark	225.706	580	25.606	1.730	253.622
Suisse	153.317	184	9.384	2.114	164.999
Gr. Britain	2.084.390	2.710	96.627	7.620	2.191.347
Spain	95.800	890	20.957	1.320	118.967
Italy	365.595	1.680	241.824	16.410	625.509
Cyprus	78.365	58	10.356	1.633	90.412
Holland	466.378	1.930	36.525	6.110	510.872
Sweden	307.024	782	6.702	2.522	317.030
Finland	110.520	276	5.139	583	116.518
Soviet Union	55.187	2.578	4.613	54.782	117.160
Other Countries	219.253	11.618	35.468	341.980	608.319
ASIA	201.678	1.308	60.630	10.555	370.171
Japan	86.964	328	1.635	980	89.907
Israel	35.510	142	9.590	573	45.815
Turkey	10.737	285	36.536	101.832	149.390
Other Country.	68.167	553	12.869	3.170	85.059
AFRICA	39.562	222	7.079	1.875	48.538
Egypt-Sudan	18.299	60	1.060	190	19.609
Other Count.	21.063	162	6.019	1.685	28.929
AMERICA	283.537	1.735	47.518	10.554	343.344
Argentina	7.295	169	1.124	206	8.764
Brazil	7.459	34	873	189	8.555
Mexico	4.135	25	1.044	132	5.336
USA	211.569	1.149	36.751	7.250	256.719
Canada	42.826	295	6.270	2.081	51.472
Other Country.	10.253	63	1.456	696	12.468
OCEANIA	45.948	666	11.012	5.368	62.664
Australia	42.144	554	8.562	4.804	56.064
Others	3.804	112	2.450	564	6.930
GEN. TOTAL	7.496.435	56.814	978.258	881.316	9.412.823

Source: ESYE (National Statistics Service)

As we can observe in the above tables, tourists coming from the different Balkan Countries and Turkey, are mainly using the Greek road network. Tourists from the other European Countries are using the airplane. In exception, tourists from Mediterranean Countries are coming by the sea. Railway, is little used (we tried to explain it before).

3.   Cruising: an unstable but important market in Greece

Cruising is one of the most important sector of tourism in Greece. Cruise ships providing maritime services belong mainly to the tourism industry rather than the maritime industry. It's about a particularly profitable sector that appeals to tourists of high income.

Greek owned cruise ships possess the 1/3 of the world fleet, which is consisting of 135 big cruise ships. In the decade of '90, the world fleet is expected to be increased by a large amount of new-built ships with high specifications. The entry of cruise ships into the market will increase the competition between the companies, that are organising cruises, and it will lead to the supply of services with high specifications and accessible prices.

The greater parts of the Greek's cruise ships' traffic comes from the United States and, then, Germany and Japan are following.

According to the selected data by ETBA (National Bank of Industrial Development), the collected exchange from cruises during the years of 1987, 1988, and 1989 increased to 27.005, 37.339, and 44.505 million drachmas corresponding to 5%, 6,8%, and 7,7% of the total tourist revenue of the country.

Greek Cruise ships, together with the Mediterranean passenger ships, can put up at luxurious cabins for 20.000 tourists at the same time, and provide a variety of tourist products, such as tours between Greek and neighboring ports.
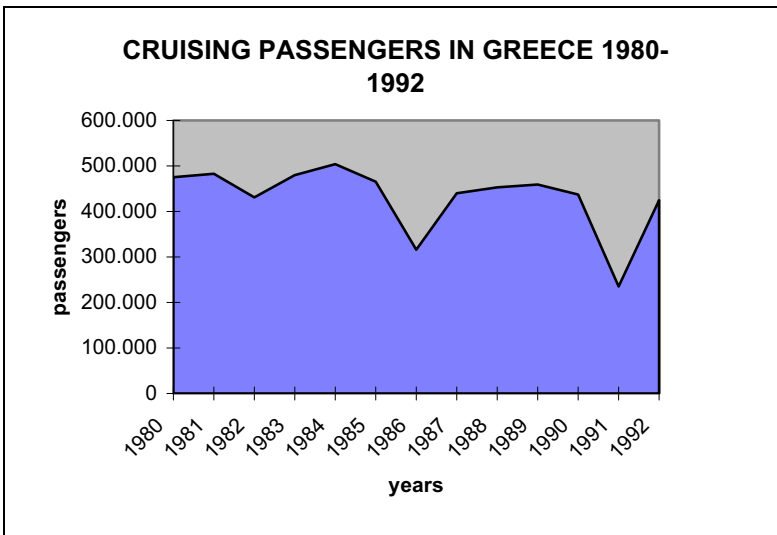

CRUISING PASSENGERS IN GREECE 1980-1992

Table 4: *Passenger traffic of Greek cruise ships (1960-1992) and the development of the market share*

Years	Passengers	% Change	% of Tot.Demand
1960	55.525	-	13.9
1965	129.178	54.0	13.2
1970	201.754	21.1	12.5
1971	276.699	37.1	182.2
1972	295.195	6.7	10.8
1973	331.133	12.2	10.4
1974	231.890	-30.0	10.6
1975	332.864	43.5	10.5
1980	475.215	-15.9	9.0
1981	482.760	1.6	8.6
1982	431.038	-10.7	7.9
1983	479.895	11.3	9.1
1984	504.074	5.0	8.4
1985	465.435	-7.7	6.6
1986	316.000	-32.1	4.3
1987	440.000	39.2	5.5
1988	453.000	2.9	5.4
1989	459.111	1.3	5.4
1990	437.182	-4.8	4.6
1991	235.131	-53.0	2.8
1992	424.652	80.6	4.3

Source: ESYE (National Statistics Service)

In the late years of the decade of '80, the average rate of increase of the world demand for cruises was 12-15% (Table 4), while Greece appears to have an important decline of demand that still remains at the same level, after the well-known events in the region of the Mediterranean Sea, which began in 1985 (T.W.A.'s high jacking, Reighan's traveling instruction, Achilles Lauro's piracy, Libya's events, Chernobyl, City of Poros, Persian's Gulf crisis).

This difference in the rate of demand's increase is caused, on the one hand, by the low cost of American's transportation, especially of tourists in the ports of cruises' arrival of the new world, and on the other hand, by the competitive prices achieved by the low crew expenses, given that in the United States ships are staffed with crews of various low-paid nationalities. On the contrary, Greek tourist ships are staffed with experienced and pure Greek crews, and they have the advantage of the high level of services they provide.

Cruiser is mainly an export product, since it is addressed, as we have mentioned previously , to foreign tourists with a high income level. Therefore the Greek cruise ship must be considered by the government as a productive unit with an export character and must have a proportional attention. The quantitative and qualitative contribution of the cruise ships to the Greek economy is very important. Economy's benefits are multiple and can be classified in the following categories:

(a) Manpower Employment
(b) Exchange benefits and
(c) Income benefits from

- The alterations, repairs and maintenance of the ships in the Greek shipyard installations.
- Tourists' expenses in the arrival ports that contribute to the reinforcement of the local markets and the rises of the living level of the inhabitants.
- Port and other taxes, which are being paid to the arrival ports
- The important reinforcement of the tourist and other professions (travel tours etc.)

(d) Transportation income
(e) Quantitative benefits, as the promotion of the country abroad etc.

4.   Yachting

Greece has more than 4000 islands (from which only 75 are habitable) and 130,000 square kilometers of protected seas, but because of the very clement climate, the natural beauty and the civilization inheritance, there are plenty advantages for the continued development of sea touring.

Sea touring, developed in the Aegean area, Ionion sea and Cretan sea is very important and offers the possibility of covering all the needs and demands of the tourists.

Yachting in Greece started as a professional activity at the end of the 60's. The law for the **Professional Tourist Ships (PTS)** was decreed in 1976 (L.438/76). According to this law, professional tourist ships could be the sailboats and the motorized over 6 meters and 5 grt with or without crew. Their main obligation is to prove 150 days freight in three years.

The PTS are divided into 2 categories:

- sail bare boats without crew
- motorized boats with crew, which can be motor yachts (engine only) or motor sailors (engine and sails)

The 1st category represents the 2/3 of the total PTS number, while the 2nd the 1/3 of the PTS. In majority these boats are constructed in Greece. The motor yachts have only high freights and bigger maintenance and staff expenses. The number of freight days is smaller than the number concerning sailboats. The motor sailors are mainly reformed wooden boats or fishing boats. They have bigger passenger capacity and lower daily freight. EOT's (National Organization of Tourism) study informs us that actually in our country, there are 4000 pleasure boats for professional use from which 3000 are bare boats while the average age of the ships is quite small , almost 5 years.

The total freight number for the yachts has reached 18000 in 1994, against 17000 in 1993, 15800 in 1992, 12500 in 1991, and 11950 in 1990.

Table 5: *FREIGHT PTS*

Year	No freight	% diferen.
1990	11.950	
1991	12.500	4,6
1992	15.800	26,4
1993	17.000	7,5
1994	18.000	5,8

The passengers who traveled with PTS were 89740 in 1992, against 79417 in 1991. These passengers spent 665.000 nights in 1992 against 662.686 in 1991. 40% of the charters were Germans, 12% French, 15% Scandinavians and 10% Americans and English. It was calculated that the average freight was 8 days. We note that yachting is classified among the most bringing exchange sectors of the Greek economy with a contribution of at least 11 billions of drs/year in exchange.

Many factors can influence positively or negatively the demand of pleasure boats.

The natural environment and the seas of a country, the infrastructure at marinas and ports, the current prices in connection with the existent income, the cost of maintenance and operation, the age and the mentality of those who are interested, compose a netting influencing the course of the market or the boat renting.

Determining factors are:

- The climate and the geographical shape. Greece disposes (covers) the conditions for the development of sea tourism and sea cruises.
- The existing infrastructure at pleasure ports and the quality of offered services.
- The acquisition value of a boat and the cost of its maintenance and operation. The massive production of boats made from plastic material has reduced their prices but the fuel, the cleaning, the repairs and the painting are the main expenses of the boat.
- The rate of the freights.
- The reputation of the country about yachting as well as the internal situation of a country in connection with the international situation.

Concerning the competition, the Mediterranean area, is an interesting market because of the following facts:

– France had and continues to have a stable market.
– Yugoslavia has been left out of our consideration because of the events that happen there, so that many boats of those activated in the area, have passed to Corfou.
– Turkey, despite the fact that it has known a fall, because of the neighboring of belligerent regions, is however turning steadily into a great power in the Mediterranean area. Enormous infrastructure works, especially marinas, are been constructed in the neighboring country.

5.   Trend Models Estimation

Taking into consideration all the previous statistical data, concerning the tourist flow to Greece from 1980 to 1994 for each transport mode (airplane, railway, sea and road) we have used regression analysis in order to explain the arrivals using time as independent variable.

The ordinary least squares estimation method had given us satisfactory results. However the fact that we have small samples gives ambiguous conclusions for the statistical significance of the estimated coefficients. The later must be taken seriously into consideration despite the fact that apart from two coefficients all the others had successfully passed the t-test, all the sampled regressions showed high F-scores and there aren't any heteroscedasticity, autocorrelation and multicollinearity problems. However the last two regressions have bad adjustment to the actual data and therefore low forecasting ability. Despite the above the following regressions verify the common accreditation of the over time ascending trend of arrivals.

The following graphs include the actual, the fitted and the residual arrivals for the period 1980 to 1998 for each transport mode separately and totally.

Definition of the variables

TOT	Total Arrivals
AIR	Arrivals by Airplane
RAI	Arrivals by Train
ROA	Arrivals by Car
SEA	Arrivals by Sea
C	Constant Term
T	Time
T2	$(Time)^2$
T3	$(Time)^3$
DRAI	Dummy for Arrivals by Train, which has 0 for the interval 1980 1990 and 1 from 1991 to 1994.
DSEA	Dummy for Arrivals by Sea, which has 1 for 1992 and 0 otherwise
AR(1)	First Order Autoregressive Term for the Remedy of Pure Serial Correlation of the Error Term through the Cochrane-Orcutt Procedure.

The numbers in parentheses express the standard errors of the respective estimates.

Estimation of Trend of Total Arrivals

TOT = 4,946,646 + 366,489.2 T
(233,587.6)   (28,396.3)

Estimation Method:	R-squared = 0.9276	Mean of Dep.var. = 7,512,071
Ordinary Least	Adjusted R-squared = 0.9220	S.D.of Dep.var. = 1,701,746
Squares	S.E. of regression = 475,161.8	F-statistic = 166.57
Sample Range:	Durbin-Watson stat. = 1.6748	
1980 - 1994		
No of Obs.: 15		

Estimation of Trend of Arrivals by Airplane

AIR = 3,317,794.7 + 118,508.6 T + 16,819.3 T^2
(245,474.2)   (81,386.7)   (5,606.4)

Estimation Method:	R-squared = 0.9588	Mean of Dep.var. = 5,285,462
Ordinary Least	Adjusted R-squared = 0.9519	S.D.of Dep.var. = 1,643,327
Squares	S.E. of regression = 360,094.8	F-statistic = 139.78
Sample Range:	Durbin-Watson stat. = 2.1062	
1980 - 1994		
No of Obs.: 15		

Estimation of Trend of Arrivals by Train

RAI = 183,565.2 - 45,855.78 T + 10,634.4 T^2 - 527.3 T^3 - 150,285.7 DRAI
(23,956.7) (15,492.6)   (2,603)   (121.5)   (38,682.4)

Estimation Method:	R-squared = 0.8714	Mean of Dep.var. = 154,512.1
Ordinary Least	Adjusted R-squared = 0.8199	S.D.of Dep.var. = 68,407.8
Squares	S.E. of regression = 29,023.6	F-statistic = 16.94
Sample Range:	Durbin-Watson stat. = 2.4693	
1980 - 1994		
No of Obs.: 15		

Estimation of Trend of Arrivals by Car

ROA = 262,266.1 T - 14,116.1 T^2 , 0.5215 AR(1)
(46,448.8)   (3,609.1)   , (0.1687)

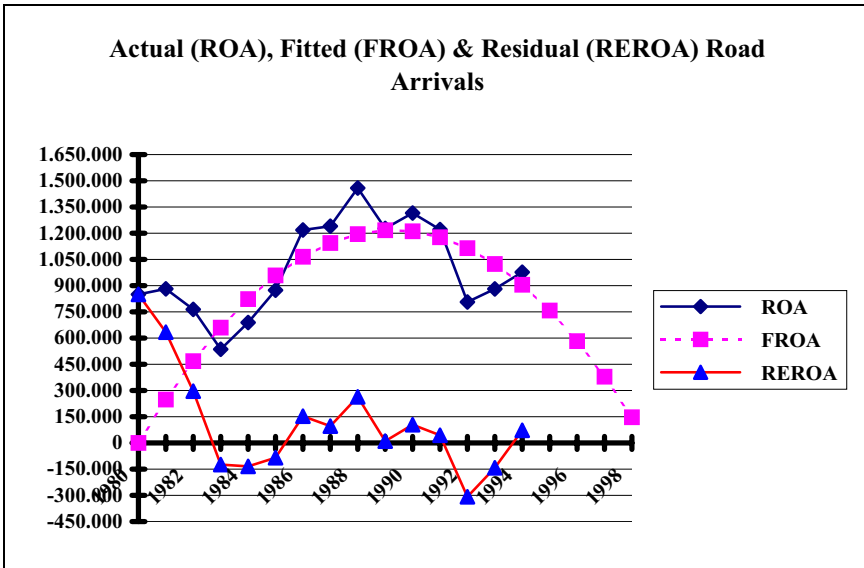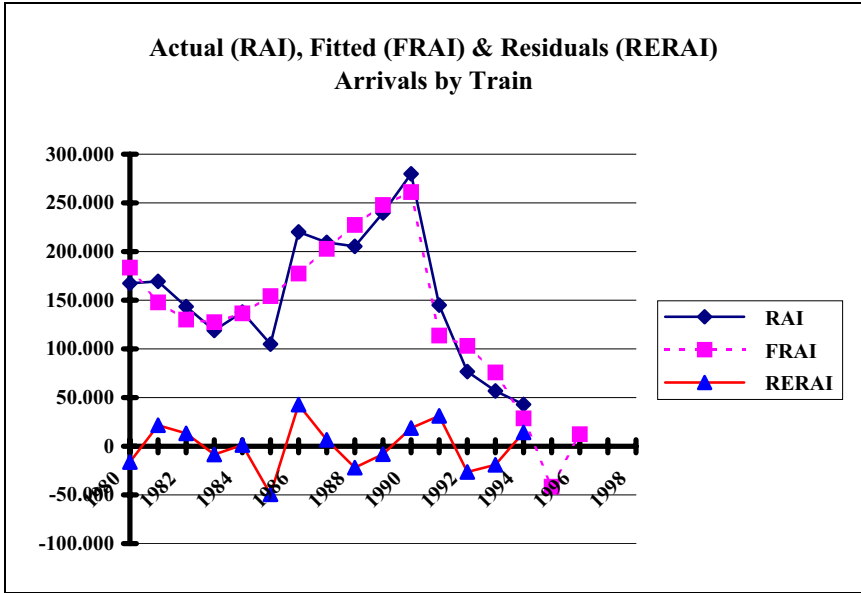| Estimation Method:	R-squared = 0.6246	Mean of Dep.var. = 1,006,421
Ordinary Least	Adjusted R-squared = 0.5563	S.D.of Dep.var. = 272,407.6
Squares	S.E. of regression = 181,437	F-statistic = 9.1521
Sample Range:	Durbin-Watson stat. = 1.9149	
1981 – 1994		
No of Obs.: 14		

Estimation of Trend of Arrivals by Sea

SEA = 1,002,779.1 + 38,596.2 T - 3,580.7 T^2 + 340,837.5 DSEA
(75,290.9)   (25,383.9)   (1,731.3)   (86,727.9)

Estimation Method:	R-squared = 0.6797	Mean of Dep.var. = 1,076,103
Ordinary Least	Adjusted R-squared = 0.5924	S.D.of Dep.var. = 172,227.3
Squares	S.E. of regression = 109,948.8	F-statistic = 7.7839
Sample Range:	Durbin-Watson stat. = 1.7929	
1980 - 1994		
No of Obs.: 15		

Actual (TOT), Fitted (FTOT) & Residuals (RETOT) Total Arrivals

Actual (AIR), Fitted (FAIR) & Residuals (REAIR) Arrivals by Airplane

Actual (RAI), Fitted (FRAI) & Residuals (RERAI) Arrivals by Train

Actual (ROA), Fitted (FROA) & Residual (REROA) Road Arrivals

Actual (SEA), Fitted (FSEA) & Residual (RESEA) Arrivals by Sea
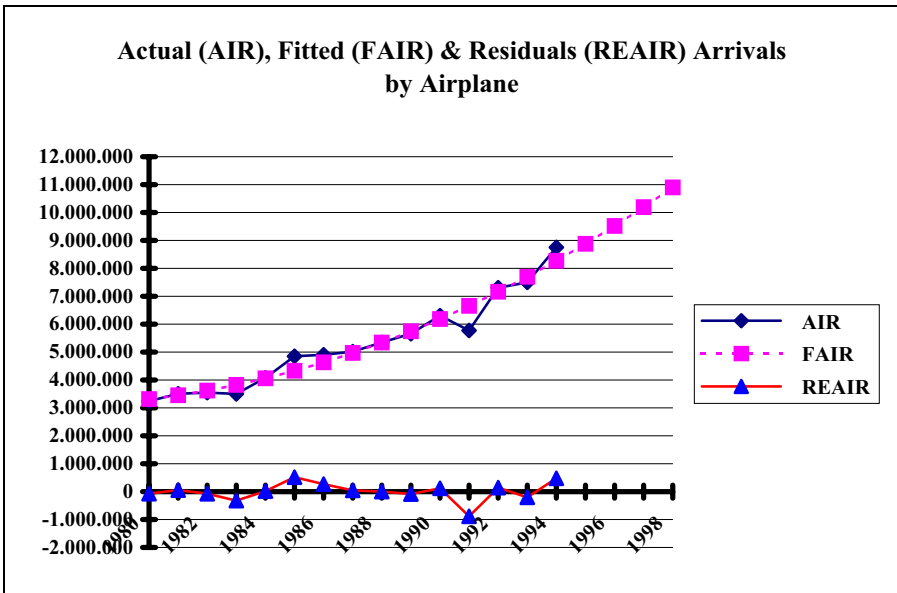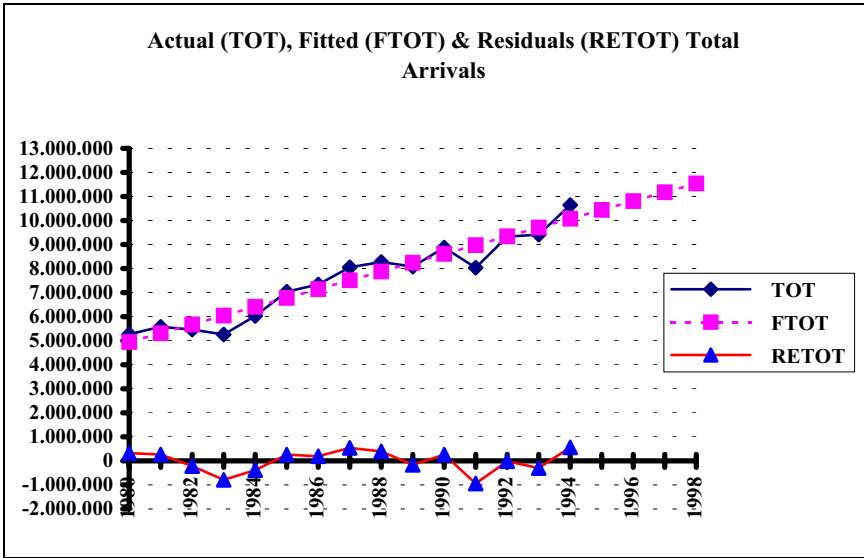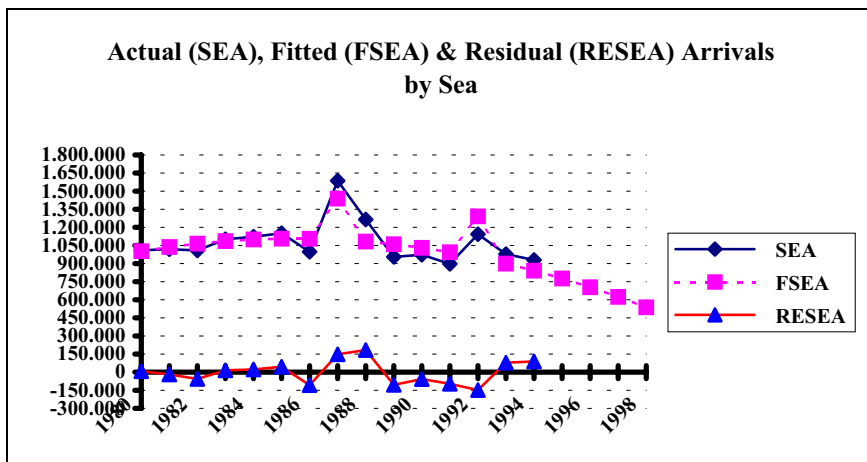
6.   Conclusion

Transport is a key point for the development of the Tourist sector of Greece since it ensures the mobility of the tourist flow towards and from Greece. The existing data prove that the modal split analysis in the Greek tourist flow is in favour of air transport, since almost 70% of tourists choose the aeroplane for visiting our country. At the same time only 15% of the tourists chose the road transport and 10-20% visit our country by sea. The study regarding the forecast and the trends of the tourist flow in Greece confirms through a regression analysis the positive trend of tourist figures for the years to come. More specifically the trend models for each transport mode prove that tourist arrivals by aeroplane are expected to increase while all the other transport modes show negative trends over the next years. The trend models analysis that were presented in this article could be used for the extraction of useful conclusions regarding the Greek transport policy, especially in the field of transport infrastructure so as to satisfy the estimated tourist demand.

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