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**Article**

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SPOUDAI - Journal of Economics and Business

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*Suggested Citation:* Goulielmos, Alexander M.; Sitzimis, Giannis (2012) : Measuring market concentration in the Aegean ferry system, SPOUDAI - Journal of Economics and Business, ISSN 2241-424X, University of Piraeus, Piraeus, Vol. 62, Iss. 1/2, pp. 7-27

This Version is available at:

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*Journal of Economics and Business*

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## Measuring Market Concentration in the Aegean Ferry System

By

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### Abstract

The paper calculates the concentration in 6 major routes of the ‘Greek ferry system’ (2001-2010), important not only for international tourism, including Cruises, but also for the cohesion of the Greek space with EU. Worth noting is the consolidation of companies that took place, where from 25 companies operated (prior of 1994) to 5 groups (by 2012). This was due to: (1) the abolition of ‘cabotage’ (i.e. the right to restrict coastal services to national-flagged ships) by EU. The relevant legislation passed in 1992 with a long transition period (1992-2004), and (2) the listing of ferry companies in Athens Stock Exchange. Frequent buy-outs increased the monopoly power of companies involved. The Greek ferry system was a par excellence state-regulated one since 1976, with State issuing licenses and determining fares, but failing to control quality. A measure of monopoly power was calculated, based on the work of Lerner, Herfindahl and Hirschman, known as the ‘Hirschman-Herfindahl Index’. After a brief examination of what is meant by ‘market’, we provided the values of HHI for the 6 routes: (1) Piraeus-Crete, (2) Piraeus-Chios-Mytilene, (3) Crete (Iraklion)-Piraeus, (4) Piraeus-Crete (Rethymno), (5) Piraeus-Dodecanese and (6) Piraeus-Cyclades. These show a distinct pattern of *oligo-poly/monopoly*, with the traffic concentrated in a small group of companies. We argue that the number of ships of different companies in *one route determines the market*. Neither partial (2002) or full (2006) deregulation had any effect in increasing competition, as expected, with the temporal exception in one or two cases. Moreover, Greek authorities had not prepared properly for deregulation and as a result failed either to prevent monopolies or to create the effective antitrust regulation like in USA.

**JEL Classifications:** K23, L11-13, L22, L43.

**Keywords:** Concentration, Greek ferry system, The ‘Hirschman-Herfindahl Index’, Deregulation.

### 1. Introduction

The ‘Greek Coastal Ferry System’ (GCFS) offers sea transportation services mainly in the Aegean Sea. It is a dominant force in connecting the area of Greek

mainland with its islands. It transported about 20 million passengers in 2009. The industry was partly *deregulated* in 2002 and fully in 2006. It consists of 3 main markets: (1) the route 'Perama-Salamis Island'. This is a ten minutes crossing. It transported about 9 million passengers (46% of total) in 2009 (up from 5.8 million in 1984<sup>1</sup>). This was the third busiest route in Europe after Dover. (2) The routes serving the big Aegean islands, which served 7.5 million passengers (39%) in 2009 (up from 4.8 million in 1984). (3) The 'Saronicos Bay' route, with 3 million passengers in 2009 (15%) (up from 2.5 million in 1984).

The 2nd market of GCFS -on which we focus- had about 25 companies with about 80 ships in 1993 (increased from 51 in 1984). By 2012, *only 5 main groups* of companies with about 65 ships remained. Despite this *extensive consolidation*, worth noting is that the *speed* of ferries became the main mean of competition between companies after 1995 and till this day. Listing in Athens Stock Exchange facilitated, no doubt, the above concentration of coastal companies (listings begun in 1994<sup>2</sup> for the first time).

Moreover, the existing 'cabotage'<sup>3</sup> phased-out between 1992 and 2004 –a very long adaptation period indeed for Greece. Cabotage adopted not only by Greece, but also in all European ship-owners of South Europe. But EU-members, as a result of the Single Market, had also to remove restrictions on 'free movement', within the EU, of seamen (Goulielmos-Milliaraki, 1994). Moreover, companies in GCFS are seen to specialize in 'passenger-plus-private-cars-plus lorries' services *in their effort to achieve economies of scope*<sup>4</sup>. The end of Greek cabotage initiated in 1992 was an initiative of EU (Council Regulation 3577), legislated to be completed by 1st January 2004, as mentioned. This long transition period of 12 years was especially granted to Greek Government on account of special social and economic conditions linked to the economic well-being of numerous Greek islands and the necessary cohesion with mainland and rest of EU.

However, the Greek administration, on its own initiative, "liberated"<sup>5</sup>, as said, the sector a year earlier (1/1/2003) to avoid its coincidence with Olympic Games (in 2004). In fact to be clear, this whole process was one of *deregulation and not privatization*; the Greek law 2932/2001 (since 1st November 2002), e.g. was mis-titled as "Coastal shipping *Liberation Law*". In fact, this law in Article 12 feared monopolistic situations and provided the establishment of an ill-fated 'Antitrust Department in Shipping Ministry- called ΠΑΘΕ<sup>6</sup>, from 1st January 2002...

GCFS, especially after 1976, (Presidential decree 684/1976), was subject to the full state regulation (Goulielmos-Lekakos, 1992). The state determined fares and granted licenses to operators. The state did not, however, determine quality of ships and services beyond the basics. Worth noting is that the *supply of services* was solely in the hands of the Minister of Shipping - a political person whose judgments were made on political grounds. The 'demand for services' naturally

could not be regulated and depended mainly on the particular conditions of the domestic and foreign tourism<sup>7</sup>.

Worth noting is that the partial deregulation<sup>8</sup> of GCFS on 1/1/2002 did not involve *privatization*<sup>9</sup>, as one would expect, because shareholders/ship-owners were already *private persons*. Moreover, ‘companies formed by the island people involved as shareholders’ (the first was formed on the initiative of the citizens of Crete after the accident of F/B ‘Iraklion’ in 1965), were also private; the difference among companies was only the number of shareholders<sup>10</sup>. Deregulation after all permitted the long sought after by ship-owners right<sup>11</sup> to set fares at will and to submit a plan of ‘itineraries intended to serve’ to the state once in a year.

Our research seeks to answer the question: “Did deregulation help competition as this has been done in the deregulation<sup>12</sup> of USA airline system” (Holloway, 2003; Pickrell, 1991)?

## 2. Aim of the paper

The paper determines first the ‘market structure’ of GCFS -paying particular attention to *measuring monopoly power* after partial deregulation in 2002 and full in 2006. As this is known, ‘industrial-organization economists’ tried for a long time to summarize the distribution of market shares among firms in a *single index* (Tirole, 1988, p. 221). It was hoped, in vain, that this could be used in antitrust analysis in GCFS, as this is done in US and the EU. In this paper we will use the ‘Hirshman-Herfindahl’<sup>13</sup> concentration index (HHI). Moreover, as Besanko *et al.* (2004, p. 228; 2010, p. 234) argued theory suggests that the *market structure* is related to the level of *prices* and the profitability prevailing in a market.

## 3. Literature review

Lerner (1934, p. 169) argued that in cases where the cost curve is horizontal, the ratio of monopoly revenue<sup>14</sup> to total receipts, coincides exactly with the ratio of the divergence of price from marginal cost to price. Lerner<sup>15</sup> named this the ‘*measure of monopoly power*’. The monopoly revenue per unit of output is the excess of price (P) over marginal cost (MC). The *absence* of monopoly holds when price, or average receipts, is equal to marginal cost. More formally, let P be price and MC marginal cost, then the ‘*index of the degree of monopoly power*’ is given by:

$$[(P-MC)/P] \tag{1}$$

If ‘marginal costs’ are replaced by ‘marginal receipts’, we arrive at the *special case*, at *equilibrium*, where

$$MR = P(1 - 1/e) \quad (2)$$

where  $e$  stands for elasticity of demand. Solving for  $e$  we obtain:

$$[e = P / (P - MR)] \quad (3)$$

meaning that the *degree of monopoly power can be determined also by the elasticity of demand*<sup>16</sup>.

Given first-order conditions for profit maximization in a Cournot form, theory suggests that *profits are proportional to a firm's market share and inversely proportional to the elasticity of demand (Price > Marginal Cost)*.

Lerner's index is always positive (or 0); this means that firms sell at a price exceeding marginal cost (given that  $P = \text{price} = MC$  holds only in perfect competition). Marginal revenue is, by definition, equal to:

$$P + QdP/dQ \quad (4)$$

For profit maximization is well known that marginal cost must equal marginal revenue. Elasticity of demand,  $e$ , is given by  $(dQ/dP) (P/Q)$ . Dividing (4) by  $P$ , then

$$MR/P = 1 + (Q/P) (dP/dQ) = 1 + 1/e \quad (5)$$

or

$$MR = P(1 - 1/|e|) \quad (6)$$

as  $e$  is *always negative* (Hirshleifer-Glazer, 1992).

Bain (1951, 1956) pioneered the view that concentration facilitates *collusion* between firms and increases industry *wide profits*. In theory, the link between concentration and industry profits can be seen by using the static Bertrand and Cournot models. Moreover, a number of papers (Scherer, 1980; Schmalensee, 1986; Hannah and Kay, 1977; Curry and George, 1983) has shown that there is cross-sectional evidence for a statistically significant *link* between 'concentration and profitability'.

Saving (1970) argued that Lerner's index is exactly correlated with the *total market share* provided that the  $m$  dominant companies in an industry agree to determine the price for the remaining small companies.

Weiss (1989) found that prices tend to be *higher in concentrated markets*; gasoline prices in local markets, where the top 3 retailers had a 60% market share had, on average, 5% higher prices (compared with markets in which the top 3 retailers had a 50% market share; for each 10% increase in share, a 5% increase in prices is expected).

Spulber (1989) argued that the traditional concentration ratios are good predictors of *market power* and of the efficiency of industry's equilibrium. Concentration indices are used to compare changes in the structure of production in a regional economy at two distinct points of time (Soofi, 1992; Mattas *et al.*, 2010).

Boone and Weigard (2000) showed that the institutional changes which are intuitively associated with an increase in competition, yield higher concentration levels instead of lower. *This happened also in Greek Coastal Ferry System- GCFS, we argue.*

Lijesen (2004) developed a way to incorporate quality in HHI. He tested his research on civil aviation. His index is suitable for markets where close substitutes exist *-as one may argue for the Crete routes presented in this paper-* and must be used for the factors in which substitutes differ. Our feeling is that 'speed' and 'year of built' of the ships are used as indicators of 'service differentiation' in GCFS.

#### 4. Methodology

Herfindahl Index, as mentioned will be used in this paper. It was used in 1940s as a measure of skewness. It was Cowling and Waterson (1976) that have linked the index to economic theory, and especially to Cournot's competition. It has been used since 1981 by US Justice Department<sup>17</sup> and in 1984 was adopted as a concentration measure in mergers; also by the: (1) UK monopolies and mergers commission (Hirschey *et al.*, 1995, p. 71), (2) Federal Reserve Board (banking), (3) Federal Energy Regulation Commission and (4) US Department of Transport. It is widely applied in competition and antitrust law, and technology management. It is a measure of industrial *market concentration*. It measures the size of firms belonging to one industry and it indicates the amount of competition among firms. *It is sensitive to the way market under examination is defined.*

Cowling and Waterson (1976) and Lyons (1981) used Herfindahl-Hirschman index and commented on its strengths. This takes into account the *number of firms* and their *differences in size*. It also records a positive level of concentration in industries with firms of equal size. It can vary between 0 and 1; for HHI=0 there is a large number of equal-sized firms; concentration is low. If HHI ~ 1 the market is dominated by one large firm.

To obtain HHI we add the square of each company's market share:

$$HHI = \sum_{i=1}^n S_i^2 \quad (7)$$

where S stands for market's share. The number of firms (n) can vary from 1 to 50. Small shares, when squared, do not add significantly to the total index, and some authors (Besanko *et al.*, 2004; 2010) suggest omitting all market shares below 1%.

HHI is related to Lerner's index shown above. Lerner's index is:

$$P - MC_i / P = -S_i / e \quad (8)$$

where P is price, MC marginal cost, S<sub>i</sub> the shares of the market and e elasticity of demand. This means that the larger a firm's market share is, the more market power it has. Also, the more price elastic is market demand, the less market power a company has. Now multiply (8) by S<sub>i</sub> and sum over n firms:

$$\left( P \sum_{i=1}^n S_i - \sum_{i=1}^n MC_i S_i \right) / P = - \sum_{i=1}^n (S_i)^2 / e = [(P - \overline{MC})] / P = -HHI / e \quad (9)$$

i.e. the weighted average price minus cost margin for the industry is related to the HHI of concentration divided by elasticity of demand (Jacobson and Andreosso-O'Callaghan, 1996, p. 81).

Moreover, the profit function ( $\Pi$ ) in Cournot's model (1897), in its exact form, can be written as (following Tirole, 1988, p. 218) as shown also above:

$$\Pi^i(q_i, q_j) = q_i P(q_i + q_j) - C_i(q_i), \quad (10)$$

and for profit maximization:

$$\Pi_i^i = P(q_i + q_j) - C_i'(q_i) + q_i P'(q_i + q_j) = 0, \quad (11)$$

where the first two terms on the right hand side give the *profitability* of a marginal unit of output. This is equal to the difference between price and marginal cost. The third term gives the effect of an extra unit on profitability of the infra marginal ones (which is zero for a competitive firm).

According to theory, it is *the number of firms that determines fares*. Similarly in GCFS, where the number of firms fell from 25 to 5, fares were increased (Goulielmos-Sitzimis, 2010). The market price and each firm's profit decreases

with the number of firms (n). As the price decreases with n, so does the total profit nΠ. As n→∞, the market price tends to the competitive price, as shown below.

Given asymmetric market shares we can define: Π=industry-wide profits as:

$$pQ / e(\sum_{i=1}^n a^2_i) = pQ/e \text{ HHI} \tag{12}$$

(where e = elasticity of demand) with constant marginal costs (Cowling and Waterson, 1976) given also Lerner’s index (Tirole, 1988, p. 222). If e=1 then Q=k/P and k>0 and Π=kHHI=kR+1. The Herfindahl Index yields an *exact measure of industry’s profitability* (up to k). Moreover, Lerner’s index=HHI/e and L=1/e for profit maximization, where perfect competition has e=∞ or optimally L=0.

For a non cooperative Cournot-Nash model, Encaoua and Jacquemin (1980) showed that an arithmetic average of Lerner’s index across firms equals HHI multiplied by the reciprocal of demand elasticity, as shown above.

Concentration indices are useful as they give an easily computable and interpretable indication of how competitive an industry is. They depend on a *proper definition of the particular market*, however, as in this paper (where ‘substitutability’ is the dominant criterion). Moreover, the *geographic scope* is also important, as also considered in this paper, thus defining each itinerary/route as *the market*.

Given the various practices that are used in the calculation of HHI, we will adopt the critical values of Herfindahl Index shown in the Table 1 below due to Besanko *et al.*, (2004 and 2010).

**TABLE 1**

Critical values of the Herfindahl index according to Besanko *et al.*

Perfect competition	<0.2 (usually)	Fierce competition
Monopolistic competition	<0.2 (usually)	Fierce or weak competition depending on product differentiation
Oligopoly	0.2 to 0.6	Fierce or weak competition depending on inter-firm rivalry
Monopoly	0.6 and over	Weak usually; taking into account the threat of entry

Source: Besanko *et al.* (2004, p. 207).



Hirschey *et al.*, (1995, p. 71), e.g. determined differently the value of HHI: if lower than 1000 indicates a competitive structure; from 1000 to 2000 there is a grey area; over 2000 indicates high concentration. A dangerous area is when  $HHI=2000+100$  in USA.  $HHI=1$  means one firm in the industry.

The US Department of Justice and the Federal Trade Commission use HHI as a screening tool to define whether a planned merger is likely to raise antitrust concerns, e.g. rises of over 0.01. Moderate concentration means that HHI varies from 0.10 to 0.18, and ‘concentration’ starts if HHI is higher than 0.18.

According to EU<sup>18</sup> *effective competition brings benefits to consumers such as: lower prices, higher quality of products, a wide range of products and services to choose from, and innovation. Moreover, increased power in the market is defined as the ability of a company to increase prices profitably, to reduce production, to restrict choice or quality of products, or services, to diminish innovation or to influence competitive factors.* To measure concentration levels, EU Commission uses the HHI; also it uses the shares of the 3 or 4 largest companies. If  $HHI=10000$  indicates pure monopoly. EU stresses the fact that the *variation* of HHI - called delta<sup>19</sup> - is also useful when HHI is measured *before* and *after* concentration. In EU a ‘dominant position’ is characterized by a market share of over 50% (even a lower percentage between 40% and 50% creates suspicions’ and in certain cases even lower, i.e. below 40% - as in the “Rewe/Meinl” and “Nestle/Ralston Purina” cases). An  $HHI \leq 1000$  does not reduce competition after concentration. Similarly, cases where concentration has produced  $HHI \geq 1000$ , but  $\leq 2000$  and  $\delta < 250$  or  $> 2000$ , but  $\delta < 150$ , are *examined*, if six further criteria are met (as set out in the EU guidelines cited above). The Commission underlines also the fact that the *definition of the relevant market is always crucial*.

## 5. The ownership structure of GCFS by 2010

The present ownership pattern of GCFS after deregulation of 2002 and 2006 is as follows: MARFIN controls 100% of Blue Star Ferries and 89.14% of Superfasts (Attica group, where 10.86% is held by public). Sea Star Capital (SSC) partially controls ANEK (32.5%) and Hellenic Seaway Carriers (HSC) (25.4%). ANEK totally controls ANEN, as well as 33.35% of HSC and 50.11% of LANE. 59.23% of ANEK is in public and 8.27% is held by Morgan Stanley (and 32.5% by SSC).

The Grimaldi Group (Italian interests) controls 85% of Minoan and 15% is in public hands. The 19.98% of NEL belongs to Antelope, 5.02% to Ventouris, 5.6% to Millenium Bank, 56.84% is held by the public and 12.56% is held by Allianz S.E. 49.89% of LANE belongs to public and 50.11% to ANEK. 88.34% of SAOS belongs to Manousis family and 11.66% to public (bankrupt in 2009).

C-link belongs to NEL. Hellenic Sea Carriers belong to the Iliopoulos group. GAF belongs to Agoudimos G. (bankrupt in 2010). KF belongs to Spanos G. (bankrupt in 2009) and Pascal Lota. ASL belongs to Evgenides-Demitriades.

Above analysis confirms that 5 main business groups control GCFS. As noted, concentration was not so intense before 1994, when companies started to be listed on Athens Stock Exchange. The first company was 'Strintzis Lines' (later owning 'Blue Star Ferries') in 1994, followed by 'NEL'<sup>20</sup> (1995), 'Minoan Lines' (1998), and 'ANEK' (1998-99). The 'Attica Group' listed in 1924 using a company that was listed on Athens Stock Exchange since 1918, but it belonged to the food sector. Each company wanted to 'gather' as many 'licenses'<sup>21</sup> as possible so that after liberalization they could appeal to the 'grandfather clause' and maintain as many routes as possible.

Moreover, as Keynes (1936, p. 151) argued, when you resort to a Stock exchange, in the morning you are a farmer, and in the afternoon you are not. But by the next morning you can again be a farmer by buying back 'your' shares. Stock exchanges make all fixed investments without stock exchanges liquid. So, in 1994 'Strintzis Lines' belonged to 'Strintzis family' by majority, but in 1999 and in 2000 about 49% belonged to 'Attica enterprises'. Later they have been sold to MARFIN.

## 6. How Greek ferry market can be defined?

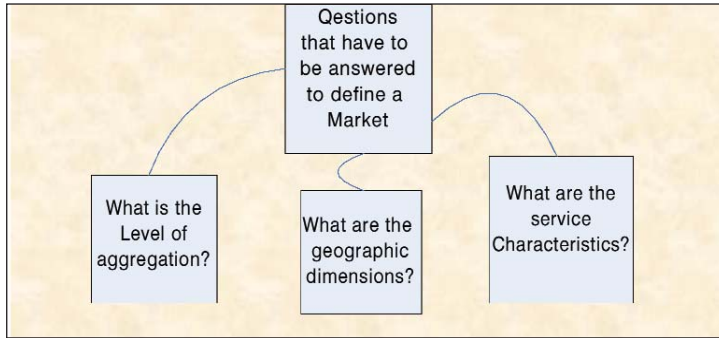
Economists do not provide a clear definition of a 'market' (sic). Varian (1990) in his first chapter of his book titled 'the Market' he gives too no definition... Pearce (1992) states that "market generally is any context in which the 'sale and purchase of goods and services' takes place", with an obvious effort to include distant markets (e.g. telecommunications). What really market is then Internet? Market definitions are general and inadequate as they do not distinguish one market from another.

US Department of Justice in its Mergers Guidelines (1982-84) has formally defined a market, but in an obscure way. Also, EU commission (1997) stated that a market definition is required to identify competitive constraints, and restricts it to the product and *geographic* dimension. EU following industrial organization theory wants to define market so that to identify *actual competitors*. Further, EU emphasizes demand and finally defines market 'if products and services are *regarded*<sup>22</sup> *interchangeable or substitutable* by the user/consumer' (Martin, 2010, pp. 799-806).

Further, market is 'a nexus of interaction between buyers and sellers, or a locus of purchase by buyers and sale by suppliers of 'similar' goods (not defined); or an institution within which the interaction between economic agents performing these two functions establishes the price of a good'. Each market must have a geographic extent (Jacobson and Andreosso-O'Callaghan, 1996).

**FIGURE 1**

Questions encountered when one wants to define a Market



Source: Inspired by Lijesen (2004).

The weakness of economists in defining the market objectively is exploited by large oligopolies, wanting to buy-out smaller -but strongly ‘relative’/relevant companies- arguing that their products (to buy-out) allegedly *belong to different market* (Besanko *et al.*, 2010, p. 211).

How could then the ferry market be defined? The solution is not easy. Figure 1 underlines the problems emerging when one tries to define a market.

### 6.1 A historical definition of the coastal shipping market

In 1984 IOBE<sup>23</sup> gave implicitly an answer about coastal shipping ‘market’. It estimated a statistical function of the type  $Y=a+bX$  using *the total year cost of 14 ships belonging to all existing companies in Greek Coastal shipping*:

$$\text{Cost (per year)} = -75980755.62 + 5891.87 \text{ drachma times sea miles produced} \quad (13)$$

$$R^n=0.80 \text{ (where } n=2) \quad (14)$$

The Marginal cost is €17 after converting it from drachmas. Subsequently, the intercept ‘a’ was found to be statistically zero and omitted. Thus,

$$\text{Cost was} = b \text{ sea miles produced} \quad (15)$$

As a result ‘total year cost is equal to: Marginal cost times sea miles produced’ (16)

If we divide both sides of (16) by ‘sea miles produced’, marginal cost *equals* average cost. This outcome is wrong; it indicates, however, the view prevailing at

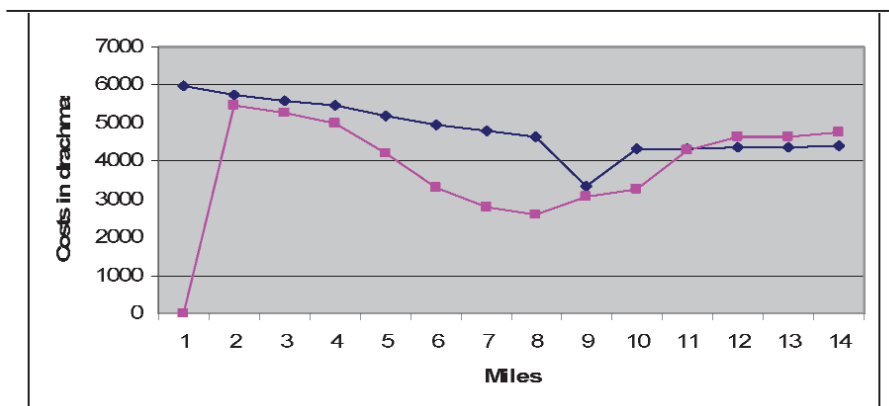
the time that fares must be set so that miles produced multiplied by average cost should cover total ship costs (Goulielmos-Sambracos, 2002) or full cost pricing.

Taking total miles produced per ship, as provided by IOBE, and dividing total year cost, we may derive average and marginal cost<sup>24</sup> curves, assuming that these 14 ships consist the market (despite operation in different routes). For such a figure to make sense, we arranged ship costs in order, with ships with higher costs to produce fewer miles and so on.

As shown (Figure 2) marginal cost (€12) cuts average cost at a total production of 571.837 Sea miles (not shown). This should be equal to marginal revenue at equilibrium in a competitive market. Unfortunately, this is not the lowest average cost point (which is €9), according to theory. Moreover, if ships services are priced at marginal cost, the fare should be €7, uniformly for all ships (and at  $Q=403,647$  miles). The user pays €17 per Sea mile for a distance of 64,416 miles per annum. This is more than twice the marginal cost and consequently the monopoly power is  $\approx 0.6$ , according to Lerner's index ( $P-MC/P$ ), and thus we conclude that according to IOBE we have an *entire monopoly* in the Greek Coastal Shipping. This is surely wrong.

**FIGURE 2**

Average and Marginal Costs for 14 ships in 1983 at various productions of sea miles



— marginal cost — average cost

Source: IOBE and Excel.

Now, pricing at marginal cost (€7) -as we should according to theory- creates losses for the 11 out of the 14 ships, with only three ships producing profits; ships had to produce more than 635,000 sea miles per year (and where  $MC > AC$ ). Figure 2 proves the harsh reality that pricing at marginal cost, ships produce losses.

Marginal cost is less than the average cost due to prevailing strong ‘economies of scale’ in the majority of the ships.

Figure 2 tells another truth, which is that ships have *different cost functions* in producing total quantity demanded. Indicates also that is meaningless to consider market as consisting of 14 ships over various and different routes. Although costs differ from ship to ship, great differences in costs, we believe, occur also due to the varying distances<sup>25</sup>. So, above analysis confirms our theory that market cannot be that with all existing ships, but only of those belonging to *one specific route* at least. In other words there are as many markets as there are routes. This is the contribution of this paper. So, the ‘Herfindahl Index’ will have a meaning only per route.

## 6.2 The Herfindahl Index per route

We will measure HHI in the following, considered as the most important, six routes: (1) Piraeus-Chania, (2) Piraeus-Chios-Mytilene, (3) Piraeus-Iraklio, (4) Piraeus-Rethymno, (5) Piraeus-Cyclades and (6) Piraeus-Dodecanese.

(1) The Piraeus-Crete (Chania) route: The HHI is calculated for passengers, private cars and Lorries<sup>26</sup> (Table 2).

**TABLE 2**

HHI for shares of traffic between 3 ships belonging to 3 different companies (‘Blue Star Ferries’, ‘Hellenic Seaways’ and ‘ANEK’), 2006, on the Piraeus-Crete (Chania) route

<u>Passengers:</u>	<u>Private cars:</u>	<u>Lorries:</u>
$81.6^2 + 18.4^2 + 0.00 = 6.7$ <i>Monopoly (of ‘ANEK’).</i>	$80.2^2 + 19.8^2 + 0.00 = 6.8$ <i>Monopoly (of ‘ANEK’).</i>	$99.2^2 + 0.8^2 + 0.00 = 9.8$ <i>Monopoly (of ‘ANEK’).</i>

As shown above the route is a monopoly of ‘ANEK’ in all kinds of traffic. ‘Blue star ferries’ withdrew in 2005 (March) after remaining in the route for 2 years (since March, 2003) using ship ‘Blue Star 2’. ‘ANEK’, though, committed a series of managerial mistakes like over-borrowing, unnecessary recruitment and monopoly treatment of its clientele. ‘Blue Star Ferries’ failed to secure a serious share of the very important, for revenues, lorry traffic. The ‘Blue Ship’ then transferred to Italy-Greece routes. Hellenic Seaways withdrew in 2008. Worth noting is the fact that ships like ‘Highspeed II’ were not designed for transport also of Lorries –depriving their company of the economies of scope. ‘MARFIN’ returned in April 2010 using the ship ‘Blue Star Horizon’.

The situation was no different in years 2003 to 2005 and 2007 to 2009 (Table 3).

**TABLE 3**  
HHI on Piraeus-Crete (Chania) route, 2003-2005 and 2007-2009

<u>Passengers:</u> 2003: 5.0 oligopoly	<u>Cars:</u> 5.1 oligopoly	<u>Lorries:</u> 8.0 monopoly
2004: 5.0 oligopoly	5.2 oligopoly	6.0 monopoly
2005: 6.1 monopoly	6.2 monopoly	8.9 onopoly
2007: 6.1 monopoly	---	9.7 monopoly
2008: 10. monopoly	10. monopoly	10. monopoly
2009: 10. monopoly	10. monopoly	10. monopoly

*Source:* Calculated from traffic provided by Companies' information booklets.

On the above route, oligopoly power has been replaced by monopoly over the years in all kinds of traffic, despite deregulation. ANEK is firmly established in transporting the Lorries –the why of which needs further examination. In a market with only few ships owned by few sellers, however, it is not surprising to see the entry of new ships, as in 2003-2005, which introduced oligopoly power by reducing the pre-existing monopoly one. 'Hellenic Seaway Carriers' performed a cream skimming strategy, however; 'Blue Star' withdrew from the route after failing to secure a serious share of the lorry traffic, as mentioned, which is very important for Crete and its exports to Italy and Europe, as well as for ship's revenue. 'Blue Star Ferries' returned in 2010 (end April) to the route, reducing fares by 40%, a start of a *price war*. This happens when traffic is *not adequate* for both ships belonging to different companies.

(2) The Piraeus-Chios-Mytilene route. Three companies operate here: 'NEL' with 4 vessels, 'Hellenic Seaways' with 1 new-building (since Sept. 2005) and

‘SAOS Ferries’ with 1 ship transporting only Lorries. The monopoly company, however, is ‘NEL’ with a share of 67.2% in 2004 and 72% in 2006.

The HHI calculated for 2005 (when data is available) was as follows:

**TABLE 4**  
HHI Piraeus-Chios-Mytilene, 2005

<u>2005: Passengers and private cars:</u> $(57\% \text{ HS})^2 + (43\% \text{ NEL})^2 + (0.00)^2 = 5.1$ oligopoly	<u>Lorries:</u> $(26\% \text{ HS})^2 + (47\% \text{ NEL})^2 + (27\% \text{ SAOS})^2 = 3.6$ oligopoly
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There are 5 routes, but only in one ‘NEL’ has a monopoly (Piraeus-Chios-Mytilene, with over a 60% share). ‘Hellenic Seaways’, using a fast ferry, obtained a serious share of the market in passengers and cars. ‘NEL’ was obliged to run a new-building ferry (the ‘Mykonos Island’) on this route and *reduce* fares to €10 for economy class for passengers travelling to Chios... This is one case when *oligopoly benefits passengers*.

(3) The Crete (Iraklion)-Piraeus route, 2001-2009 (nine months). Three companies operated in 2005 (‘MINOAN’ with 2 ships, ‘ANEK’ with 2 ships and ‘C-link Ferries’ with 1 ship), and 3 other companies joined later (‘Superfast Ferries/Attica Enterprises/MARFIN’ with 1 ship, which entered in 2004), while ‘C-link’ withdrew. We will calculate the HHI for passengers, private cars and Lorries for 2001 to 2009 as we used to do so far.

**TABLE 5**  
HHI Crete (Iraklion)-Piraeus, 2001-2009 for passengers

2001	2002	2003	2004	2005
<b>Passengers</b> $(23\% \text{ ANEK})^2 + (77\% \text{ MINOAN})^2 = 6.5$ monopoly	$(25.6 \text{ ANEK})^2 + (74.4 \text{ MINOAN})^2 = 6.2$ monopoly	$(27.2 \text{ ANEK})^2 + (72.8 \text{ MINOAN})^2 = 6.0$ monopoly	$(28.8 \text{ ANEK})^2 + (71.2 \text{ MINOAN})^2 = 5.9$ oligopoly	$(29.1 \text{ ANEK})^2 + (70.9 \text{ MINOAN})^2 = 5.9$ oligopoly
2006	2007	2008	2009 (Oct.)	
$(29.4 \text{ ANEK})^2 + (70.6 \text{ MINOAN})^2 = 5.8$ oligopoly	$(28 \text{ ANEK})^2 + (72 \text{ MINOAN})^2 = 6$ monopoly	$(30.5 \text{ ANEK})^2 + (69.5 \text{ MINOAN})^2 = 5.8$ oligopoly	$(20 \text{ ANEK})^2 + (61.6 \text{ MINOAN})^2 + (18.4 \text{ ATTICA})^2 = 4.5$ oligopoly	

Source: Companies’ booklets and our calculations.

‘ANEK’ has adopted a flexible pricing policy and moved 2 faster ships from the Italian-Greece routes to this route in 2002 (‘Crete 1 and 2’). In 2009 ‘Attica

Enterprises’ entered this route and obtained a share of 10% of the traffic at the expense of the other two companies. In private cars the picture was similar as shown below. It started as a monopoly in 2001 (HHI=6.15) and ended up in 2009 as oligopoly (HHI=4.45).

**TABLE 6**

Concentration measuring in Iraklion-Piraeus route traffic of private cars and Lorries, 2002-2008.

2002 Cars	2003	2004	2005	2006	2007	2008
HHI=5.73	5.313	5.293	5.303	5.242	5.298	5.251
2002 Lorries	2003	2004	2005	2006	2007	2008
HHI=5.409	5.155	5.014	5	5	5	5.138

In Lorries, the picture was one of oligopoly (2001=HHI=5.34) as shown above, but the oligopoly power reduced dramatically until 2009 to HHI=3.8.

According to various authors (Besanko *et al.*, 2004; 2010) the number of companies (or the number of ships per route belonging to different companies) drastically affects the monopoly power and fares. Here theory is confirmed.

(4) The Piraeus-Crete (Rethymno) route. Until 2006 there was only one company on this route (‘Preveli’; ‘ANEK’). Given the system of state licenses before 2002, it was the state that has put barriers to entry implicitly in favor of certain companies. In the liberalization process additional companies and ships were indeed attracted (e.g. vessel ‘Eolos Kenderis’ of ‘NEL’ and the ‘Blue Star Ferries’).

(5) The Piraeus-Dodecanese route. In 2009 two 11 year old ships of ‘Blue Star Ferries’, two ships of ‘G. A. Ferries’, with an average age of 29 years, and a few others operated on this route. ‘DANE’<sup>27</sup>, which used to service this route, withdrew due to the alleged bad management of company’s funds by its president.

‘Blue Star Ferries’ gained an increasing share of traffic (50% +). Table 7 gives HHI for 2009.

**TABLE 7**

HHI in traffic of Piraeus-Dodecanese route, 2009

<p><u>Passengers:</u>  <math>(1.5\%)^2 + (82.5\% \text{ Blue Star Ferries})^2 + (16\%)^2 = 7.1</math>                      = monopoly</p>	<p><u>Private cars:</u>  <math>(1.9\%)^2 + (83.3\% \text{ Blue Star Ferries})^2 + (14.8\%)^2 = 7.2</math>                      = monopoly</p>	<p><u>Lorries:</u>  <math>(5.3\% \text{ G. A. Ferries})^2 + (85.6\% \text{ Blue Star Ferries})^2 + (9.1\% \text{ ANEK's 'Preveli'}^{28} \text{ and 'Terapetra'})^2 = 7.4</math>                      = monopoly</p>
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Source: Information booklets of the companies involved and our calculations.



The HHI for 2004 to 2008 for passengers was as follows: 4.302; 5.242: *oligopoly*; 6.152; 6.058; 6.569: *monopoly*. In private cars: 2004-2008, 4.594; 5.392; 5.968; 5.800: *oligopoly*; 6.349: *monopoly*. In Lorries for 2004-2008 the HHI was: 4.15; 5; 5.24; 5.34; 5.92: *oligopoly*.

'DANE Lines' withdrew in 2005. 'G. A. Ferries' reduced its presence in all kinds of traffic from about 33.3% to 5.3% in 2009, and went *bankrupt* in 2010. 'Blue Star Ferries' gained a rising share in passengers; 55% in 2004, 61% in 2005, 74% in 2006, 73% in 2007, 78% in 2008, and 82.5% in 2009. In private cars 'Blue Star Ferries' obtained 57% in 2004, 64% in 2005, 72% in 2006, 70% in 2007, 76% in 2008 and 83% in 2009. In Lorries 'Blue Star Ferries' obtained 45% in 2004, 51% in 2005, 61% in 2006, 63% in 2007, 71% in 2008 and 86% in 2009. The monopoly of 'Blue Star Ferries' thus dominated this route.

The course of the monopoly power in all three classes of traffic on this route was rising (2004-2009) from 4.3 to 7.1 in passengers, from 4.6 to 7.1 in private cars and from 4.1 to 7.4 in Lorries, despite deregulation since 2002.

#### (6) The Piraeus-Cyclades route.

The companies provided services on this route are 'Blue Star Ferries' (4 vessels<sup>29</sup>, of average age 11 years), 'Hellenic Seaways' (4 vessels<sup>30</sup> of average age 5 years) and some 4 smaller companies<sup>31</sup> (9 vessels with an average age of 17 years). The traffic for 2009 (nine months) is given in Table 8.

**TABLE 8**

HHI in traffic in the Piraeus-Cyclades route, 2009 (1/1-30/9)

Passengers: Hellenic Seaways: 24.9%; Blue Star Ferries: 48.2%; rest: 26.9%) <sup>2</sup> = HHI=3.7 =oligopoly	Private cars: (24.9% HS; 45.2 BSF; 29.9% rest) <sup>2</sup> = HHI=3.6=oligopoly	Lorries: (7.3% HS; 58.4% BSF; 34.3 rest) <sup>2</sup> =HHI=4.6= oligopoly
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Source: Companies' booklets and our calculations.

As shown, *two oligopolies* dominate this market with *numerous small competitors* acting at market's periphery –the fringe firms. This analysis is based on our theory in oligopoly conceived *mutatis mutandis* from a 'monopoly market analysis' advanced by Besanko *et al.*, 2010; in monopoly we find *one* firm not producing 100% of the product, but having only a 60% share, considered sufficient for monopoly to exist. Therefore, a monopoly situation is seen with one dominant firm and the existence of many small firms producing 30% to 40% and competing/co-existing with monopoly (called 'fringe firms'; Besanko *et al.*, 2010, p. 217). We here presented an oligopoly similarly.

The oligopoly power (HHI) on this route has fallen marginally, since 2004, in passengers from 4.3 to 3.7. In private cars HHI fell most, i.e. 1.5 units, from 2004

to 2005 from 5.1 to 3.6, and remained at 3.6 in 2009. In Lorries the reverse was true; it rose from 3.6 (2004) to 4.3 (2005) and 4.6 (2009).

## 7. Conclusions

This paper presented the concentration profile of the five entrepreneurial groups serving Ionian and Aegean islands, transported 7.5 million passengers in 2009. The industry was state-regulated since 1976. The state licensed ship-owners and determined fares, but failed to regulate quality.

European Union decided in 1992 to waive the cabotage of the Greek flagged ships by 1st January 2004. Greek government though brought deregulation one year earlier (1/1/2003) to avoid coincidence of that with Olympic Games (2004). Moreover, the government passed a law in 2001, to 'liberate' ferry system, which came into force in November 2002. The law was mis-titled as it dealt with *deregulation*, not *privatization*. The law pretended to be a '*liberalization*' law, but its provisions talked about 'a special antitrust service' (called in Greek ΠΑΘΕ), thus revealing its true mission to combat monopoly. This paper measured the extent of monopoly and oligopoly in the ferry system after partial deregulation in 2002 and full deregulation in 2006.

Ship-owners on their part reacted since 1994 to the prospective waiving up of cabotage by 'buying-out' one another, at time when companies started also to be listed on the Athens Stock Exchange. The first listing made in 1994 by 'Blue Star Ferries', followed by all others. MARFIN acquired Attica Enterprises about seven years ago or so, i.e. the 'Superfast Ferries and Blue Star Ferries'; Italian interests acquired 'MINOAN'; 'ANEK' resisted, and 'SEA STAR CAPITAL' emerged as a new player.

True is that the Greek state was unprepared to resist to the creation of oligopolies and monopolies before deregulation, and thus permitted 5 groups to be formed from some 25 pre-existing companies.

The paper showed that certain monopolies turned into oligopolies, depending, not on deregulation, *but on number of ships on each route* belonging to the independent companies. The reverse was also true. If there was an antitrust service and legislation, then if a company wanted to buy the shares of another, it would have to apply for approval first. In that case the 'Herfindahl Index' and especially its variation, '*delta*', could help the authorities to evaluate which mergers would threaten competition by increasing monopoly power... But this did not happen to the present day.

We thought necessary first to define the ferry market on which concentration depends. The ferry market does not consist by all ships running on all routes as thought by the official research institute IOBE, because the geographical element and not only is dominant. So, *each route is one market for this paper*.

Six markets were concentrated as shown. Obviously, the markets are not competitive and thus fares are *higher* than if competition prevailed. Therefore, it can be finally concluded that deregulation *did not help Greek consumers or domestic and foreign tourists to reap benefits, as happened in the liberalization of USA Airlines Industry*, almost 40 years or so ago. Rather than bringing in more competition, EU Regulation 3577/1992 brought in more monopoly and oligopoly power...

## Notes

1. Data for 1984 from: 'The South European Cabotage Study' prepared for EEC by Tollenaar R L (1987) (Rotterdam, MERC NO 86E17).

2. 'Strintzis' tried to be listed in 1991, but prevented. It had to be a public company for at least three years before listing. This was done accordingly in 1994.

3. French term meaning that transportation services could be provided by ships, of 1000 grt or above, if they *fly only the national flag*.

4. Economies of scope are present when the cost of providing together *more than one services* is, when added-up, lower than the cost of each service separately. This means that if we want to transport passengers or private cars or Lorries we face first the cost of providing one ship for passengers, one for cars and one for Lorries. Alternatively, we build one -bigger perhaps- ship for all three traffic classes together. Then the cost of these two situations is calculated and compared. If the total cost in the second situation is lower than in the first, we say that economies of scope exist. In transport, cost is not the only factor however.

5. Meaning 'opening up the coastal transport market to competitive forces'.

6. I.e. the "Regulatory Agency of the Internal Sea transport".

7. Many times tourism has been affected by alleged terrorism, transnational threats of war, travel warnings for alleged dangers and seismic activity.

8. Deregulation removes legal and other barriers that inhibit entry and exit from an industry.

9. Meaning transfer of ownership.

10. With the latter, involving, as a rule, a much larger number/few thousands of small shareholders.

11. Naturally, safety remained in hands of the State.

12. Holloway (2003, p. 130) argued that the 'pricing freedom introduced by market deregulation and liberalization has *allowed many carriers to practice* much finer and more dynamic price discrimination... *this has led: to a reduction in real average fares in many markets...* in wider availability and deeper discounts.

13. The index is named after Orris C. Herfindahl, who used it in his PhD at Columbia University dealt with the 'concentration in the steel industry'. Symbolized by HHI, the index is called the 'Herfindahl-Hirschman Index'. Hirschman (1964) claimed that he had first created this index. The HHI was also applied by Herfindahl between 1959 and 1974 to quality of environment and resource economics. It has been widely applied, including bank loans.

14. Perfect competition exists only if there is a complete *absence of monopoly*. Pure monopoly is a case where one is confronted with a falling demand curve for the service one sells, but buys in a perfect market.

15. Spulber (1989) described Lerner's index important.

16. Saving (1970) showed that *concentration ratios* for firms in a price leadership model are related to *Lerner's index*.

17. In November 1981 (Wall Street Journal) the Department of Justice announced the use of the HHI in merger guidelines.

18. Official Gazette of EU, 5.2.2004, C 31/03: "Guidelines for assessing horizontal concentrations according to Council's regulation for the control of concentration among companies"; and Regulation 4064/89/21.9.1990 concerning Merchant Marine/Liners/Containerships.

19. The formula for the latter calculation can be derived as follows: let there be two companies 1 and 2 with markets shares  $a$  and  $b$  wanting to merge; the HHI is  $(a)^2 + (b)^2 = 1125$ ; after concentration the index becomes  $(a+b)^2 = \text{HHI} + 2ab$ . Thus  $\delta\text{HHI} = 2ab = 900$ , i.e. the total HHI after merger is 2025.

20. 16.5% of total shares were bought by 'ANEK' in 1999.

21. These are the famous *ἀδειες σκοπιμότητας*. This has been rather accomplished by private agreements providing shares of the listed dominant company to co-operating companies for the value it has been estimated to have their companies.

22. A subjective element.

23. The 'Foundation of Economic and Industrial Research' (Athens).

24. Defined as the rise (per Sea mile) of total costs (economic theory). Thus we sacrifice the first entry of data to obtain marginal cost. It is interesting that the miles produced and total costs are *proportional* and produce an almost *straight line of cost/fares*. This explains the fact that fares in Greece were *distance-determined*, where distance was used as a *proxy of cost*. This rule, however, was violated in practice, we believe, due to pressures exerted on state, by certain influential ship-owners, in determining by the state fares to be charged to public.

25. It is important to recognize that distance is related to speed and crossing time and not only. A ship providing overnight service due to a long distance has to provide cabins, thus *increasing her fixed cost*. Increased fixed cost provides greater economies of scale. On the other hand, faster ships face high bunkers costs and higher engines maintenance costs.

26. A 'price war' started in April 2010 with a serious reduction of fares (40%) by 'Blue Star Ferries'.

27. DANE founded in 1980 (with ship Kameiros; in 1982 bought Ialysos; in 1985 the Lindos and in 1989 the Rhodos; and in 1991 the Patmos) to connect Dodecanese with Piraeus and later (1991) with Salonika. In 1994 it employed 425 persons as crew and 50 at the office. In 1994 it decided to be listed on the ASE. Its shareholders at the time were 4,515 locals (no-one having above 5% of the capital, while the majority had 500 shares) with a capital in 1994 of 2.2 billion drachmas (6.4 m. €). Net profits were 1.75 million € in 1992. The ships transported about 700,000 passengers, 62,000 private cars and 41,600 Lorries. It served Kalymnos, Karpathos, Leros and Patmos islands.

28. Subsidized by the state in two routes per week.

29. 'Blue Star Ferries': 'Paros'-Ithaki'-Naxos' and 'Diagoras'.

30. 'Highspeeds 1-5'.

31. In 2006 these were: NEL (Eolos Kenteris II), Kallisti Ferries (Costiga Express III), Aegean Speed Lines (Speedrunner I and II) and G. A. Ferries (Rodanthi, Anthi Marina, Marina, Romilda, Daliana).

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