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Maritime Transport and Trade: The Impact of European Transport  
Policy. An Overview of Maritime Freight Transport Patterns

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By

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**Abstract:**

*In order to unblock major transport routes and to ensure sustainable mobility, the changing of freight road to rail or maritime transport is an European Union objective. The increasing seaborne transport, the growing process of containerization and building an infrastructure for regular maritime lines and increasing Short Sea Shipping draws a scene with maritime sector of companies of major size, as a result, in many occasions, of mergers and acquisitions. These dynamics seems to draw a new stage, with more concentrated markets. In this paper we intend to make an approach to the levels of concentration of maritime transport in Europe, trying to find a possible connection between new market structure in the maritime transport sector and the new economic situation promoted by European Transport Policy rules.*

**Keywords:** *Maritime Transport, Concentration.*

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## **Introduction: EU Regarding Environment**

The globalisation of trade has led to the emergence of a single market, where multinational firms provide increased competitiveness in terms of comparative costs, locations and their position within the different niches of the market.

Europe is worried about sustainability. Economic growth is closely linked to an increasing transport network. Protecting the environment and making it compatible with economic development is a goal for the European Union. The process of economic growth is not only European, but also worldwide. Policy makers, being conscious of the major link between the environment and the increasing transport networks, are trying to transform and improve the transport sector in order to achieve sustainability.

In this perspective, European Union Transport Policy is trying to avoid the imbalance between modes of transport in the European Union; the great prevalence of road transport does not help to avoid air pollution, noise, climate changes, congestion and accidents, and consequently sustainability. Not all transport modes are involved in the same ecological level. European Union tries to create a Transport Policy as ecological as possible – the White Paper: The European Transport Policy (2001) -. Protecting the environment is necessarily engaged with “nodal shifts”; that is to say, the movement of traffic from roads or highways to other modes, the so called “less environmentally damaging modes”. The most ecological transport mode is the maritime one. Thus, trying to avoid the transport of freight by roads or highways and transporting it by sea, EU contributes to sustainability. The European Transport policy is now moving very positively in favour of maritime intermodal transport solutions.

In this paper we first make an overview of maritime transport in the Trans-European Network of Transport (TEN-T) context, showing that the way towards economies of scale is a goal for firms, in order to achieve the best way for competition, involving maritime transport sector in an increasing concentration process. We also summarize the key aspects and trends in maritime traffic and we describe the main objectives of agents involved in this transport mode. The second section focuses on searching for evidence of the concentration process in the European Union countries, by analysing three different points: a) The distribution of maritime traffic among the European countries, b) the whole maritime traffic of each country in comparison with the traffic in main ports, c) the vessel maritime traffic and the containerization level, its evolution, and the movement of cargo in the top 20 container ports in the European Union. For the concentration analysis, we have calculated the aggregated percentage of freight handled for the main agents, and we also applied the Herfindahl-Hirschman index. Results and implications are shown in the third section of this paper.

## **Part I: Maritime Transport in the European TEN-T**

Under the freight transport perspective in Europe, an important development of maritime transport has appeared, which not only has increased, but it also has been growing and changing at the same time. Indeed, there are several maritime transport modes with different ways of development. The cargo market is usually divided into several different markets: container, Ro-Ro, conventional general cargo (break-bulk), dry bulk, and liquid bulk. The maritime transport industry is supported by distribution and storage networks and infrastructures.

An examination of the most relevant features of practices in the maritime transport sector reveals: a) standardization of norms; b) homogenization of services; and c) objectives are set in order to achieve economies of scale and agglomeration; i.e. organizations produced by greater concentration and centralization of economic agents in the sector, in the form of consortiums, alliances or strategic partnerships. It is said that, nowadays, maritime transport, to be precise, short sea shipping, is the only real hope in holding back the spectacular growth in road freight transport all over the EU.

The increasing containerization process is promoted for the globalisation and the economic development, the growing economic activity, trade liberalisation, reduced import tariffs, outsourcing, increasing containerization of dry bulk and break-bulk cargoes -Henderson et al. (2002)-. The process of containerization is an important element in the current context of maritime transport. It has increased dramatically since the sixties. Technical, technological and logistical advances have transformed and brought the maritime transport sector up to date Kuby and Reid (1992), Talley (2000). Not only is new cargo transported, but also the total capacity of ships has increased. This assumption can be supported by the following data: a) As the European Commission Staff Working Paper 1139 (2007) indicates, container shipping has been the fastest growing sector of the maritime industry during the last two decades, the number of containers shipped worldwide has nearly doubled in the past six years from 60.5 million twenty-foot equivalent units (TEU) in 2000 to 112 million TEU in 2006. In Europe the largest part of container traffic is concentrated in North Western Europe (the "Hamburg-Le Havre range") whose ports registered 41.7 million TEU in 2005, representing a share of 56% of the total European container traffic. In particular, the three largest European ports - Rotterdam, Hamburg and Antwerp - handled 23.86 million TEU. b) the containership market has maintained an annual growth rate of 10% over the last decade, aiming to reach 10 million TEUs by the year 2008, compared to the records in the previous years: 3,196 TEU in 1996; 5,071 in 2002, and 7,691 in 2005, by the top 100 global operators in terms of container capacity; c) the amounts accumulated in ports have also increased, maintaining a growth rate of 6% over the last decade; d) transfers at ports are on the increase, this means greater imbalances when assessing container transport, their classifications as full/ empty, or analysing import and

export; and e) average ship size has increased, indicating a trend towards naval gigantism, e.g. currently there are ships with 12,000 TEU transport capacity, when fourth generation ships (known as Post Panamax during the 1988-2000 period) transported between 4 and 6,000 TEUs, and the fifth generation ships (known as Post Panama Plus) could hold between 6,000 and 10,000 TEUs. Paixao & Marlow (2003); González-Laxe (2005).

The container transport industry consolidates two aspects: firstly, determining different vehicles related to ship property and rental; secondly, concentration dynamics i.e. increasing traffic density on particular regular lines in order to achieve a more competitive position. The results of such dynamics are evident: a) the leading ten companies provide 60% of the total supply, while ten years ago this figure reached only 43.6%; b) the perspectives for consolidation in the containerization sector are increasing as new construction requirements for vessels are being carried out by the five leading companies and c) this means that a maritime industry oligopoly may be formed, according to Allix (2006).

Such processes feed off each other through partnership agreements; consortiums or alliances in the quest to reduce risk, increase display capacity, and minimize transport costs by widening the range of activity. Similarly, the processes of merging and acquiring businesses presage a new era, both in terms of the composition of economic power and the alignment of strategies employed by regular line operators, Frémont & Soppé (2004), Foued (2007), leading to a high concentration of maritime agents.

Adding to all these points, the firms and all agents involved in maritime transport are looking towards scale economies and we can see a characteristic stage: Regular lines for transportation, regular ports where inward or outward the freight and vessels are increasing more and more. It seems to entail a new structure to afford this new era in maritime transport: bigger and stronger companies, enforced ports structure and services, and a better intermodality system. The panorama seems to appoint to a new stage where concentration will be necessary for competitiveness for all agents (Robinson, 2002)

Shifting the balance between modes involves looking beyond the rightful place of each particular mode and securing intermodality. The biggest missing link is the lack of a close connection between sea, inland waterways and rail. For centuries, sea and river dominated goods transport in Europe. Major towns were built on rivers or on estuaries and the large trade fairs in the Middle Ages were always held at river or sea ports. Nowadays, despite a slight revival, water transport is the poor relation even though it is a mode which is not expensive and does less damage to the environment than road transport -White Book: The European Transport Policy (2001).

**Figure 1: Based on a study by J.E. Pérez Fiaño (2007)**

<i>Key aspects and trends in maritime traffic</i>	
<p style="text-align: center;"><b>ROUTES AND REGIONS</b></p> <ol style="list-style-type: none"> <li>1. Concentration of maritime routes in the great central East-West and North-South areas.</li> <li>2. Concentration of flows on the Long Branch routes.</li> <li>3. High growth rate of traffic with the East.</li> <li>4. Imbalance in flows between regions.</li> </ol>	<p style="text-align: center;"><b>PORTS</b></p> <ol style="list-style-type: none"> <li>1. Development of hub ports at connection points on branch routes and feeder routes.</li> <li>2. Evolution from maritime-land interfaces towards logistical platforms and intermodal nodes.</li> <li>3. Increase in ferry activity.</li> </ol>
<p style="text-align: center;"><b>SHIPOWNERS</b></p> <ol style="list-style-type: none"> <li>1. Process of mergers and acquisitions between global operators.</li> <li>2. Streamlining traffic for economies of scale.</li> <li>3. Using ships with increased capacity.</li> <li>4. Local alliances between large and small ship-owners for feeder routes.</li> <li>5. Vertical alliances with logistical operators</li> </ol>	<p style="text-align: center;"><b>TERMINAL OPERATORS</b></p> <ol style="list-style-type: none"> <li>1. Growth in the participation of global operators.</li> <li>2. Vertical integration of ship-owners, terminal operators and logistical operators.</li> <li>3. Dominant presence of global operators in Asia, Europe and North America.</li> <li>4. Developing markets in Latin America, Oceania and Africa.</li> </ol>

Taking into account the European geography, its history and the globalisation process, the European Union is still dependent on the maritime transport. Nearly 90% of its external trade and more than 40% of its internal trade goes by sea; on the whole, nearly 2 billion tons of freight are loaded and unloaded in EU ports each year; maritime companies belonging to European Union nationals control nearly 40% of the world fleet; the majority of EU trade is carried on vessels controlled by EU firms; and finally the maritime transport sector - also including shipbuilding, ports, fishing and related industries and services - employs around 3 million people in the European Union.

The main objectives of maritime agents showed by the strategies of maritime companies, terminal operators and port authorities are set out in Figure 2 outlining the different objectives, results and impacts. The diversity of concepts and strategies of the agents and institutions is particularly noticeable, from maximising profits and position on the market (formulated by Shipping Companies) to customer loyalty and logistical services to increasing service value (by Terminal Operators) or maximising profits in cargo maintenance (Port Authorities' goals). It is equally important to emphasise different concepts in terms of the variety of instruments used: Shipping Companies tend to prioritize their shares when studying fees and costs; terminal operators are characterised by their attention to prices and use of technology; port authorities put special emphasis on maritime access, followed by territorial regulation and concessions (Kent, 2001; Notteboom & Rodrigue, 2008).

**Figure 2: Own Elaboration**

<b>OBJECTIVES AND INSTRUMENTS OF MARITIME AGENTS</b>			
	<i>Maritime Companies</i>	<i>Terminal Operators</i>	<i>Port Authorities</i>
<b>OBJETIVES</b>	Maximizing profits; improve position on the markets; controlling logistical chains	Maximizing profits; customer loyalty and logistical services; increasing value-added.	Contribution to minimizing costs through logistical chains and maximizing cargo maintenance
<b>INSTRUMENTS</b>	Fees; controlling costs in terms of capacity, cargo volume, time, cooperation, marketing and services.	Prices; maintenance technology for improving quality, speed, safety, information etc.	Maritime access, territorial regulation and concessions; socio-economic negotiation; pricing policies.
<b>IMPACTS</b>	Large ships; streamlining sailing networks; alliances and consortiums; specialized terminals.	Economies of Scale, industrial logistics	Information about maritime access, guarantee of social and economic stability, industrial strategy and concessions policy.

## Part II: Searching for Evidence of Concentration Process in the EU

Since concentration is inherent in the maritime transport sector in regular lines (mergers and acquisitions are usual), and its form, nature and effects have improved modes and the organization of the sector (together with changes of production) Foued, A (2007). In order to analyze concentration levels in maritime traffic in the EU we focus on four key aspects: a) The maritime traffic held in the whole of Europe and its distribution among countries, b) The maritime traffic held for each country contrasted with the traffic in main ports (that is to say, ports with more than 1 million Tm -tones- of freight), c) The movement of cargo in top ports in the EU, in the context of vessel maritime traffic. The measure we are going to use is the usual one in this field: the CR concentration index, that shows the aggregated percentage for the top agents, in this way, the CR4 is reporting information about the accumulated percentage for the 4 top agents; although this index is criticized for omitting the number of agents involved, its intuitive information makes it a very useful tool. The other concentration index used in this paper is the Hirschman-Herfindahl

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

Where

$$p_i^2 = \frac{\text{Handled goods for } i^{\text{th}} \text{ agent}}{\text{Handled goods for all agents}} \quad (2)$$

This index belongs to the Hannah-Kay characterized for taking into account the whole concentration curve, as opposed to the CRi index.

$$HHI_a = \left[ \sum_{i=1}^n p_i^{(1+a)} \right]^{1/a}; \quad a > -1 \quad \text{and} \quad a \neq 0 \quad (3)$$

The parameter in the exponent ( $1+a$ ; in this case is 2) modulates the weight level assigned to the agents with a major market quota. In this case when the market is

distributed between big and small agents, the concentration measure of Hannah-Kay indices are usually as big as big the parameter. HHI is a particular case in this group.

The objective in point a) is to see if some concentration of maritime traffic is taking place in some countries or in some special geographical areas, in point b) we try to detect movements of loaded or unloaded freight from smaller ports to bigger ones in the same country. The possible movements of containerizing freight from one top port to another are analyzed in c).

### **a) Maritime Traffic in UE Countries**

The level of cargo handled in the EU-27 ports during 2006 was 3.834 million tonnes (See Table 1). We have analyzed the level of this traffic in each country in order to detect possible changes among ports; in other words, we tried to find out if there is some concentration of traffic of goods in any port caused by the diminishing of traffic in another port. First we have analyzed the total figures (inwards plus outwards), but we want to underline that it is correct to say that this is the movement of cargo of goods handled, but we must be careful with the meaning of “global transport of goods”: It is obvious that these totals may include a “double counting” (it is possible that goods loaded in one port would be then unloaded in another port. If both are reported data to Eurostat, the movement of cargo is being double-counted). To avoid possible confusion with double-counting we also analyze cargo going outwards and cargo coming inwards.

The weight of goods handled has increased by 3.2% since 2005 (in 2005 it was 3,717 million tonnes). It grew in all Member States except Latvia (- 5%), Poland (-3%), Romania (-2%) and the United Kingdom (-0.2%), but the most relevant rise has been seen in Slovenia (23%). This has to do with the dry bulk goods handled in the port of Koper; Finland (11%) and Bulgaria (11%). have also increased the handled good level. The United Kingdom is still the leading EU-27, despite the slight decrease mentioned above, representing more than 15% of the EU-27 total. Italy is the second one, with a share of 14%, followed by the Netherlands (12%) and Spain (11%). Greece and Spain show the highest increase in the same period. However, in these cases the increases are mostly due to the improvement of the statistical coverage<sup>3</sup>. Since 1997 goods handled in EU-15 ports have increased in 463.568 million tonnes (24.7%). A similar trend is seen for EU-12. The progressive growth is not the same for all countries. By analyzing global trends for the top countries we find that the United Kingdom has grown far below the other top countries. Italy, the Netherlands, Spain, and Greece have

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<sup>3</sup> Greece: The statistical coverage of data has considerably improved between 2001 and 2002, being these reference years. In particular, collection of data on ferry boats started from the last quarter of 2001. From 1997 to 2003, in the tables from the “Passengers” collection the number of passengers corresponds only to the number of non-cruise passengers (“ferry passengers”). Spain: Data include Ceuta and Melilla. The statistical coverage has significantly improved in 2001 (inclusion of new ports). Data only cover “main ports”. Data for the period 2003-2005 are provisional and likely to be revised. (Eurostat Methodological notes, statistics in focus 62/2008)

grown at a rate of 18.6%, 17.6%, 50.9% and 49.3%, respectively. EU-15 increased its handled goods in 20.9%, and the Euro Area (12) went up to 26.8%.

Analysing loaded and unloaded cargo, we can appreciate increasing values for United Kingdom 21.8% Italy 19.0%, the Netherlands 14.1%, Spain 56.1% and Greece 49.9% inwards and -18.2%, 18.4%, 30.3%, 39.8% and 49.0% outwards, respectively. The leader shows a less balanced growth, we also found that the low growth that has taken place in the last years is due to the loaded goods, because the unloaded ones support acceptable growth levels. Other top countries grow in an unequal way, as loaded or unloaded goods are considered. The most balanced growth is shown by Italy and Greece. For Italy and Spain inwards flows rise over outwards flows, contrary to this, in the Netherlands the level of inwards good is quite small. The quantity of outwards goods is relatively low in comparison with the inwards ones; this fact might explain these growth taxes. In addition, while the inwards goods are growing every year, the outwards range shows positive and negative growths along the period of study.

The CRi, it's to say, the accumulated percentage of freight for main countries is shown in table 2. The results indicate that only five countries achieved more than 60% of freight, not only for total freight, but also for inwards and outwards

The evolution of cargo handled in all European countries is quite similar, in the sense that it doesn't show significant differences among countries. There are no signs of changes in cargo from one country to another. The observation of inwards and outwards cargo movements shows approximately the same results. The Hirschman-Herfindahl concentration index -see table 3- indicates low levels of concentration in all cases (inwards, outwards and total goods handled). A slightly decreasing trend is shown for freight outwards and it remains in the same levels for total goods handled due to levels of traffic inwards (bigger than outwards), that remain in the same concentration level along the period of study. According to what we stated above, we can't conclude that some concentration process was taking place in any country of the EU-15 from 1997 to 2006. By analyzing the HHI for EU-27 from 2003 to 2006, it is possible to appreciate the same tendency, as shown in table 4. Concentration values are low, particularly for outwards freight. Nevertheless, the main movements of freight are inwards flows, and the value of HH concentration index in this case is also low, but bigger than the outwards. The decrease in HHI values when analyzed within EU-27, as opposed to EU-15 is due to the bigger number of countries taken into account.

## **b) The Whole Maritime Traffic and Main Ports**

In point a) we have proved that maritime traffic is increasing in the European Union, and we have also elaborated CRi and HHI concentration indexes to evaluate the concentration level by countries. Next, we analyze the performance of each country. In order to do that, we must analyze possible interchanges of cargo among ports that belong to the same country. We have made a distinction between the main ports in the country (with handled goods over 1 million tonnes) and the other ports. Eurostat provides quarterly statistics

for main ports, as well as annual statistics for all goods handled in each country (in other words, for all the ports in each member state). We have homogenized both series and put the information together to elaborate an index: handled goods of main ports/total handled goods in all ports, in percentage terms. This indicator (shown in Table 5) shows relatively homogeneous results for all countries in the European Union<sup>4</sup>.

Data only show a complete series for ten countries available in the EU: Belgium, Denmark, Germany, Ireland, Greece, Italy, the Netherlands, Portugal, Finland and Sweden. By analysing countries with a complete series, we can appreciate that most maritime traffic is supported by the main ports, almost in all cases it is over 70%. Focusing on the evolution, the dominating feature is the stability, except for Greece and Ireland. Greece has begun to reduce its maritime traffic in main ports since 2000 showing the lowest level in 2002, while in 2004 the main ports reached a level under 70%. This shows less concentration in maritime traffic than at the beginning of the serial. Ireland presents a decrease at the beginning of the period but since 2001 it remains steady. Finland goes down in 2001. Other countries show the same path, with levels of concentration between the 72% of Denmark and the 99.4% of the Netherlands all through the period. The average values stay around 88%, decreasing slightly at the end of the period.

The highest concentration levels are in the Netherlands (99.4% in 1997 and 99.8% in 2006), Greece (99.4% in 1997 and 67.7% in 2006), Finland (93.3% in 1997 and 88.5% in 2006), Belgium (98.1% in 1997 and 98.7% in 2006) and Germany (96,6% in 1997 and 97,3% en 2006), although there are some differences regarding the cases, in particular because while the Netherlands, Germany and Belgium show an increase in the concentration of handled goods in their main ports, Greece and Finland show exactly the opposite trend.

For 2005 and 2006 we can analyze complete series for the 20 countries, the 15 European Union, the 13 Euro area and the 12 Euro area. Data for all European countries in 2005 and 2006 show stability in percentage of maritime traffic held by the main ports of all countries.

Summarizing, there is an important concentration of freight in main ports, as it was expected. Nevertheless, if we were searching for an increasing or decreasing tendency in concentration levels, we could not find any radical change. As data show, the same percentage of freight supported by main ports applies to EU-25, EU-15, EU-13 and EU-12, even with diminishing on one point. The countries that have increased concentration of maritime traffic in main ports are Ireland, France, Italy, Portugal and United Kingdom while Estonia, Greece and Cyprus have that concentration diminished.

Based on the appreciations shown above, we can not come to the conclusion that there is an increasing concentration. As stated above, no obvious conclusion can be reached. It is possible to believe that some increasing concentration is

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<sup>4</sup> We need to underline the exceptional data of year 2001 for Belgium and France. This difference may be originated in different database sourcing (although both come from Eurostat) or in data reported from countries to Eurostat. In any case it is not a very significant divergence with our analysis.

beginning to appear in some countries, but more empirical evidence is needed to sustain a solid estimation.

### **c) The Movement of Cargo in the Top 20 Container Ports in the EU**

To afford the high level of competition, firms are thinking about saving costs through scale economies. This helps shipping lines to invest in containerships with more capacity. The increase of vessels size concentrated the main growth in vessels between 5000 and 7500 TEU and in excess of 7500 TEU (the larger size range). The capacity has increased twelve-fold in the last ten years, with an annual growth of about 30% and a trend towards big size vessels<sup>5</sup>. The presence of scale economies is linked to this process Cullinane K.P.B., Khanna M. (1999) and it may involve a change in market structure and even in maritime traffic flows direction.

In our research about changes in maritime freight volume searching for a concentration levels evolution, now we focus on the analysis in vessel traffic in the European Union. To avoid double-counting problems we only take into account inwards vessel traffic. First of all, we focus on levels of vessel traffic in EU countries in terms of the total number of vessels and the number of container ships. Secondly, we analyze data for both regarding gross registered tonnage (GRT). Finally, we elaborate some comparative indexes to determine the relation GTR/N° in order to achieve some results about vessels size evolution.

The number of vessels handled in EU 15 in the period 2000-2007 is characterized by a progressive growth (1.763.454 vessels in 2000 to 1.88.257 in 2007), showing the highest level in 2004 (2.062.587 and in 2006 with 2.0208.907). In reference to the kind of vessels, most are non-specialised general cargo carriers, liquid bulk ships (tankers) (showing a slightly decreasing tendency), container ships ((in progressive growth), dry bulk carriers (decreasing slightly), miscellaneous vessels (dredgers, research vessels, others), specialized carriers, vessels for offshore activities, fishing vessels, dry cargo barges, tugs and others.

When talking about evolution among countries, the most important increase in number of vessels is recorded in Spain 314% between 2000 and 2007, and Portugal 121%. Most countries show a rising tendency, except France (-30%), Greece (-32%), Italy (-26%) and Denmark (-2%). In terms of cargo, a progressive growth is shown for EU-15 and most European countries. In countries with a decreasing tendency in number of vessels, only France and Italy show the same decreasing tendency for gross registered tonnage. Italy shows a big fall in the last year (2007), but FROM 2000 to 2006 it has been progressively rising. France shows the opposite tendency: it had been slowly decreasing in the period 2000-

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<sup>5</sup> In 2000 10% of the total fleet was represented by vessels with a capacity in excess of 5000 TEU, by 2010 the share of this vessel size is expected to represent 40% of the total fleet. On the Far East – Europe route the average vessel size in 2000 was 4500 – 5500 TEU; in 2010 it is expected to be 8000 – 9000 TEU, with a further increase by 70% by 2015. The largest operational container vessels have a capacity in excess of 12000 TEU. A similar trend is visible in the Ro- Ro sub-markets of car carrying, ferry market and unaccompanied freight.

2006, but in 2077 it began to grow. The most important growth is shown by Portugal and Spain (39% and 33%, respectively).

To have an overall view of the evolution of vessel traffic, we have analyzed some indexes showing the evolution for tones/number of vessels. In both cases (total vessels and containers), we can appreciate –see table 6- an increasing tendency within the European Union. Once having analyzed the previous data, we have clearly seen the increase in vessel size and in cargo circulation. However the same concentration level remains steady.

To complete this analysis, we have studied the level and evolution of container traffic in the top 20 ports of EU. We have noticed an increasing traffic of containers, but it's not linked to changes in concentration levels in the 20 top ports; that is to say, the distribution of freights among ports remains the same. In fact, we realized that the percentage of participation in the whole traffic is almost constant in all ports. There are two important characteristics. The first one is a possible slight signal of concentration for the three top container ports: Rotterdam (NL), Hamburg (DE) and Antwerp (BE); and the second one is the special behaviour of Algeciras (ES), because it does not show a clear tendency. These oscillations in level of cargo are not explained by any other Spanish port in the Top-20 schedule, because neither Barcelona, nor Bilbao, nor Valencia, nor Las Palmas have special oscillations. What is happening here is exactly quite the opposite.

Through the observation of data for Spanish ports, it is possible to prove exactly what we are stating: Barcelona, Bilbao, Las Palmas and Valencia, portray a steady maritime traffic with a slight increasing tendency towards the end of the period of study. None of them seems to absorb the Algeciras variations, as these oscillations are explained for the Eurostat methodological notes, where it is reported that data for Algeciras are underestimated in 2004. If we accept this explanation, then Algeciras behaviour is the same as for the other ports.

To further explain, we have studied the concentration index for top-20 ports, which are shown in tables 7 and 8 in the attachment. We have used the CR index and Herfindahl-Hirschman index. Both of indexes got similar results: There is a relatively high level of concentration in 3 or 4 top ports, but it seems to stay in the same values along the estimated period. Regarding the concentration index, a steady level of concentration is shown; it even seems more like a decreasing trend than an increasing one. The evolution of each port separately is observed in the next table using the CR<sub>i</sub> concentration index.

Combining the information offered by both indexes in the most favourable case for defenders of increasing concentration it would be possible to conclude that there may be some concentration levels concerning CR<sub>4</sub> or other values of CR index. Port markets have been traditionally perceived as oligopolistic markets (especially due to their own geographical situation). It is significant to highlight that for all those years, the top 4 ports are the same: Rotterdam (NL), Hamburg (DE), Antwerp (BE), Bremen & Bremerhaven (DE), except in 2000 when the top 4 were formed by Rotterdam (NL), Hamburg (DE), Felixstowe (UK), Bremen & Bremerhaven (DE). Nevertheless, the levels of cargo volume are really similar.

Concentration levels in the 20 top ports in the EU, together with the large expansion in handled freight, are probably creating congestion problems for these ports, and may be an important reason for not increasing maritime traffic. If our guess turns true, then the next ports on the top list (for example ports between 20 and 40 positions) would be in a situation of absorbing maritime traffics from the smaller ports, because their size could be more adequate to afford the raising goods handled.

What has changed is the congestion level. Congestion has had a huge impact on the whole supply chain. Still, we must not dismiss the idea of concentration. This may happen to appear in ports which have not been considered as top ports. The rising concentrate activity may be in full bloom in less important ports and this way proves that this concentration process is alive and really working.

### **Conclusions**

Despite maritime traffic in Europe being quite concentrated in some countries, showing the existence of concentration in the maritime transport sector, the levels of concentration do not point out changing signs. The Hirschman-Herfindahl concentration index is decreasing from 1997 to 2006). Hence, there are no solid reasons to suspect about increasing concentration.

Even though there is an important concentration of freight in main ports for most member states of the European Union, concentration levels show a very slight rise, and the increasing concentration ratio involves most countries in the European Union. Nevertheless, we can not conclude that there is a growing concentration, contrary to our expectations. Therefore, maybe some increasing concentration is beginning to appear, but more empirical evidence is required to sustain a firm presumption.

Focusing on the top 20 ports in the European Union, there is a relatively high level of concentration in 3 or 4 top ports, but it seems to stay in the same values along the period of study. The number of ports equivalent (using HHI concentration index) is around 11 (the total number of ports analyzed are 20). The congestion problems probably affecting the top 20 European ports could translate the research field to the next 20 or 30 top ports, because it's likely to find some increasing concentration level in these big ports, not included in the top 20 lists.

The increasing containerization processes appear in the European Union, not only in terms of number of container ships (and also other traffics), but also in terms of volume or transported freight. At the same time there is an increase in vessels size, as ratios  $GRT/N^{\circ}$  vessels and  $GRT/N^{\circ}$  of containers are increasing.

### **References**

- 1) Allix, Y. (2006), "De l'atomisation à l'oligopolisation: stratégies de concentration dans les industries maritimes et portuaires conteneurisées, Ecole de Management de Normandie", Working Paper 43/2006.

- 2) Cullinane K.P.B., Khanna, M., (1999), "Economies of Scale in Large Containerships", *Journal of Transport Economics and Policy*, Vol. 33, N° 2, pp. 185-208.
- 3) European Commission, (2007), *Staff Working Paper* 1139.
- 4) European Commission, (2007), *Staff Working Document*, accompanying document to Communication on a European Ports Policy. Full Impact Assessment COM 616 final, SEC 1340.
- 5) European Commission, (2001), *The White Paper: European transport policy for 2010: Time to decide*. Italy.
- 6) Foued, Aloulou, (2007), "La concentration dans le transport maritime des lignes regulieres", *Economie Appliquee*, December v. 60, iss. 4, pp. 163-96.
- 7) Fremont, A., Soppe, M., (2004), Les stratégies des armateurs de lignes régulières le desserte maritime et la domination asiatique et le renouveau européen, Seminaire INRETS, Paris.
- 8) González-Laxe, F., (2005), "Puertos y transportes marítimos: ejes de una nueva articulación global", *Revista de Economía Mundial*, 12, 123-148.
- 9) Henderson, J, P. Dicken, M. Hess, N. Coe, H. Yeung, (2002), "Global production networks and the analysis of economic development", *Review of International Political Economy*, Vol. 9, pp. 436-464.
- 10) Kent, P. E., A. Ashar, (2001), "Port Competition Regulation. A Tool for Monitoring for Anticompetitive Behavior", *International Journal of Maritime Economics*, Vol 3, N° 1, pp. 27-51.
- 11) Kuby, M., N. Reid, (1992), "Technological change and the Concentration of the U.S. General Cargo Port System: 1970-88", *Economic Geography*, Vol. 68. N° 3, pp. 272-289.
- 12) Notteboom, T., J.P. Rodrigue, (2008), "Containerisation, Box Logistics and Global Supply Chains: The integration of Ports and Liner Shipping Networks", *Maritime Economic and Logistics*, Vol 10. pp. 152-174.
- 13) Paixao, A. C., Marlow, P.B., (2003), "Fourth Generation Ports. A question of agility", *International Journal of Physical Distribution and Logistics Management*, 33(4), 355-376.
- 14) Pérez Fiaño, J.E., (2007), *Infraestructura portuaria y logística del transporte interoceánico regional*. Conf. Foro Iniciativa Cuenca del Pacífico. Cali, 29/I/2007.
- 15) Robinson, R., (2002), "Ports as elements in value-driven chain systems: the new paradigm", *Maritime Policy and Management*, 29(3), 241-255.
- 16) Thalassinos, E., Michalopoulos, V., (2005), "A Time Series Model for the Long - Term Forecast of Ports' Container Handling: The Case of Port of Piraeus", *European Research Studies Journal*, Vol. VIII, Issue 3-4.
- 17) Thalassinos, E., Schinas, O., (2003), "Adjusting Basic Maritime Training in an E-Learning Environment", *European Research Studies Journal*, Vol. VI, Issue 3-4.
- 18) Talley, W.K., (2000). "Ocean Container Shipping: Impacts of a Technological Improvement", *Journal of Economic Issues*, Vol. 34. N° 4, pp. 33-48.

## Appendix

**Table 1: Goods Handled in European Union ports (Million Tonnes), Inwards and Outwards Own elaboration based on Eurostat Data.**

MARITIME TRAFFIC IN EUROPEAN UNION: Goods Handled in European Ports (Million Tonnes)												
	Goods Handled in European Ports				Inwards				Outwards			
	2003	2004	2005	2006	2003	2004	2005	2006	2003	2004	2005	2006
<b>27 European Union</b>	3.450.537	3.568.410	3.717.066	3.834.334	2.175.776	2.264.213	2.342.284	2.436.486	1.274.761	1.304.196	1.374.783	1.397.848
<b>25 European Union</b>	3.393.255	3.504.690	3.644.361	3.760.121	2.144.422	2.228.228	2.302.823	2.395.680	1.248.833	1.276.462	1.341.538	1.364.441
<b>15 European Union</b>	3.188.830	3.304.564	3.433.783	3.545.911	2.100.345	2.182.351	2.254.074	2.333.307	1.088.485	1.122.212	1.179.710	1.212.604
<b>13 Euro area</b>	2.378.549	2.475.833	2.583.680	2.689.494	1.638.796	1.703.599	1.759.401	1.824.537	739.753	772.234	824.278	864.957
<b>12 Euro area</b>	2.367.760	2.463.770	2.571.054	2.674.011	1.631.088	1.694.807	1.750.359	1.813.944	736.673	768.963	820.696	860.067
<b>Belgium</b>	181.110	187.889	206.539	218.941	103.940	108.946	116.603	125.486	77.170	78.943	89.936	93.455
<b>Bulgaria</b>	21.358	23.125	24.841	27.513	12.696	13.614	14.293	16.250	8.661	9.511	10.548	11.263
<b>Denmark</b>	103.954	100.373	99.688	107.674	56.908	54.568	53.545	59.682	47.046	45.806	46.143	47.991
<b>Germany</b>	254.834	271.869	284.865	302.789	159.202	168.490	172.257	182.246	95.632	103.379	112.608	120.543
<b>Estonia</b>	47.048	44.808	46.546	49.998	4.664	4.042	4.557	6.765	42.383	40.767	41.988	43.234
<b>Ireland</b>	46.165	47.720	52.146	53.326	33.234	34.703	37.654	38.563	12.931	13.017	14.492	14.763
<b>Greece</b>	162.534	157.892	151.250	159.425	94.343	92.740	88.173	94.323	68.191	65.152	63.078	65.102
<b>Spain</b>	343.716	373.065	400.019	414.378	249.633	269.906	290.528	298.636	94.083	103.159	109.492	115.742
<b>France</b>	330.135	334.035	341.470	350.334	237.278	240.524	243.747	250.550	92.858	93.511	97.723	99.784
<b>Italy</b>	477.028	484.984	508.946	520.183	334.819	338.374	348.235	358.108	142.209	146.610	160.711	162.076
<b>Cyprus</b>	7.258	6.837	7.290	7.924	5.665	5.573	6.019	6.508	1.593	1.264	1.271	1.416
<b>Latvia</b>	54.652	54.829	59.698	56.861	3.794	3.549	4.679	6.787	50.858	51.281	55.019	50.074
<b>Lithuania</b>	30.242	25.842	26.146	27.235	4.097	4.372	4.710	8.466	26.146	21.470	21.435	18.769
<b>Malta</b>	3.417	3.474	3.503	3.578	2.976	3.027	3.321	3.347	441	447	182	230
<b>Netherlands</b>	410.330	440.722	460.940	477.238	318.489	339.510	350.952	358.912	91.841	101.212	109.988	118.326
<b>Poland</b>	51.020	52.272	54.769	53.131	15.171	16.522	16.420	19.906	35.848	35.751	38.350	33.225
<b>Portugal</b>	57.470	59.071	65.301	66.861	42.794	43.135	47.473	46.886	14.676	15.936	17.828	19.975
<b>Romania</b>	35.925	40.594	47.864	46.700	18.658	22.371	25.168	24.556	17.267	18.223	22.696	22.144
<b>Slovenia</b>	10.788	12.063	12.625	15.483	7.709	8.792	9.043	10.594	3.080	3.271	3.583	4.889
<b>Finland</b>	104.439	106.524	99.577	110.536	57.356	58.479	54.737	60.235	47.083	48.045	44.840	50.301
<b>Sweden</b>	161.454	167.350	178.122	180.487	88.583	90.552	95.780	94.569	72.870	76.798	82.342	85.918
<b>United Kingdom</b>	555.662	573.070	584.919	583.739	323.766	342.425	354.391	365.112	231.896	230.645	230.529	218.627

**Table 2: CR Concentration Index EU-27 2006.**

Year 2006	Goods handled		Year 2006	Inwards		Year 2006	Outwards		CRI			
United Kingdom	583.739	15,22%	15,22%	United Kingdom	125.486	5,15%	5,15%	United Kingdom	93.455	6,69%	6,69%	CR1
Italy	520.183	13,57%	28,79%	Malta	365.112	14,99%	20,14%	Malta	218.627	15,64%	22,33%	CR2
Netherlands	477.238	12,45%	41,24%	Poland	358.912	14,73%	34,87%	Finland	162.076	11,59%	33,92%	CR3
Spain	414.378	10,81%	52,04%	Finland	358.108	14,70%	49,56%	Spain	120.543	8,62%	42,54%	CR4
France	350.334	9,14%	61,18%	Sweden	298.636	12,26%	61,82%	Poland	118.326	8,46%	51,01%	CR5
Germany	302.789	7,90%	69,08%	Greece	250.550	10,28%	72,10%	Sweden	115.742	8,28%	59,29%	CR6
Belgium	218.941	5,71%	74,79%	Spain	182.246	7,48%	79,58%	Greece	99.784	7,14%	66,43%	CR7
Sweden	180.487	4,71%	79,49%	Cyprus	94.569	3,88%	83,47%	Cyprus	85.918	6,15%	72,57%	CR8
Greece	159.425	4,16%	83,65%	Belgium	94.323	3,87%	87,34%	Belgium	65.102	4,66%	77,23%	CR9
Finland	110.536	2,88%	86,54%	Slovenia	60.235	2,47%	89,81%	Slovenia	50.301	3,60%	80,83%	CR10
Denmark	107.674	2,81%	89,34%	Netherlands	59.682	2,45%	92,26%	Portugal	50.074	3,58%	84,41%	CR11
Portugal	66.861	1,74%	91,09%	Romania	46.886	1,92%	94,18%	Netherlands	47.991	3,43%	87,85%	CR12
Latvia	56.861	1,48%	92,57%	Germany	38.563	1,58%	95,77%	France	43.234	3,09%	90,94%	CR13
Ireland	53.326	1,39%	93,96%	Bulgaria	24.556	1,01%	96,77%	Estonia	33.225	2,38%	93,31%	CR14
Poland	53.131	1,39%	95,35%	Estonia	19.906	0,82%	97,59%	Bulgaria	22.144	1,58%	94,90%	CR15
Estonia	49.998	1,30%	96,65%	Italy	16.250	0,67%	98,26%	Romania	19.975	1,43%	96,33%	CR16
Romania	46.700	1,22%	97,87%	Lithuania	10.594	0,43%	98,69%	Latvia	18.769	1,34%	97,67%	CR17
Bulgaria	27.513	0,72%	98,59%	Latvia	8.466	0,35%	99,04%	Germany	14.763	1,06%	98,73%	CR18
Lithuania	27.235	0,71%	99,30%	Portugal	6.787	0,28%	99,32%	Italy	11.263	0,81%	99,53%	CR19
Slovenia	15.483	0,40%	99,70%	France	6.765	0,28%	99,60%	Lithuania	4.889	0,35%	99,88%	CR20
Cyprus	7.924	0,21%	99,91%	Denmark	6.508	0,27%	99,86%	Denmark	1.416	0,10%	99,98%	CR21
Malta	3.578	0,09%	100,00%	Ireland	3.347	0,14%	100,00%	Ireland	230	0,02%	100,00%	CR22

Own elaboration based on Eurostat data.

**Table 3: Hirschman-Herfindahl Index for EU-15.**

HHI - EU 15			
	Goods Handled	Inwards	Outwards
1997	0,11496	0,11619	0,12585
1998	0,11484	0,11574	0,12656
1999	0,11400	0,11500	0,12349
2000	0,11392	0,11587	0,12218
2001	0,11232	0,11546	0,11586
2002	0,11103	0,11451	0,11368
2003	0,10908	0,11319	0,10954
2004	0,10970	0,11427	0,10816
2005	0,10987	0,11486	0,10692
2006	0,10835	0,11388	0,10321

Own elaboration based on Eurostat data.

**Table 4: Hirschman-Herfindahl Index for EU-27.**

HHI - EU 27			
	Goods Handled	Inwards	Outwards
2003	0,0941	0,1057	0,0840
2004	0,0949	0,1064	0,0839
2005	0,0947	0,1066	0,0826
2006	0,0935	0,1047	0,0810

Own elaboration based on Eurostat data.

**Table 5: Ratio: Handled goods in main ports/ handled goods in all ports (%).**

	199	199	1999	200	2001	2002	2003	2004	2005	2006	2007
25 European	NA	NA	NA	NA	NA	NA	NA	NA	81%	81%	NA
15 European	NA	NA	NA	82%	80%	82%	81%	82%	82%	82%	NA
13 Euro area	NA	NA	NA	NA	NA	88%	88%	88%	88%	87%	NA
12 Euro area	NA	NA	NA	89%	86%	88%	88%	88%	88%	87%	NA
Belgium	98%	98%	98%	98%	101	98%	99%	99%	99%	99%	NA
Bulgaria	NA	NA	NA	NA	0%	100	100	100	100	100	NA
Denmark	72%	74%	74%	77%	79%	78%	77%	80%	82%	82%	NA
Germany	97%	97%	97%	96%	95%	96%	97%	97%	97%	97%	97%
Estonia	NA	NA	NA	NA	NA	100	96%	100	97%	95%	NA
Ireland	78%	77%	75%	76%	75%	90%	89%	89%	88%	89%	NA
Greece	99%	99%	99%	75%	79%	66%	68%	68%	69%	68%	NA
Spain	NA	NA	NA	94%	70%	94%	93%	93%	93%	93%	NA
France	NA	96%	95%	99%	101	95%	96%	95%	95%	96%	NA
Italy	81%	83%	83%	84%	85%	85%	85%	86%	83%	84%	NA
Cyprus	NA	NA	NA	NA	NA	NA	NA	NA	101	98%	NA
Latvia	NA	NA	NA	NA	NA	98%	98%	98%	98%	98%	97%
Lithuania	NA	NA	NA	NA	NA	100	NA	100	100	100	100

<b>Malta</b>	NA	NA	NA	NA	NA	NA	100	100	100	100	100
<b>Netherlands</b>	99%	99%	100	99%	99%	100	100	100	100	100	NA
<b>Poland</b>	NA	99%	99%	99%	NA						
<b>Portugal</b>	87%	86%	87%	90%	90%	91%	89%	90%	87%	89%	89%
<b>Romania</b>	NA	NA	NA	NA	NA	92%	94%	100	100	99%	NA
<b>Slovenia</b>	NA	NA	NA	NA	NA	99%	99%	99%	99%	99%	NA
<b>Finland</b>	93%	94%	92%	93%	78%	88%	88%	89%	89%	89%	NA
<b>Sweden</b>	81%	81%	83%	83%	86%	82%	83%	83%	85%	85%	85%
<b>United Kingdom</b>	NA	NA	NA	88%	89%	88%	88%	89%	88%	89%	NA

Own elaboration based on Eurostat data (NA- Not available).

**Table 6: Vessel Traffic in European Union.**

VESSEL TRAFICC - SOME INDEX	2.000	2.001	2.002	2.003	2.004	2.005	2.006	2.007
<b>NUMBER OF VESSELS</b>								
<b>European Union (15 countries)</b>	1.763.454	1.776.354	1.907.889	1.993.960	2.062.587	1.981.640	2.028.907	1.884.257
<b>Euro area (BE, DE, IE, GR, ES, FR, IT, LU, NL, AT, PT, FI)</b>	1.121.141	1.164.189	1.292.909	1.386.925	1.456.345	1.382.437	1.438.297	1.278.926
<b>NUMBER OF CONTAINERS</b>								
<b>European Union (15 countries)</b>	57.688	68.440	74.353	79.093	84.037	83.248	87.226	88.738
<b>Euro area (BE, DE, IE, GR, ES, FR, IT, LU, NL, AT, PT, FI)</b>	48.918	59.455	64.977	69.787	74.312	73.224	76.630	77.140
<b>GROSS REGISTERED TONNAGE (GRT) TOTAL VESSELS</b>								
<b>European Union (15 countries)</b>	10.411.675	10.942.330	11.946.228	12.314.558	12.656.071	12.731.882	13.100.681	13.130.157
<b>Euro area (BE, DE, IE, GR, ES, FR, IT, LU, NL, AT, PT, FI)</b>	6.351.775	6.887.394	7.830.702	8.133.310	8.377.461	8.501.784	8.887.797	8.707.924
<b>GROSS REGISTERED TONNAGE (GRT) CONTAINERS</b>								
<b>European Union (15 countries)</b>	942.720	1.152.647	1.309.390	1.324.018	1.486.700	1.488.305	1.653.561	1.658.302
<b>Euro area (BE, DE, IE, GR, ES, FR, IT, LU, NL, AT, PT, FI)</b>	771.071	966.453	1.109.317	1.118.283	1.261.171	1.270.380	1.414.834	1.408.096
<b>GRT/N° VESSELS</b>								
<b>European Union (15 countries)</b>	5,90	6,16	6,26	6,18	6,14	6,42	6,46	6,97
<b>Euro area (BE, DE, IE, GR, ES, FR, IT, LU, NL, AT, PT, FI)</b>	5,67	5,92	6,06	5,86	5,75	6,15	6,18	6,81
<b>GRT/N° CONTAINERS</b>								
<b>European Union (15 countries)</b>	16,34	16,84	17,61	16,74	17,69	17,88	18,96	18,69
<b>Euro area (BE, DE, IE, GR, ES, FR, IT, LU, NL, AT, PT, FI)</b>	15,76	16,26	17,07	16,02	16,97	17,35	18,46	18,25

Own elaboration based on Eurostat data.

**Table 7: CRi Concentration Index for Top-20 Ports in the EU (Ranking 2006).**

	2000	2001	2002	2003	2004	2005	2006
1	19,4%	17,0%	17,1%	16,8%	17,7%	17,4%	16,8%
2	32,7%	30,2%	31,2%	31,2%	32,8%	32,6%	32,4%
3	41,5%	38,6%	39,5%	40,6%	43,7%	44,3%	44,1%
4	49,7%	47,0%	47,5%	48,1%	51,3%	51,4%	52,0%
5	57,9%	54,9%	55,0%	52,9%	58,1%	57,4%	57,8%
6	65,8%	61,7%	62,1%	58,7%	63,9%	63,3%	63,1%
7	70,2%	66,6%	66,9%	66,0%	68,6%	68,5%	68,0%
8	74,3%	70,9%	71,5%	70,8%	73,2%	73,1%	72,6%
9	78,4%	75,2%	76,0%	74,9%	77,7%	77,1%	76,7%
10	82,0%	79,5%	80,0%	79,7%	81,0%	81,0%	80,4%
11	85,4%	83,4%	83,7%	82,9%	84,1%	83,7%	83,0%
12	88,8%	86,8%	87,0%	86,7%	87,2%	86,3%	85,5%
13	91,1%	90,1%	89,9%	89,0%	89,6%	88,6%	87,8%
14	93,1%	92,2%	92,1%	89,0%	91,7%	90,5%	89,9%
15	95,2%	94,3%	94,1%	92,7%	93,7%	92,3%	91,9%
16	97,2%	96,2%	96,0%	94,7%	95,5%	94,0%	93,8%
17	98,7%	98,0%	97,9%	96,6%	97,1%	95,6%	95,4%
18	100,0%	99,2%	99,1%	97,7%	98,2%	97,3%	97,0%
19	100,0%	100,0%	100,0%	98,5%	99,2%	98,7%	98,6%
20	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%

Own elaboration based on Eurostat data.

**Table 8: Herfindahl - Hirschmann Concentration Index for Top-20 Ports in the EU (Ranking 2006).**

Year	Herfindahl-Hirschmann Index	Number of equivalent ports
2000	0,09	10,66
2001	0,08	11,80
2002	0,09	11,59
2003	0,09	11,60
2004	0,09	10,94
2005	0,09	10,99
2006	0,09	11,08

Own elaboration based on Eurostat data.