SHORTSEA'96 Bergen

THE LINK BETWEEN GREECE AND THE REST OF EU COUNTRIES: STATUS AND PROSPECTS

by

Orestis D. Schinas and Harilaos N. Psaraftis

National Technical University of Athens, Greece

ABSTRACT

The purpose of this paper is to critically investigate the transportation link between Greece and the rest of European Union (EU) countries. Greece is the only non-island EU country which is not adjacent to the rest of the contiguous EU countries. Since the breakout of the war in the territory of the former Republic of Yugoslavia, the main land link through the Balkan peninsula has become dangerous and inadequate to carry the continuously growing transport load. The other link of Greece to the rest of the EU is intermodal: it connects western Greek ports with eastern Italian ports via the Adriatic Sea. Under the present circumstances, and in spite of many problems, this particular link represents the only promise for a viable connection between Greece and the rest of the EU.

The volume and value of the trade between Greece and the rest of EU countries are continuously growing. However, the existing network has reached its capacity, and poblems of insufficient land traffic interconnections are now becoming more complex, demanding immediate action.

The paper has two major objectives: the first is to describe the network by analysing the statistical data provided by public and private sources and by making references to the institutional framework. All land and sea connections, including port infrastructures, are also described. Extensive analysis of data provides an image of the traffic in ports and an ability to make aggregate projections of the traffic in the future.

The second objective is to foresee what may happen in the near future. As new fast ships may enter the routes of the Adriatic, and a new institutional environment is taking shape by EU rules and regulations, this trade will never be the same again. In order to achieve this objective, the paper estimates the transport cost and performs a modal split analysis. The new technology fast ships are technically and economically investigated. The analysis shows that a major problem is the economic viability of the fast ships, which leads to a higher required fare and thus prohibits some carriers to use them. To the best of our knowledge, this is the first time such an analysis has been performed for the Adriatic Sea link.

The paper ends with several conclusions and recommendations, which point to the inadequacies of the system and can suggest ways for a better performance of nodes, modes, branches and the whole network in general.

-

1. Origins and Scope of the Study

In considering the transport problem between Greece and the rest of the EU countries, it can be easily said that the traditional way of transporting products in and out of the Greek territory has been in many respects irrational. Greece is isolated by land from the rest of the EU countries. In fact, Greece and Ireland (which is an island) are the only two EU countries which are not directly linked by land to another EU country, and which, barring some extraordinary developments, will never be in the future. The UK recently left the "club of disconnected countries" due the Channel Tunnel, and Sweden, and, by extension, Finland, will soon be connected via a system of bridges to Denmark and to the contiguous EU.

Before the breakout of the war in Yugoslavia, transport flows to and from the rest of the EU were quite extensively oriented in the Balkan road system (and rail system secondarily). The road linking Athens, Thessaloniki, Belgrade, Austria and Munich offered a cheap and fast way to transport goods in and out of Greece. The sea-borne road of the Adriatic sea, although cheaper, took longer (about half a day more), and that was the reason of the preference of carriers for the road mode. So for the last 30 years, Greece exported and imported mainly via the Balkan States, and until 1989 mainly via the former Federal Republic of Yugoslavia. Due to the war, Greece's land connection to the rest of the EU became jeopardized, and flows of goods had to find alternate routes. The sea-borne connection with Italian ports was suddenly asked to accommodate much of these flows. It was very ill prepared to do so.

The Greek seamanship and capability in running maritime business is commonly known worldwide. However, a remarkable observation is that for many years Greek ship operators did not invest seriously in the Adriatic Sea corridor, because of low profit margins. But since the breakout of the war in Yugoslavia, these operators invested heavily in new ships and new marketing approaches to the main new users of this corridor, the truck drivers and the transportation companies. This was really a fast reaction to the new regime. Unfortunately, investment in port infrastructures and hinterland connections could not, and did not follow suit. The result: severe bottlenecks and congestion.

The analysis of this paper focuses on commodities transport by truck, but a brief report and references to the car and passenger traffic is also made, aiming to complete the general picture and to help finding the economic survivability of the investment in new technology fast ferries for passengers and cars. Transport by cargo ships such as general cargo, container or bulk, and air transport are not analysed in the paper.

It is difficult to predict the institutional environment in which Greek and other European carriers will operate in the future, but EU Legislation affects (and is expected to affect) virtually every area of economic activity, including the maritime and transport logistics industries in general. Many institutional changes are already on their way. Experience has shown that those who keep abreast of EU legislative developments tend to be better placed than those who believe that these developments will pass away. The role of Brussels is increasing and not only in transportation by rail, road and inland waterways (Title IV - Articles 74-84 in the Rome Treaty), but also in maritime business and industry with several newly adopted rules and regulations. The European Court of Justice obliged the Council to promote a European Common Transport Policy (CTP) in 1985. The White Paper on transport was released in December 1992. It developed the principles of CTP, enforcing by all possible means the freedom of every European carrier to provide services within EU borders, with no exception for residents or non residents. It also provided for a common competition law through legal harmonisation of private and state aids, taxes and fees, and by prescribing safety issues and the protection of the environment. Finally it provided for the technical harmonisation, the transport planning (considering environmental factors), and the relations of the EU to third countries.

From 1/1/1993 the Common Market is functioning under continuous liberalisation (regulation 184/88), so the only thing a land carrier needs to have is a license, provided by the Union, based upon quality criteria, which refers to the ability of the carrier as a professional. But the liberalisation is stepwise and there is no way for it to be completed before 1996. From this date every carrier cannot act only according to the Law of the country in which he is already established. By having also the license from the EU to provide services within EU borders, he may also provide services in a member state of which he is not a resident. Actually there was a transition period of three years (1/1/93 to 31/10/95), where several member states could permit only a percentage of transport services to be carried out by residents of other member states (5% for 1993, 6% for 1994 and 7% for 1995); there is also a proposal to cancel the full liberalisation to 1997. All legal acts about land transport aims in the abolition of any restraining percentage in transport quantities and the creation of a cabotage environment, protecting EU carriers from the entering in the market of carriers not belonging to a member state. The new legal environment permits the free entrance in the EU transport market, grants free professional admission, according to regulations 561/74 and 438/89, if the carrier satisfies the three main criteria of reliability, training and financial resources, and enforces common social regulations i.e. same professional terms as far as they concern labour factors such as working and resting hours.

European rail organisations and companies will face a totally different environment. An increase of their competitiveness as servers, emphasising where railways have already an advantage or take an advantage due to application of telematics, new technologies, environmental friendliness, decreased unit cost of cargo etc is not only a sound premise. Rule 561 *obliges* a fairing and normalisation of economic terms rail organisations face due to former actions taken by the States and this may also help the improvement of infrastructure, because in many countries they are the exclusive users and exploiters of the networks. The improvement of infrastructure will also be subsidised by the development of sophisticated and efficient intermodal links and interchanges in port and other land nodes.

On the other hand experts analyse the prospects in a different way and support that there will be less cargo transport, due to competition from trucks but increased passenger traffic, due to the development of high speed links between major cities. They also believe that the provision of fully integrated intermodal services in collaboration with trucks, more reliable timetables and schedules, decreased fares and concentrated services in certain links and short of transport shall be expected. EU aims to the strengthening of intermodal services but not many things can be achieved without unitised cargoes, port and rail networks infrastructure and harmonisation in technical, telecommunicational and EDI matters. Every action already taken has the same objective; to enforce the intermodality. For this particular transport system, the Adriatic Sea network with sophisticated intermodality may be the only vital solution, which fully complies with the spirit of the "White Paper".

The Greek fleet of trucks is old-aged and not suitable for transport services within EU borders, because they are not compatible to the demanded technical rules of several countries. The fleet of Car/Passenger ferries connecting ports in the Adriatic Sea is also old aged and not capable to face the challenges of the future. On the other hand marine technology develops itself rapidly and as a result in a few years the fast transportation means will be common and indispensable. Fast ferries will connect many European ports, smart material handling system will provide a fast, safe and cheap transhipment, fast rail systems will be another part in the intermodal chain of the transport and trucks will serve door to door customers all over Europe.

So there are two parameters to be concerned: the Common Transport Policy and the developments in transport technology. Under the term “transport technology” we mean not only new fast ferries or marine technologies but also new road vehicles, fast trains, port facilities, and applications of every technological advance in the transport field, such as advanced telecommunications, packaging and handling. Technology and the new institutional environment, which is formed within the EU, will bring changes, demanding solutions in existing problems and several recommendations in order to prevent the EU transport network from new problems due to the developments.

2. TRADE, TRAFFIC AND NETWORK ANALYSIS

Aggregate trade statistics

For a researcher to find data worthy of consideration for our specific problem (connection Greece- EU) is an extremely difficult task. This is so because the State collects data in a raw form from port authorities and from companies having interests in this traffic system. The result is that port authorities collect some data of interest to them and companies collect some other data of interest to them. Many times the collected data is uncorellated, inconsistent, or irrelevant. Even under the same labels or fields of the data different people mean different things, and figures attributed to these labels may be different, depending on the source. Fundamental misunderstandings of statistical results can arise when words or phrases are unwisely assumed as synonyms or when analysts apply terms inconsistenly. Data from different sources vary a lot from each other. This is the reason why in this study the analysis is based on as few as possible sources.

There is a strong belief that data from ESYE (the Greek National Statistical Service) are the most accurate. This is so because they are cross-checked from State sources and also collected by the companies. They are also provided in a suitable form for further processing and represent the traffic volumes from and to Greece (or Italy).

According to data provided by ESYE (1992 data) 23.1% of the quantity of Greek imports is coming from other EU Member States and their share of value is 63% of the whole. Greek exports to other EU Member States are 59% of total export quantity and 67% of its value. The table below forms a first image of the trade between Greece and the rest EU - Member States.

		1992	1993	1994
IMPORTS	**quantity**	6,686,087	7,077,773	5,066,887
	value	2,828,301	3,030,004	2,128,499
EXPORTS	**quantity**	13,018,838	8,751,405	6,420,351
	value	1,332,522	1,082,246	789,919

Source ESYE, values in 1,000 GRD and quantities in 1000 tonnes

One can see that imported volume is 2.25 times less than the exported volume and the imported value is 2.1 times more than the exported value. The unit value of an imported tonne from the rest of the EU is about 1994 GRD (≈$8) and the equivalent value for an exported tonne is 422 GRD(≈$1.68), meaning that the unit value of imports is 4.7 times that of exports. This leads to the conclusion that Greece imports lightweight highly priced products and exports heavy cheap ones. According also to the same trade statistics the mean annual growth of imports is about 26.9% (1988 - 1992 period) and 27.05% for exports, and the most important markets are those of Germany, Spain and Italy but the trade is spreading all over EU territory, in contrast to the past when trade was focused on certain countries and cities [1].

The table below provides a breakdown per mode for 1992 and refers to the trade between Greece and all other countries in the world (including EU - Members).

IMPORTS

	quantity		**value**	
sea	26,310,870	91%	2,388,265,600	53%
rail	552,120	2%	258,526,065	6%
road	1,881,260	7%	1,517,806,828	33%
total	**28,831,000**		**4,554,921,745**	

EXPORTS

	quantity		**value**	
sea	19,155,500	91%	1,147,677,926	61%
rail	183,450	1%	22,497,527	1%
road	1,780,000	8%	618,179,573	33%
total	**21,152,460**		**1,880,763,358**	

Source ESYE, values in 1,000 GRD and quantities in 1000 tonnes

Regrettably, a breakdown per mode is *not* available for the trade between Greece and the rest of the EU. However, no less than 95% of the rail and road flows in and out of Greece are associated with trade to and from the rest of the EU. From the above table a significant remark can be made: Although trucks serve only 8% of the whole volume, they transport goods representing 33% of the whole value. Looking closer, only 5.7% more tonnes were imported than those exported, but with a value of 145% more than the value of the exported ones. This also explains the difference of 132% of the unit values. It shall be noted that under the term transport by trucks are included also intermodal movements with trucks and other means.

<u>Geography, networks, ports</u>

The Greek road network is generally poor, and does not permit high capacity and speed. The network of "national roads" (roads that do not necessarily have full motorway specifications) has a total length of

9,526 km and 85% of it is characterised by the Ministry of Public Works as good. The network is sufficiently preserved but is poorly designed. Viewing the map of Greece (Fig. 1) one can see that there is no North-South motorway on the western side of the mainland, one that could permit the easy transport of goods and persons. Also there is no main East-West road axis. This means that there is no link between the productive Greek eastern mainland and the ports of western Greece, the ones that are closest to Italy.

Figure 1: Greek motorway and other main road network

The most significant port in the western Greek coast is Patras, where an industrial zone of major importance exists. The port of Patras serves mainly the international traffic of car/passenger ships heading to Italy or Yugoslavia and some cruise ships. However, the cruise ship business has not been properly developed and presently the ships are using the port of Katakolo, west of Patras. The traffic to and from Italy has increased, but the growth is not the expected one. The road connections are sufficient, due to the lack of a proper bridging between Rio and Antirio, the truck traffic to the north side is hindered and the car traffic is forced in a way to remain low.

Patras is the only western port with a rail connection. However, the railway network in the Peloponnese peninsula (where Patras is located) is incompatible with the rest of the network in Greece but also with the rest of Europe rail networks due to a smaller gauge of 1.0 m width. So as far as rail is concerned, Patras can only serve the trade needs of the Peloponnese, and the capacity of the line to Athens is very low.

The other major port of the western Greek coast is Igoumenitsa. This port is the endpoint of the future *Egnatia* highway, an East-West axis that will connect the EU via the Adriatic Sea, to Igoumenitsa and then to Thessaloniki and Turkey. The port has two main functions: to handle the coastal ferry traffic and connection with Corfu (the distance is only 18 sea miles) and to serve the international ferry traffic with Italy or Yugoslavia. No cargo facilities are provided and the port is limited to serve Ro/Ro or Car/Passenger traffic. Igoumenitsa is located in Epirus, a mountainous area where no significant economic activities are taking place. If there is an improvement in land interconnections then Igoumenitsa will accommodate more traffic, as happened although there was no improvement of facilities provided during the war in Yugoslavia. Epirus has no rail network, and it is not planned to build one before the end of the century.

Corfu has a port of minor importance, which has two main and distinct functions: to handle the local traffic to and from the mainland and to handle the international traffic to and from the island. The main activity of both classes of traffic is tourism, and the movements of merchandise cargo are limited.

For the railway network in Greece the only thing that can be said is that there is no integrated network at all, since the line serving the Peloponnese ends in a railway station terminal in Athens and the rest of the network is a standard gauge axis connecting Athens with Thessaloniki and further on to Balkan countries in the north. The two lines are disconnected in Athens because of their different gauge and because of infrastructure problems of the Greek Railway Organisation (OSE) (even the terminal stations are different). OSE has the exclusive right to exploit all facilities of the national railway network, to provide any available rail service within Greek territory and to cooperate with foreign railway organisations about anything concerning services and administrative matters. The total length of the network is only 2,126 km, and 62% of it has a normal standard gauge. Only 9.7% of the total provides a second (double) track.. No electrification currently exists, although there are plans for doing so in the future. The achieved speeds are comparatively very low, and often derailments or several other accidents happen. But the major problem is the complete lack of terminals and organised nodes. Perhaps the only port for which some real physical connection between rail and ship can be achieved in the one in Thessaloniki (which is of no consequence to our analysis). So, for the purposes of our specific study, no real rail-ship intermodality can be achieved. The cargo traffic has been decreasing year by year. During the war in the Balkans trains passed through Bulgaria and Romania, almost along the same routes as trucks did.

The main Italian ports facing the Adriatic Sea are Trieste, Ancona, Bari, Brindisi, and Otranto. For the needs of this study only the ports of Ancona, Bari and Brindisi and their land connections will be analysed. By contrast to Greece, in Italy substantial road and rail networks exist. OSE has cooperated usually with the rail organisations of Yugoslavia and Austria, but never with the Italian rail organisation (Ferrovie dello Stato- FS) due to incompatibility of the gauges between Patras and Italy. In Italy the road networks are excellent and high speeds can be achieved. The rail networks serve all the Italian mainland and can connect all major ports in the Adriatic Sea to markets anywhere in Europe.

One of the safest and deepest port in the the Adriatic Sea is Ancona: a well protected and adequately equipped port that can serve cargo, passenger and ro/ro traffic. The road and rail links need an improvement and Italian Authorities have taken into serious consideration the further development of the port. Of course, as long as Greece has no real rail port the existence of good rail facilities and connections in Italy is important only for theoretical considerations.

Bari is a very important port linked to all road and rail Italian networks. But further improvement of the railway node is necessary. Traffic analysis will prove that it is wise to consider a common future for the ports of Brindisi and Bari. Brindisi has a natural port which serves passenger traffic along the summer season. There is an adequate rail connection but the connection to the motorway system is not ready yet. Many works are in progress, financed by special reserved funds, but a great amount of work is still to be done such as relocation and reconstruction of the whole port.

Although many technical problems exist, thus far Greek operators and users typically have preferred to disembark in Bari or Brindisi. Now the future is quite unpredictable, because a newly adopted Italian policy wishing to free the road networks in the south may oblige indirectly Greek trucks to disembark in a northern port, such as Venice or Trieste. But even if the traffic figures remain the same for the next decade, the port facilities in southern Italy shall be improved [5],[1].

In closing this paragraph it should be noted that the road networks through the Balkan States are insufficient and narrow, but no significant traffic jams occur except in custom houses or near major cities. In the rest of EU countries, including Austria, the networks are very good but often jammed due to heavy traffic. The main problem for Greek carriers are the new technical rules (about environmental protection and labour matters) followed by many controls and checking during the trip. Many controls are performed from Italian Authorities. This may revive the port of Trieste and the utilisation of intermodal links between Trieste and Verona or Villach (in Austria); from Verona any western market is easily reachable and from Villach any central European or eastern market is similarly accessible.

Traffic figures

The figures describing the traffic of trucks also include "intermodal" traffic between trucks and any other mode. This includes the traffic when trucks cross the Adriatic onboard car/passenger ships.

There are four main "gateways" (custom houses) through which trucks enter or leave Greece:

1. Euzonoi, to and from the Former Yugoslav Republic of Macedonia (FYROM).

2. Patras, to and from Italy.

3. Promachon, to and from Bulgaria.

4. Igoumenitsa, to and from Italy.

The traffic figures (expressed in number of trucks) are as follows (this data is actually the most up to date that can be officially provided by ESYE).

			FYROM		ITALY		BULGARIA		ITALY	
	Total		Euzoni		Patras		Promachon		Igoumenitsa	
	In	Out	In	Out	In	Out	In	Out	In	Out
1989	75,596	88,287	47,463	61,267	8,998	9,695	9,645	6,854	3,245	2,555
1990	63,783	85,394	27,317	60,247	5,814	5,526	12,487	3,524	4,264	3,610
1991	81,095	82,645	35,551	54,513	5,052	3,061	18,797	7,536	6,289	4,764
1992	102,349	143,472	31,158	39,731	5,577	30,568	44,941	51,585	N/A	N/A

Source ESYE. Trucks of international transports crossing the frontiers. Distribution by custom-house. Note: including transit.

In every custom house the procedure of control for the vessel as well as for the cargo is exactly the same and several statistical figures are collected.

A striking observation from the above table is the tenfold increase in the Patras *outbound* traffic from 1991 to 1992. Oddly enough, this is not matched by an equivalent increase of the inbound traffic, leading to the suspicion that there might be something wrong with the data. Unfortunately, there is no further information on this from any other official table, or even a note about it. Anyway, a general observation from the table is that carriers seem to use now more frequently the Adriatic Sea link. But the gateway of Euzoni that was dominating with 66% of the traffic in 1989, due to the war fell in 1992 to only 30%. By contrast, the gate of Promachon (Bulgaria) has increased its share from 3.2% to 44% in 1992. Apparently carriers prefer to send their trucks through Bulgaria and Romania in stead of using the Adriatic Sea link.

In the next paragraphs the results of the statistical investigation will be presented. In the first paragraph statistics from year 1985 to 1994 are analysed per year and Greek or Italian ports. The traffic of passengers and cars represents a main stream of tourist flow to Greece, which is highly seasonal and creates congestion in the ports during the summer. It is also a great income source to the shipping companies, not only as fares, but also as hotel services. On the other hand the traffic of trucks is almost continuous with little seasonality. The trucks are the original users of the sea - linking network and preserve a standard income to the companies during the winter, when tourist traffic is negligible. Sasonality hinders trucks to cross the Adriatic in the summer, and the lack of traffic in the winter forces the shipping companies to reduce sailings.

Passengers

	Patras		Igoumenitsa		Corfu		Ancona		Bari		Brindisi	
	in	out	in	out	in	out	in	out	in	out	in	out
1985	416,521	418,259	115,581	89,992	139,290	133,841	151,000	153,947	44,953	40,269	393,488	417,296
1986	367,622	377,609	111,812	86,178	133,069	129,790	142,078	142,266	34,868	36,754	350,052	364,123
1987	400,368	422,990	117,399	95,676	139,195	137,319	182,684	170,307	49,409	46,208	384,440	401,134
1988	456,266	455,606	127,076	93,163	164,216	177,634	211,019	198,883	52,788	61,489	386,070	412,406
1989	486,627	468,216	137,700	100,174	169,714	174,116	252,230	249,069	58,434	71,260	369,575	412,669
1990	518,873	502,434	164,626	126,163	203,769	195,172	282,715	289,808	66,045	74,061	400,179	448,808
1991	549,609	456,674	266,161	218,008	189,959	175,046	297,090	316,241	104,883	119,963	383,098	441,598
1992	537,496	501,836	311,429	281,672	211,621	196,852	330,634	367,374	162,309	156,085	404,524	462,217
1993	508,464	462,050	423,913	401,386	198,953	178,369	287,955	319,287	194,475	205,779	473,686	522,885
1994	503,104	482,077	378,994	356,350	202,076	170,894	290,258	315,327	192,739	210,503	450,207	479,921

These figures do not represent the absolute totals of the network because traffic from several ports of minor importance is omitted. But they represent at least the 97% of the whole traffic. The passenger traffic has a total growth of 5.1% per year on the average during the pre war era and 4.4% during the war period (1992-1994). With a difference of ≈6.8% between inbound and outbound traffic it can be assumed that there is a balanced traffic between the two countries.

Cars

	Patras		Igoumenitsa		Corfu		Ancona		Bari		Brindisi	
	in	out	in	out	in	out	in	out	in	out	in	out
1985	58,552	59,540	25,421	23,396	12,316	22,982	34,723	37,160	9,049	7,717	46,821	44,475
1986	56,440	56,400	25,734	22,834	13,603	14,293	32,845	36,352	6,426	7,229	47,868	46,009
1987	59,147	62,921	28,944	25,329	14,487	25,538	42,019	41,041	10,054	9,921	47,905	48,044
1988	66,387	68,240	27,220	25,113	20,361	22,160	45,809	44,543	10,060	11,798	51,416	48,523
1989	74,033	73,340	31,431	28,505	22,814	23,406	55,054	55,870	10,789	12,617	50,677	51,686
1990	76,929	77,072	36,862	31,517	36,780	26,201	58,964	61,507	11,178	12,766	53,839	54,805
1991	81,910	76,319	65,906	56,296	30,369	26,079	63,845	73,529	23,526	26,931	56,578	63,139
1992	90,811	80,619	78,058	69,850	27,647	25,550	73,053	85,674	34,138	34,182	53,382	63,204
1993	84,373	70,955	106,678	98,608	26,031	32,992	64,441	80,552	42,036	42,681	71,217	79,493
1994	84,611	73,589	95,895	88,243	28,757	23,949	66,754	81,657	36,099	40,442	70,217	73,450

The average annual growth of car traffic has been 7.6% until 1991 and 5.5% from 1992 to 1994. The growth rates are more or less equal, but the interesting remark is the difference between the car traffic coming to Italy and the traffic leaving Greece. This is not a statistical mistake, but due to bad land interconnections in the mainland and the existence of some interesting tourist islands, ships transport often cars from Patras to other ports and vice versa.

Trucks

Patras	Igoumenitsa	Corfu	Ancona	Bari	Brindisi

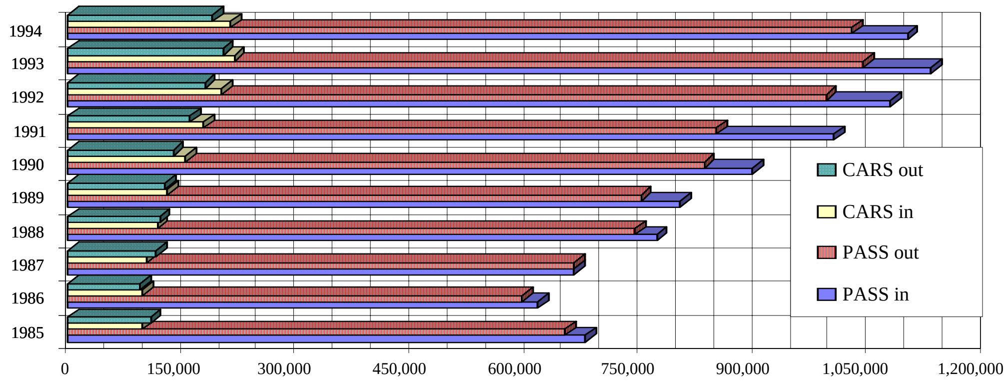
	in	out	in	out	in	out	in	out	in	out	in	out
1985	20,942	18,652	1,705	1,152	76	53	3,054	4,037	304	311	16,464	18,300
1986	16,751	16,269	2,222	1,148	74	175	4,323	4,732	726	639	12,521	13,644
1987	17,821	18,155	886	1,097	165	149	7,014	6,713	2,363	2,397	10,112	9,881
1988	26,499	26,920	1,847	1,149	854	877	10,887	11,684	6,559	6,160	10,366	10,380
1989	35,223	34,145	3,819	2,906	565	246	18,423	20,716	8,415	8,470	9,883	9,799
1990	41,094	39,882	4,548	4,531	7,980	6,790	19,351	23,309	8,983	9,573	13,822	12,516
1991	49,545	42,593	8,276	6,994	3,782	951	20,522	25,790	11,511	12,577	14,650	19,377
1992	60,302	56,352	10,399	9,814	6,339	1,618	25,604	33,122	16,982	17,868	17,613	16,657
1993	96,400	78,672	21,198	20,987	7,361	2,212	32,913	43,467	24,366	36,247	36,254	37,282
1994	105,826	94,618	28,088	20,334	8,921	3,002	31,985	40,577	37,012	44,129	49,137	48,637

The average growth of the total truck traffic is 13.2% from 1985 to 1991 and 23.9% from 1992 to 1994. Note here that there is no information about the quantity and kind of their load.

As data in the previous table may look totally different from the data on truck movements as reported by custom houses, it must be mentioned that many differences in data between custom houses and port authorities exist, because port authorities collect data about traffic not only of import or export but also of internal needs, whereas custom houses collect data only about traffic related to movements abroad.

The traffic of passengers is strongly related to that of cars. Looking closer to the combined graph below it can be seen that there is the same annual trend, although more passengers and cars seem to be coming in than going out. There is no certain explanation of this imbalance. Passenger imbalance might be due to some passengers leaving Greece via other gateways (including air transport). Car imbalance might be explained by an underlying steady "immigration" of cars into Greece.

Relation between Car and Passenger Traffic



From the Greek side the main port is Patras. Patras may be losing part of its share, but it remains the most significant port as far as passenger traffic is concerned. Until 1991 Patras was serving 62.5% of the passenger traffic (coming to Greece) and 60.0% (travelling to Italy) annually. Corfu has a steady flow in and out of less than 200,000 passengers and an average of 25,000 cars during the 1990's. Igoumenitsa's shares were 18.7% and 15.5% respectively. But during the war period Igoumenitsa's shares increased reaching the percentages of 35.1% (incoming) and 34% (out coming) and the shares of Patras decreased to 47.4% and 47.5% respectively A very interesting notice about car traffic is that Patras served 57%, Igoumenitsa served 26% and Corfu 17% during the pre war era but from 1992 Patras's shares fall to 41% and Igoumenitsa gets 45% . As far as it concerns passenger traffic in the ports of Italy, Brindisi had an average of 60% annually, Ancona 31% (in and out), and Bari only 8% (in and out). A remarkable change during the period 1992 and 1994 is the increase of passenger traffic in Bari, where the percentages become 19.7% (in) and 18.8% (out), in the same time where Ancona had a steady flow of total traffic of 32.6% and Brindisi gets a 48% annually. But from the Italian side things became more interesting and complicated. Brindisi is suntil the main port serving most of the traffic. Brindisi and Ancona share also ≈ 80% of the car traffic. As the passenger traffic was split in Italy during the pre war period, so does also and the car traffic. Brindisi and Ancona serve ≈46% and 43% respectively. During the war their shares decrease to 37% and 41% revailing an increase of the importance of Bari as a port.

Things are looking different concerning the shares of truck traffic in Italy and in Greece. The main port not only of destination but also of orientation is Patras during the decade, although Igoumenitsa increases its shares from 1992 continuously. More specifically Patras served ≈88% and Igoumenitsa 8%. For the period of 92-94 Patras served 78% and Igoumenitsa ≈17%. But generally speaking things are different in Italy. Until 1991 the main ports were Brindisi and Ancona; in the period 85-91 a mean annual share of the total traffic is 42% for Brindisi, 40% for Ancona and the rest 18% for Bari. As happened for the car / passenger traffic Bari increases its share in favour of Brindisi during the war era achieving the percentages of 25%, where in the same period Brindisi gets 37% and Ancona 37%. An interesting observation is that all Greek ports are receiving more traffic than they send, except in 1987 and 1988 in Patras and in 1990 in Igoumenitsa where the figures were marginal equal.

Seasonality is observed mainly in the car / passenger traffic. From the provided data (not attached here) is obvious that the main stream of traffic flow (65% of the total) is served during the third quarter, summer season. In the second quarter 20% of the traffic is served and the other two quarters get an equal share of 7.5%. The seasoning is exactly the same, as obviously expected, in Italy and in Greece. Truck traffic was stable during the decade, where the second, the third and fourth quarter got a percentage of ≈ 27%. Remarkably is that the first quarter in Greece has a 19% and in Italy has 27%, but the rest quarters have a stable seasoning of ≈24%.

4.TECHNICAL ASPECTS OF THE MODES

Having a brief look at the existing fleet operating in the Adriatic Sea network until May 1994 some interesting remarks can be made. The first is that mean fleet age is about 24.55 years. This old-aged fleet is operating with an average speed of 18.89 knots. The above observations concern ships of 1,000 GRT and more. The fleet has an average GRT of 8,865 and a mean number of crew of 98. The average ship has a capability of transporting 1,113 passengers, 328 cars and 37.3 trucks. The sample is not poor; it represents 52 of 57 ships totally, and the result of the above statistical analysis is characterised as sufficient. The only extracted result that can be disputed is the transport capability of the typical ship.

Two more interesting remarks are that 48 of the 57 vessels are under Greek or Cypriot flag (generally Greek owned) and they are occupied ≈5.46 months annually in the routes of the Adriatic. Another remark is that almost all ships are second hand. This means that the operating companies generally do not invest (or have not invested until now) in newbuildings. The above remark is not suprising and already explained in [2]. In 1994 some companies announced the routing of some newbuildings in the Adriatic Sea network and actually they are operating since the beginning of the summer of 1995. These ships are conventionally designed, but they are fast enough to serve users with high value of time.

From a Naval Architecture point of view it is very interesting that these ships are conventionally designed. "New technology" designs, such as SWATH or CATs are not operating yet. Three conventionally designed car/passenger ships which can make about 26.5 knots and can cover the distance between Patras and Ancona within 20 hours are already routed. Representatives of the companies said that at the beginning the idea of routing "new technology" fast ferries was tested, but due to technical and financial problems the idea was rejected. After successful routings in the Adriatic Sea in summer of 1995 the companies seem to be satisfied. Unfortunately however, there are no statistical data provided yet in order to understand the shares gained by these ships. It is very important to remark that these ships are newbuildings, specifically designed for this link and operating under the Greek flag and law. This is indeed a new trend. Shipping companies and operators are expecting a lot from these investments.

Still, what will likely affect this transport system the most is the possible routing of "new technology" fast ships in this trade (called from now on High Speed Craft -HSC). Based on a previous paper [2] any sea vessel exceeding 20 meters in length and having a cruising speed over 30 knots can be characterised as *fast*. In trying to classify HSC some criteria have been set; and the comparison among the designs is very subjective. From an engineering point of view the criteria are typically the following: speed, ride quality and comfort, capacity, reliability, strength, and energy savings [3].

Nobody knows exactly how the market will react upon appearance of HSCs in this trade. In fact, passengers are not used to sit in a comfortable seat for 6 or 8 hours in order to cross the Adriatic. Also it cannot be accurately predicted if they are willing to pay more than the usual fare, or if a calculated Value Of Time (VOT) extracted from a regression model reflects the real intentions of customers. On the other hand, it is known that transport companies demand faster crossing of the Adriatic.

The table below lists a limited number of HSC types and their main characteristics. The data is provided by several magazines focusing on developments in Naval Architecture. The selection of these specific ships among a much wider sample of HSCs is based mainly on their technical data and scope of this rough analysis is to ascertain if their economic future is promising in one of the existing lines.

Design or Name	Type	Speed [kn]	Passenger	Cars
SEÁJET 250	Semi-SWATH	40.8	450	120
STENA SEA LYNX 2	Catamaran-Wave Piercer	37	600	240
M&K FERRY	Monohull	33	600	160
ALBAYZIN	Monohull	38	450	84

The table below shows the required fares these types of HSC must charge to break even for some specific routes, in comparison with two existing conventional designs, "old" and "new" ("new" being the equivalent of the fast newbuildings recently purchased). The model of predicting the required fares is presented and extensively used in [5].

Sea miles	130	210	210	290	500	600
Required Passenger Fare	IGOUMENITSA	PATRA	IGOUMENITSA	PATRA	IGOUMENITSA	PATRA
in GRD	BRINDISI	BRINDISI	BARI	BARI	ANCONA	ANCONA
SEAJET 250	59,791	61,973	61,973	64,154	86,754	89,481
STENA SEA LYNX	24,652	26,072	26,072	27,491	37,922	39,696
M&K FERRY	30,763	32,717	32,717	34,670	48,074	50,516
ALBAYZIN	13,624	33,710	33,710	35,853	49,904	52,583
"OLD" CONV/NAL	16,382	17,354	17,354	18,327	20,881	22,096
"NEW" CONV/NAL	24,439	25,220	25,220	26,000	28,049	29,025

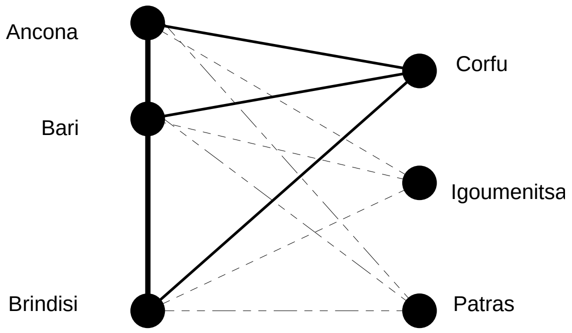
As a percentage of the	IGOUMENITSA	PATRA	IGOUMENITSA	PATRA	IGOUMENITSA	PATRA
cheapest fare	BRINDISI	BRINDISI	BARI	BARI	BRINDISI	ANCONA
SEAJET 250	439%	357%	357%	350%	415%	405%
STENA SEA LYNX	181%	150%	150%	150%	182%	180%
M&K FERRY	226%	189%	189%	189%	230%	229%
ALBAYZIN	100%	194%	194%	196%	239%	238%
"OLD" CONV/NAL	120%	100%	100%	100%	100%	100%
"NEW" CONV/NAL	179%	145%	145%	142%	134%	131%

It is obvious that all new designs require higher fares than the conventional designs, except only in the case of the link between Igoumenitsa and Brindisi, This may explain why new conventional design were preferred to enter the network in this link.

5. MODAL SPLIT ANALYSIS

Given the data on traffic and by making some additional assumptions there is a possible way to forecast what is expected to happen in case HSCs enter this trade in the near future. We do this here by adapting the "revealed preference" method used in [4] (for a modal split analysis within the Aegean Sea in order to assess the possible impact of HSCs in 2004, the year of market deregulation).

As in [4], the first step in this method is to choose a workable and relevant subset of the network. A subset has to be chosen because the entire network would be unworkable because of its complexity (at least two origins in Greece such as the two major Greek cities of Athens and Thessaloniki and several major European destination cities such Munich, Paris etc). What is of interest to our study is the sub-network of the Adriatic Sea. This sub-nework schematically looks as follows.



In spite of a 3-port configuration at each side, notice that there is a fundamental asymmetry in this configuration: Greek nodes are effectively disconnected from each other, wheras Italian nodes are connected. Indeed, whereas Italian "autostrade" effectively link Brindisi with Bari and then Ancona, nothing similar exists at the Greek side. In fact, nobody in Patras would consider going to Igoumenitsa to take the ferry to Italy, because the road connection (which actually involves a ferry crossing) is too cumbersome. The same argument applies for Corfu, which is an island.

So the main assumption is that the Greek origin or destination places are not linked together and all the traffic to Italy is heading to the northern part of the Italian coast. This means that all traffic to Italy essentially has the same intermediate destination point, Ancona, before continuing further north to destinations in Central EU. Obviously this assumption omits any traffic connecting Greece to Rome and other southern parts of Italy, or traffic directly going to Venice or Trieste. However, these flows are much smaller than the ones in the network examined. Also the model does not consider "new" prospective ports such as Rimini or Ravenna for example (although such new nodes could be included).

The model will thus compare the routes Patras ↔ Ancona, Igoumenitsa ↔ Ancona and Corfu ↔ Ancona and for each case the three possible ways to get to Ancona: directly by ship, via Bari by ship and then by road, and via Brindisi by ship and then by road.

In [4,5], the Value of Time (VOT) was calculated using a multinomial logit model and the "revealed preference" method. A similar approach has been used here, the preferences revealed being determined by how traffic is split along the network examined. For the needs of this analysis the following "modes" are set: mode1 is referring to the direct sea link from Patras or Igoumenitsa or Corfu to Ancona, mode2 is referring to the link from Patras or Igoumenitsa or Corfu to Ancona via Bari and mode3 via Brindisi. To calculate VOT (calibration of the logit model) all "modes" refer to conventional ships, since this is the only data available.

The results of the analysis ([4] provides more details as to how the logit model was formulated and solved) are shown in the three tables below, for passengers, cars, and trucks separately. Each row in each table refers to a specific route, with a separate row for each direction. Notation used in the tables is as follows:

f_i % share of mode i (i=1: directly, i=2: via Bari, i=3: via Brindisi)

p_i total fare (GRD) by mode i (i as above)

t_i time (hrs) by mode i (i as above)

VOT value of time (GRD/hr)

p_x total fare, mode x (HSC) (GRD)

t_x time (hrs) by mode x

s_x % share of mode x

s_i % new share of mode i (i as above)

P Patras

A Ancona

I Igoumenitsa

C Corfu

The results are as follows.

Passenger traffic

	f_1%	f_2%	f_3%	p_1	p_2	p_3	t_1	t_2	t_3	VOT	p_x	t_x	s_x %	s_1 %	s_2 %	s_3 %
P→A	48.26	14.51	37.23	22,960	24,400	22,160	33	22.5	27.5	343	30,000	25	56.69	20.38	12.18	10.75
A→P	47.76	16.17	36.07	23,200	24,800	22,000	33	24	26.5	387	30,000	25	50.90	23.13	15.49	10.48
I→A	24.19	29.51	46.30	25,700	28,000	25,200	10	16	23	1,214	38,000	15	32.57	15.67	22.95	28.80
A→I	22.93	29.45	47.62	26,000	28,500	25,000	10	17	24	1,289	38,000	15	31.18	15.37	23.91	29.55
C→A	37.45	8.58	53.97	23,700	27,000	23,200	10.5	15.5	35.5	12	25,000	20	22.58	11.87	54.72	10.84
A→C	40.16	8.00	51.84	23,000	26,000	23,000	10	15	35.5	18	25,000	20	29.94	8.93	49.60	11.53

Car traffic

	f_1%	f_2%	f_3%	p_1	p_2	p_3	t_1	t_2	t_3	VOT	p_x	t_x	s_x %	s_1 %	s_2 %	s_3 %
P→A	33.88	30.43	35.69	25,500	25,000	25,500	33	22.5	27.5	18	30,000	20	4.64	27.93	38.08	29.35
A→P	65.46	13.68	20.86	25,500	26,500	27,000	33	24	26.5	954	30,000	20	14.82	47.88	13.48	23.83
I→A	21.12	42.03	36.85	24,500	43,500	40,500	10	16	23	77	35,000	22	24.49	37.43	18.17	19.91
A→I	29.95	27.36	42.68	25,500	44,000	41,000	10	17	24	2,123	35,000	22	27.25	11.41	26.18	35.17
C→A	92.66	1.41	5.92	23,500	43,000	39,000	10.5	15.5	35.5	123	35,000	24	11.06	0.60	51.63	36.71
A→C	48.01	8.87	43.12	24,500	43,500	39,500	10	15	35.5	547	35,000	24	16.83	2.70	25.83	54.63

Truck traffic

	f_1%	f_2%	f_3%	p_1	p_2	p_3	t_1	t_2	t_3	VOT	p_x	t_x	s_x %	s_1 %	s_2 %	s_3 %
P→A	34.08	25.96	39.96	435,000	402,000	445,000	34	22.5	31	955	550,000	22	7.10	25.53	43.99	23.38
A→P	63.63	10.70	25.67	435,000	417,000	460,000	33	24.5	33	7,892	550,000	22	44.13	15.85	0.72	39.30
I→A	33.63	61.02	5.34	327,500	416,645	474,200	10	18	36	8,322	500,000	15	0.34	98.04	1.61	0.01
A→I	29.09	28.71	42.20	332,000	422,300	479,400	10	19	37	9,600	500,000	15	23.53	11.47	20.64	44.36
C→A	80.41	2.23	17.36	320,400	408,500	473,300	10.5	17.5	38.5	4,607	450,000	25	0.41	0.00	0.00	99.58
A→C	44.53	10.38	45.10	325,700	415,900	478,700	11	18.5	39.5	5,383	450,000	25	4.20	0.01	0.56	95.23

The fares that are used are calculated through an approximation of all normal possible costs, and the main difference among prices of inbound and outbound traffic is due to the different fuel cost in Italy and Greece. Also some time data is different in the two directions because delays are also taken into account. The delays are personal experiences of people working in the ships, but the difference is an hour or a half hour. Notice that delays (and therefore overall times) are generally different for passengers, cars, and trucks. The cost for trucks is based on an approximating model developed in [1]. The cost for cars is a summation of fuel costs and the the fares, and for the passengers is the summation of the fares, a standard spending onboard, and a split of the cost of car by 2.5, because a car contains 2.5 people in average (an estimate of travel agencies in Patras).

It is very interesting to see that routing a new HSC vessel may have different results on passenger and vessel traffic. For example a new fast mode routed from Patras to Ancona and vice versa will get about 50% of the passenger traffic and only 5÷15% of the car traffic. Also trucks from Ancona to Patras will prefer this vessel, but from Patras to Ancona the vessel may be empty of trucks, because Bari attracts the most. Another interesting observation is that routing a fast vessel from or to Corfu will guide the traffic to the southern Italian destination. So before the investment on any vessel, it has to predict the separate shares in a relevant way with the future of other routes after the routing of this new vessel.

Some other useful remarks are that passengers are willing to pay more in order to get at their destination sooner, but that is not valid for car traffic, which will mainly use the existing modes. Time may be the critical factor for the decision among routes and modes, because more people will use southern ports as already happens (except the case of Corfu). The observed significant "spread" in the estimated VOT for passengers and cars can only be explained by the speculation that there are probably more factors affecting passenger preference for a specific route than fare and trip time alone. In fact, the pleasure of a journey onboard a luxurious ferry may outweigh the preference for a faster crossing in many cases.

However, it is interesting to note that such a spread in VOT is not observed for truck traffic, meaning that for a truck driver fare and trip time are far more important factors than they are for a passenger with or without a car.

As far as truck traffic is concerned, one can see that the routing of a new HSC vessel may dramatically change the status and diminish some routes. For movements from Italy to Greece a new fast vessel will dominate the route of Patras, carve almost the same niche as Brindisi and Bari for the route of Igoumenitsa and lead all traffic from or to Corfu to routes of Brindisi. The higher VOT of the links from Italy to Greece prove also that time costs more in imports, and it is obvious that the link from Patras to Ancona (the longest movement) serves exports of smaller VOT than any other port.

One final point: Notice that this analysis (especially for trucks, and to a lesser extent, for cars) shows important *directional asymmetries* with respect to VOT and HSC share. Most notable is the projected share of HSC of 44.13% from Ancona to Patras (with a VOT of 7,892 GRD/hr), whereas the share in the opposite direction is only 7.10% (with a VOT of 955 GRD/hr).

An asymmetry in HSC shares is not in itself unexpected, because the overall problem has a number of other asymmetries, as noted earlier (the asymmetry of import/export unit values and the asymmetry in network topology are just two). Here we have yet another asymmetry: notice the initial shares of truck traffic (without a HSC), which are 63.63% from Ancona directly to Patras and only 34.08% in the opposite direction. Such an initial asymmetry may very well be attributed to factors additional to fare and transit time, which are not that asymmetric. Such other factors (such as for instance differences in port infrastructure or limited service in certain ports) cannot be taken into account by the logit model, which tries to explain them only in terms of differences in VOT. Asymmetries in VOT ultimately result in asymmetries in HSC projected shares. To the extent that such asymmtries in other factors will still exist after the introduction of the HSC, they are expected to further pronounce the share asymmetries that currently exist.

6. RECOMMENDATIONS

To the best of our knowledge, this is the first time such an analysis (economic feasibility and modal split) has been performed to investigate the potential of HSCs for the Adriatic Sea link. This analysis can lead to some interesting conclusions.

It is obvious that there are some malfunctions and discontinuinities of the transport chain. Sometimes it seems that there is no chain at all. There was and there will be problems in linking Greece with the rest EU-States via the Balkan roads; before the war in Bosnia there were not enough tresspassing licences, during the war road connections through Bulgaria and Romania do not provide safety and low cost, so the future does not seem very prosperous. On the other hand the Adriatic Sea link does not provide proper services; the ports of Patras and Igoumentisa are not properly connected to the major trade regions of eastern Greece and there is an absolute lack of rail services. In addittion, the operating ships are relatively slow so there is a time handicap of approximately a day long, depending on the destination point. The link via the Balkan States leads to Austria and Germany, where special envirnonmental laws will be gradually effective -if they are not already effective- due to the principle of territoriality, prohibiting the tresspassing of the majority of Greek trucks, so the transport cost will be increased.

The Adriatic link will not be the same in the years ahead. New fast conventionally designed ships are already operating and serving the northern Italian ports. It is sure that these new ships will attract more trucks, especially during the winter. Unfortunatelly, these ships entered the route between Patras and Ancona in the summer of 1995 and there is not any available traffic data or statistics.

The last objective of this paper is to propose some recommendations. All recommendations are derived from the above conclusions and follow the principles:

- removal of any exclusiveness and restraint;
- improvement of the efficiency of the network, nodes, modes and of specific branches -ways;
- application of new technology;
- immediate planning of new Greek national transport policy within the frames and needs of EU

The first proposal is the creation of new tracks of transportation, exploiting in the best way the willingness of EU to get cargoes from the road to the sea. Greece can develop new lines connecting significant trade regions, such Creta directly to major European ports. This is not only applicable to isolated regions but also to regions confronting problems of road congestion such as Epirus or the Peloponnese. Small multipurpose ships can collect cargoes and direct them to ports such as Marseille, Trieste or Barcelona. Ships with holds capable to keep adequate temperatures for the expensive fresh vegetables and fruit, ro/ro facilities and high cruising speeds will require less time for the movement from Greek coasts not only to northern Italian ports, but also to the new dynamic markets and future significant nodes such as Marseille. Thus requires a sophisticated management with an aggresive marketing, which will pursuade all user to change the way of transport, collect and handle cargoes in large storehouses and operate fast, accurately and safely.

The existing system suffers from inadequate links and congestion in several roads, ports and custom places. This problem is mainly a Greek one; the port of Patras can hardly get more traffic unless it is reorganised and the port of Igoumenitsa is not properly linked to Athens and Salonika, the two major trade regions of Greece. A substructural problem like this can be solved by the Greek government through EU fundings and will permit trucks to use the exsting fleet of the Adriatic Sea. But it is wise to follow international practices; the lack of rail connections makes it impossible to move large, cheap cargoes with the relevant cost abroad. So Patras can became a rail port, connecting Italy's rail lines with Greece, permitting the existence of many today relatively slow ships if only the handling of cargoes is adequately fast. At this point the RoadRail technology can be applied. Other applications of new technologies are the use of highly sophisticated telecommunication facilities and packaging, improving the efficiency of nodes.

In other words it may be useful to create port pairs, because there is no other obvious way to keep the demand high enough for the supply to act. It is also the only way to exploit all new institutional and technical changes of the recent years.

REFERENCES

[1] O.D. Schinas, "The Transportation of Goods between Greece and the rest of Europe; Status, Prospects and Recommendations" (in Greek), Diploma Thesis submitted to the Department of Naval Architecture and Marine Engineering in September 1994; Thesis Supervisor Professor H.N. Psaraftis.

[2] H.N. Psaraftis, A.D. Papanikolaou, "Impact of New Technologies on Shortsea Shipping in Greece", Paper presented in the First European Research Roundtable Conference on Shortsea Shipping, Delft, 1992.

[3] J.P. Dobler, "Growth Prospects of High - Speed Car - Ferries utilization on European Short - Sea Routes", Paper presented in the Second European Research Roundtable Conference on Shortsea Shipping, Athens, 1994.

[4] H.N. Psaraftis, V. F. Magirou, G. C. Nassos, G. J. Nellas, G. Panagakos and A.D. Papanikolaou, "Modal Split Analysis in Greek Shortsea Passenger/Car Transport", Paper presented in the Second European Research Roundtable Conference on Shortsea Shipping, Athens, 1994.

[5] H.N. Psaraftis, "Greek Coastal Shipping: Status, Prospects, and Investment Opportunities", Final Report to ETBA (in Greek), Athens, 1993