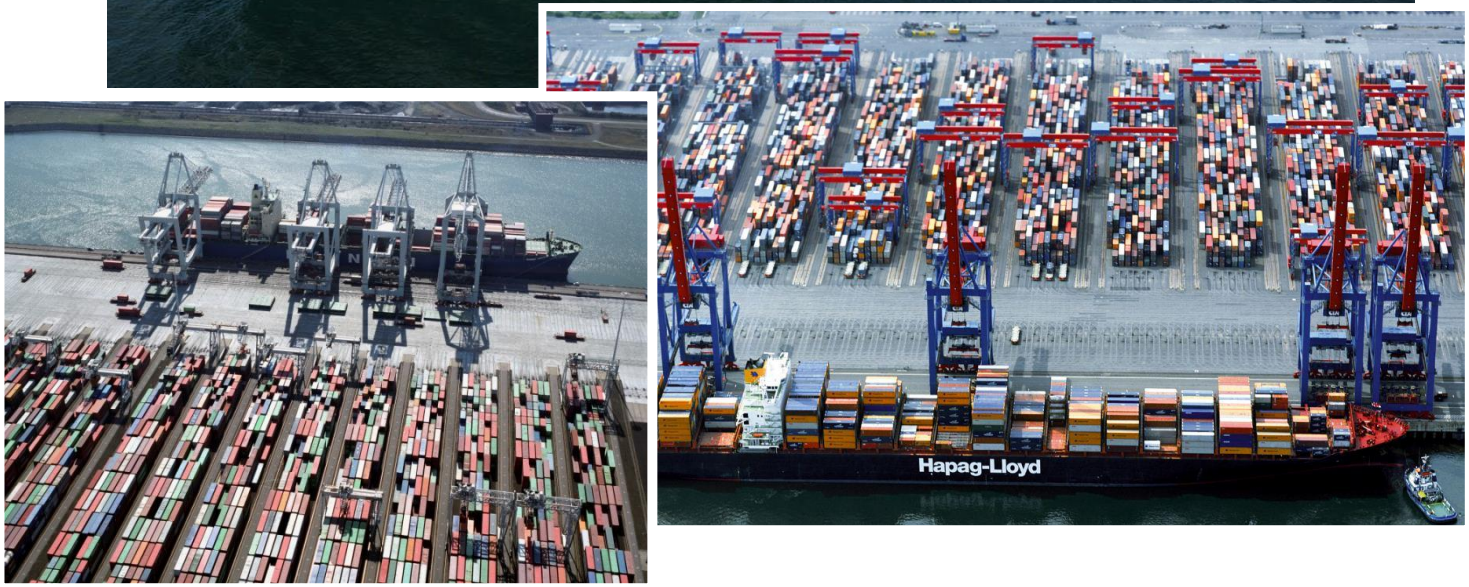
ERASMUS UNIVERSITEIT ROTTERDAM
ERASMUS SCHOOL OF ECONOMICS

Is market concentration in the terminal operating and liner shipping industry threatening the market position of the HLH range port authorities?

Analyzing market concentration within the Hamburg - Le Havre Range



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PREFACE

This Master's Thesis report is the final part of the Urban Port and Transport Economics master at the Erasmus School of Economics of the Erasmus University in Rotterdam. The thesis examines the market concentration at the terminal operating industry and the liner shipping industry and whether or not the market concentration negatively influences the market position of the Hamburg Le Havre range port authorities.

The finalization of this Master's thesis has been a longer than anticipated process and therefore I would like to thank my girlfriend, brother and parents for their patience, strength and useful advice on my thesis. Furthermore I would like to thank my supervisor Michiel Nijdam for his suggestions, guidance and constructive criticism during my research.

Hellevoetsluis, May 2013,

Mark van der Waal

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1. Introduction

In the few decades that the container has been utilized within maritime transport, this universal transport box has put a distinctive mark on the shipping industry. In the past three decades the container industry grew an average of 9.2 percent per year. Other industries such as liquids and dry bulk grew much slower with an average of 1.8 and 3.1 percent per year. The strong growth of containerized transport had a large impact on global trade, on the maritime shipping sector and on the seaports. This Master's thesis will focus on the ports that are located within the Hamburg Le Havre (HLH) range. The container throughput of the HLH range increased almost nine fold from 4.8 million Twenty foot Equivalent Unit (TEU) in 1980 to 40 million TEUs in 2008. Over the course of the years the playing field within the HLH range ports changed from small sized local players, to the entrance of large scale global terminal operating companies. Together with the growth and maturation of the container industry challenges like market concentration arose. Market concentration takes place whenever a couple of players hold an above average share within an industry and are capable of negatively affecting competition by utilizing market power.

In this Master's thesis it is the goal to identify if market concentration in the terminal operating and liner shipping industry affects the market position of the Hamburg Le Havre (HLH) range port authorities. Heaver et al. (2001) used the term principal players to group and identify the terminal operating companies (TOC's), liner shipping companies and forwarders. In this paper the term principal players will solely refer to terminal operating companies and the liner shipping companies. The industries of the principal players have grown strongly and so have the individual companies within the industries. The growth of the companies has taken place in the form of autonomous growth and several consolidation rounds that included mergers and acquisition and the formation of alliances. All these activities attribute to the market concentration within the two industries. Heaver et al. conclude that each of these organizations separately strives explicitly towards expanding its sphere of influence. Expanding the sphere of influence can be done in the form of autonomous growth and the above mentioned consolidation. The horizontal integration occurs within one industry and can lead to the dominance of a couple of firms and alliances within the market. The vertical integration takes place between the two industries. The liner shipping companies are for instance vertically integrating into the terminal operating industry, in the form of joint-ventures, shareholding or subsidiaries.

In prior research the market concentration of the liner shipping industry was analyzed amongst others by Sys (2009), Panayides et al. (2011) and Soppe et al. (2009). Sys identified that: "The current competitive environment of the container liner shipping industry is more complex and changes at a faster pace than 10 years ago. This is due to a number of factors such as the rapidly changing customer requirements, the deployment of ever larger container vessels, advances in information technology, increasing competition and intense consolidation." Sys believes that the trend of growing concentration will most likely continue and that the liner shipping industry can be regarded as a rather fragmented industry in its current state. The concentration in the terminal operating industry was amongst others analyzed by Notteboom (2006), Notteboom & Rodrigue (2010), Soppe et. al. Notteboom & Rodrigue identified the trend of growing market concentration in the terminal operating industry. Notteboom & Rodrigue witnessed that smaller terminal operators have not been successful

in neutralizing the power of the global terminal operators. As a result the smaller companies tend to avoid direct competition and focus more on niche markets such as short sea shipping. Soppe et al. witnessed that both the younger terminal handling industry and the liner shipping industry experienced a consolidation trend and faced increasing levels of concentration. Notteboom (2006) determined the inequality of the port ranges in the European and U.S. seaport system, by analyzing concentration of the throughput on a port level. The inequality on a port level within the HLH range exceeded that of all other ranges and is the result of five ports (Rotterdam, Hamburg, Antwerp, Bremerhaven and Le Havre) controlling nearly 95 percent of the HLH range throughput.

The subject of analyzing market concentration in relation with the terminal operating industry, the liner shipping industry or the ports is therefore not new in this respect. This research will however focus on the effect that these two industries have on the HLH range port authorities. Prior research often determined the market concentration on the scope of the port itself or the port range. This research will determine the market concentration on a much more detailed scope, the HLH range terminal operating companies and container terminals. The developments of the horizontal and vertical integration have likely been accelerated by the effects of the economic crisis that unfolded at the end of 2008. The horizontal integration within either of the two industries and the vertical integration between the two industries will have an effect on the market concentration. The effect of the horizontal and vertical integration of the principal players on the port authority is described by Notteboom (2010) as: “Through horizontal and vertical integration strategies shipping lines, forwarders and intermodal operators have a growing decisional power on supply chain spatial design.” An even more clear-cut statement can be derived from Suykens et al. (1998): “Greater concentration of power does indeed carry with it a risk of ports being played off against each other.” This led to the following research question and sub questions:

RQ: Is market concentration in the terminal operating and liner shipping industry threatening the market position of the HLH range port authorities?

Directly derived from the main research question are the three sub questions.

SQ1: Are the HLH range terminal operating companies subject to market concentration?

SQ2: Is market concentration taking place in the container liner shipping industry?

SQ3: Is the market position of the port authorities worsened by the market concentration at the container terminal operating and liner shipping sector?

The relevance for the research in market concentration of the container industry was displayed at the end of 2011, when another round of consolidation took place in the container shipping industry. The introduction of the Daily Maersk service on the Europe – Asia trade send a shockwave through the liner shipping industry. This comprehensive new service of the largest container liner led to the broad based partnership between second and third largest liner shipping companies of the world, MSC and CMA CGM (cma-cgm.com, 2011). This was followed by the formation of the G6 alliance, a merger of the New World and Grand Alliance and a broad based cooperation between the CKYH alliance and Evergreen. In addition multiple Vessel Sharing Agreements (VSA´s) were forged or altered. The consolidation strongly changed the composition of the liner shipping industry changed strongly at the end of 2011, resulting in a different competitive environment and increased the market concentration.

1.1. Defining market concentration

The Master's thesis will investigate whether or not market concentration is taking place in the in the HLH range terminal operating and global shipping industry. In order to determine market concentration and to draw conclusions from the proposed research, it is important to define the term market concentration. Market concentration is essentially a combination of two individual terms, therefore the term market and the term concentration are first defined separately. The publication of Khemani & Shapiro (1993) provides a glossary of industrial organizational economics and competition law for the Organization for Economic Co-operation and Development. Amongst these definitions the definition for concentration can be found: *"Concentration refers to the extent to which a small number of firms or enterprises account for a large proportion of economic activity such as total sales, assets or employment."*

The definition of a market can differ based on the context in which it is utilized, according to Sys (2009). In general economics the definition of a market encompasses both the supply side as well as the demand side of the goods, while the marketing literature often only covers the supply side. For this Master's thesis the general economics definition will be utilized. When the individual definitions for the relevant market and concentration lead are combined, it leads to the definition of the market concentration as provided by Khemani & Shapiro: *"Industry or Market Concentration which measures the relative position of large enterprises in the provision of specific goods or services such as automobiles or mortgage loans."*

The consequence of market concentration according to the industrial organization economic theory is explained by Khemani & Shapiro as: "Which *suggests that, other things being equal, high levels of market concentration are more conducive to firms engaging in monopolistic practices which leads to misallocation of resources and poor economic performance. Market concentration in this context is used as one possible indicator of market power."*
Therefore the presence of market concentration could lead to the potential usage of market power and the harmful effect of generating monopoly rents. In that case the monopolist increases its price above the optimal price level, generating more revenue for itself and making it less accessible for all the consumers. The higher price only benefits the monopolist and could have been spent more efficiently for the society/economy as a whole. The adverse effect that these rents generate is called a deadweight loss or excess burden and can be regarded as the welfare loss for the economy. The enticement of every company to use this power of generating above average monopoly rents is a fundamental theory of economics called rent-seeking behavior. *"The opportunity to capture monopoly rents provides firms with an incentive to use scarce resources to secure the right to become a monopolist"*, Khemani & Shapiro.

1.2. Determining market concentration

The determination of the market concentration on the various datasets will be determined by the normalized Hirschmann Herfindahl index. The normalized H* index is based on the regular Hirschmann Herfindahl Index (in short HHI or HH-Index). This index has been used to measure the concentration of a transport system in the papers of Notteboom (2006, 2010) and Sys (2009). The normalized Hirschmann Herfindahl Index (H*) is calculated as follows:

$$\mathrm{H}^* = \frac{\frac{\sum_{i=1}^{n} TEU^2}{\left(\sum_{i=1}^{n} TEU_i\right)^2} - \frac{1}{N}}{1 - \frac{1}{n}} \qquad and\ 0 \leq H^* \leq 1 \tag{1}$$

In the formula above TEU_i is equal to the container throughput in TEU of port *i* and *n* concerns the sample size, for instance the number of ports. The normalized H* index is derived from the regular HH-Index, which needs to be determined first. The HHI calculation is constructed in such a manner that the higher the market share, the higher the contribution to the HHI. Therefore if a single terminal operator has a 30 percent of market share, the HHI will be higher than summed market share of three players all having 10 percent of the market.

The difference between the HH-Index and the normalized H* index originates from the fact that the two are measured on a different scale. The HH-index results are measured on a 1/n to 1 scale, where *n* is the sample size (often number of companies or terminals). The normalized H* Index is corrected for the sample size and always provides results between 0 and 1. This makes the H* index result more understandable and comparable than the regular HHI. Ellison & Glaeser (2010) provided bandwidths for the H* index: ”As a general rule, a Herfindahl Index below 0.10 signals low concentration, while above 0.18 signals high concentration, whereas an index between 0.10 and 0.18 shows that the industry is moderately concentrated.”

Another way to determine the concentration is by measuring the market inequality, which can be performed with the Gini coefficient. The papers of Sys and Notteboom (2006) provide examples of how this coefficient could be utilized within the maritime industry. In the case of this paper uses the Gini coefficient as portrayed by Notteboom:

$$G = \left| 1 - \sum_{i=0}^{N} (\sigma Y_{i-1} + \sigma Y_i)(\sigma X_{i-1} + \sigma X_i) \right| \tag{2}$$

The above displayed formulas will help to answer the sub questions which in their turn will help to answer the research question and the underlying sub questions. The two formulas will help to identify whether or not market concentration is present in each of the analyzed industries.

1.3. Scope and boundaries

The global maritime container industry together with the Hamburg Le Havre range container industry can be defined as part of the relevant market within the thesis. The thesis is focused on the HLH range port authorities and what Heaver et al. (2001) referred to as the principal players within a port. The terminal operating companies, liner shipping companies and the port authorities therefore subject of analysis. The relationship between the three players and the market concentration is researched, with a strong focus on the HLH port range. Provided the global nature of the maritime container industry, the analyses are also focused on the global container industry, which is can therefore also be regarded as part of the scope.

Within the HLH range lots of ports with different sizes and functions reside. The HLH range ports with a throughput larger than 250.000 TEU per annum as measured in 2010, will be part of the research. This scope of the HLH range ports ensures that all of the selected ports receive deep-sea containers and are therefore part of the global containerized trade. The port selection also defines the terminal operating companies that are included in the market concentration analysis of the TOC's. All TOC's from which data was available that operated within the ports larger than 250.000 TEU per annum are analyzed.
The container liner shipping industry is closely related to the terminal operating industry. Given the global nature of the liner shipping industry, this principle player is analyzed on a global scale. Albeit with a strong focus on the transport and trade taking place in combination with the HLH range ports. For liner shipping companies the definition provided by Sys (2009) will be used: "The term relevant market for the container liner shipping industry covers all vessel operating common carriers (VOCC's) (e.g. Maersk Line, CMA CGM, Hapag- Lloyd, Evergreen). Other suppliers of a container liner shipping service such as non-vessel operating common carriers (NVOCC's) (e.g. ECU-line, Fast Lines) and logistic/freight forwarders (f.i. Kuehne & Nagel AG, Panalpina Welttransport AG, Deutsche Post AG) are not taken into account in this study."

The port authorities, the global terminal operating companies and the liner shipping companies each operate on a different scale and with a different scope. The connection between the each of the principal players and the terminal operating companies is different from one another and can also differ over time. The following figure assist in visualizing the relationship between the three actors.

Figure 01: The relationships between the three actors within a port

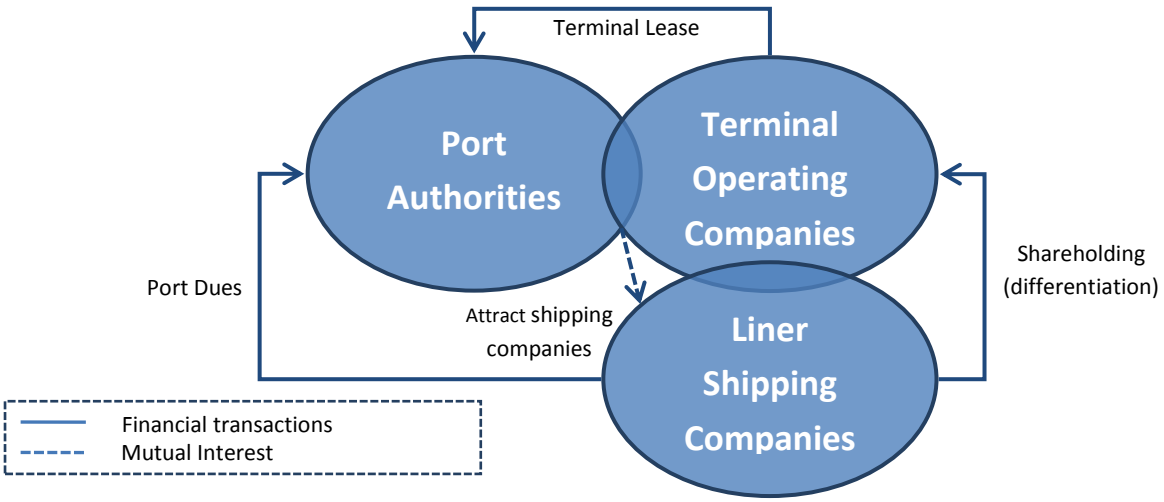


Figure 01 displays the complex relationship between the three central actors in this Master's Thesis. The financial transactions between the port authority and the principal players generate the largest source of income for the port authorities. These financial transactions primarily consist of the long long-term lease contracts paid by the terminal operating companies and the income generated by the port dues collected from the liner shipping companies. The differentiation (vertical integration) of the liner shipping companies towards the terminal operating industry has led to the liner shipping companies investing strongly in the terminal operating companies.

The dotted arrows in the figure represent the relationships between the different actors. At first the relationship of the port authority and the terminal operating companies consists of negotiating the long-term lease contract and in some cases the concession fee. This changes from the moment the contract is actually signed by the TOC. From that point on it is the mutual interest of the of the port authority and the TOC to come across as the most interesting port and TOC combination for the liner shipping companies and the other decisive players such as buyers, sellers, logistical companies, etc.

1.4. Structure of the thesis

The thesis starts with the identification of the principal players in order to get a deeper understanding of the complex environment in which the three actors operate. Understanding this environment is essential in order to provide a good answer for the research question and the sub questions regarding the market concentration. The first chapter after the introduction will concern the port and the port authorities. This chapter will cover the largest ports in the world, in the European port system and within the HLH range. This chapter will also subject the HLH range ports to a market concentration analysis.

The container terminal operating companies that are active within the boundaries of each of the HLH range port areas are analyzed next. The worldwide container operating industry is structured by large scale global terminal operating companies that in some cases operate dozens of terminals in an almost equal amount of ports. The global TOC's often also operate multiple terminals within one port range, making them more footloose when compared to the smaller local terminal operating companies and the port authorities. First off the global terminal operators are studied, since these have a distinct influence on the entire industry. This is followed by a detailed market concentration analysis of the HLH range terminal operating companies, which can be considered the heart of the thesis. The analyses will be performed on various datasets and will cover multiple years of analyses.

The liner shipping companies are far more footloose than the other actors in the port and this also reflects in the large amount of horizontal alliances that have been formed within this industry. The high number of alliances led to the fact that the market concentration analysis is performed both on the liner shipping companies and the liner shipping companies adjusted for the alliances. The differentiation of the liner shipping companies towards the terminal operating industry concludes the research on the two principal players of the port and the port authorities. After the market concentration analyses are performed the Master's thesis will be finalized with the conclusions, recommendations and limitations.

2. Ports and port authorities

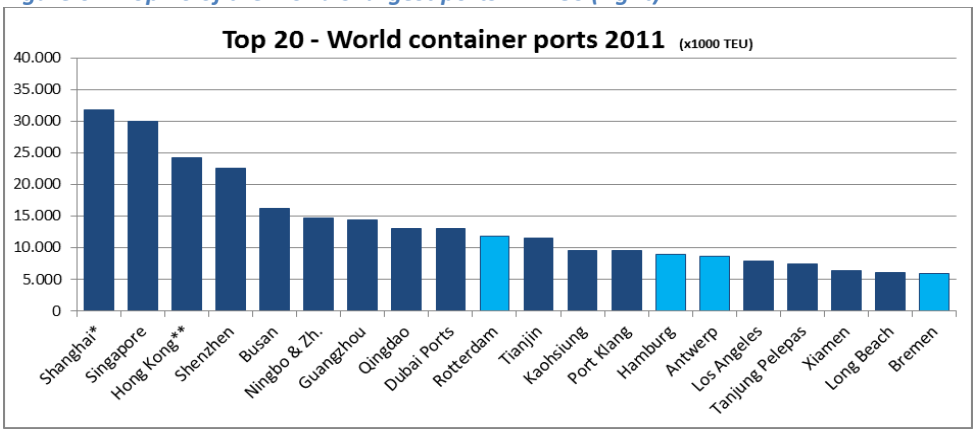
The port authority operates and governs the port area and basically provides the means for the other companies to operate within its borders, both on land and on water. The most noticeable acts of the port authority are for instance collecting port dues, providing terminal space, leasing terminal space and providing infrastructure. The main source of income for the port authorities comes from the collection of port dues and the revenue of contracts such as site rental and long-term lease contracts, Port of Rotterdam Authority (portofrotterdam.com, 2012). The port authorities role within the supply chain will first be explained, before the market concentration analysis will be performed.

Over the course of the years many different port governance models have been created. The main differences between the models can be found in the private or public provision of the port services. In the HLH range however most ports utilize the Landlord port model. A landlord port authority provides the basic elements such as the infrastructure including quays, locks, docks and yards. The private sector is responsible for the transshipment activities and port services (storage, warehousing) and all investments in superstructure. The different port types can also influence how a port would react on situations such as an economic crisis and changes in market power of the principal players. Heaver et al. (2001) stated that: “public and private port authorities, with a few notable exceptions, may be seen as responding re-actively on the organizational developments about them. Public port authorities especially, tied to their local jurisdiction, have been faced with the need to respond to the growth of container traffic and the increased power of fewer players in the logistic chains.” Most HLH ports are either directly or as a majority shareholder publicly controlled by the state, the municipality or both.

2.1. World’s largest ports

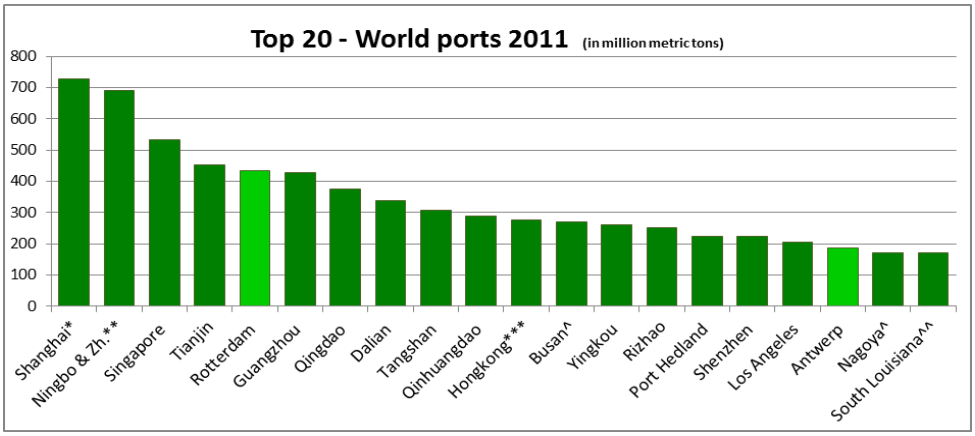
The ports that are governed by the port authorities can be measured by size by the total volume of the throughput in metric tons and in TEUs. The port of Rotterdam publications of ´Port statistics 2008 – 2010’ and ‘Port statistics 2009 – 2011’ provided the data for the world’s largest ports measured in both TEUs and metric tons. The globalization and the production factor of the Asian countries has provided them a dominant position in the chart measured in Metric tons and the chart measured in TEU. The HLH range ports are also represented in both charts and are displayed with a lighter coloration in the graphs.

Figure 02: Top 20 of the world’s largest ports in TEUs (right)



World Container ports: *Includes domestic trade, ** Ningbo and Zhousan - ports combined in 2006, ***Including river trade, ^converted from freight ton to metric ton, ^^ Converted from short ton to metric ton.

Figure 03: Top 20 of the world's largest ports in metric tons



World ports: *Includes domestic trade, ** Ningbo and Zhousan - ports combined in 2006

The United Nations Conference on Trade and Development (UNCTAD, 2012) reported that the Asian continent was responsible for 35.6 percent in their Review of Maritime Transport 2011. The Chinese mainland ports alone were responsible for 23.3 percent of the worldwide container movements in 2009 and this grew to 24.2 % in 2010. Less than a decade ago in 2002 this figure was only 11.7 percent, UNCTAD Review of Maritime Transport (2004, 2011, 2012). The size of the container ports and the port ranges depends for a large part of the size of the container industry and the containerized trade flows, which are explained in the next paragraph.

2.2. Worldwide container industry and the containerized trade flows

Heiberg (2012) provided the figures of the importance of maritime and containerized trade on a global scale in Global Enabling Trade report of the World Economic Forum. Heiberg derived its figures from the highly regarded sources such as the World Trade Organization (WTO), Clarcksons Research Services Ltd, Lloyd's marine intelligence and the DNB Bank ASA. The seaborne trade can be regarded the largest trade of the world in both volume and value. Heiberg indicated that 75 percent of the world trade in volume is transported by the sea, 16 percent by rail and road, 9 percent by pipeline and 0.3 percent is air traffic. In terms of world trade value the sea trade accounts for 9 out of the total of 15 trillion US dollars, 60 percent. A surprisingly large amount from this total maritime trade value is generated by the container industry. Although the container segment only generates 17 percent of the maritime trade measured in metric tonne (mt), it accounts for 5.6 trillion US dollars or 62 percent of the maritime trade. This indicates that the 1.5 billion mt of containerized trade has a higher value per metric tonne than the other segments of maritime trade. The importance and the trade value of containerized trade sector is therefore high on a global scale. The HLH range and its ports act on this global stage, since four of the ports can be found amongst the 20 largest ports in the world. This affirms the selection of this port range for further research.

The containerized trade is commonly divided in three major trade flows: the East-West, North-South and intraregional trade. The HPH Trust (2011) indicated that the East-West trade can be considered the largest trade flow, responsible for 56.2 million TEUs. The North-South trade can be accounted for 22.7 million TEUs and the interregional trade summed up to 55.5 million TEUs. The intraregional trade is dominated by intra-Asian trade, which is responsible for 79.5 percent of all interregional trade. For

the HLH range the most interesting trade is the East-West trade flow. The UNCTAD provided a more detailed table on the East-West trade flows in their 2011 review of maritime transport. The original tables can be found in the Appendix, whilst the most important part is shown in table 01 below. The table displays the trade flows between North America (NA), Far East (FE) and Europe (EU). In all the East-West trades a strong growth could be witnessed between 1995 and 2008. The trades involving the Far East have grown impressively and also the effect of the economic crisis is shown in the table below.

Table 01: The major East-West trade flows in 1995, 2008, 2009

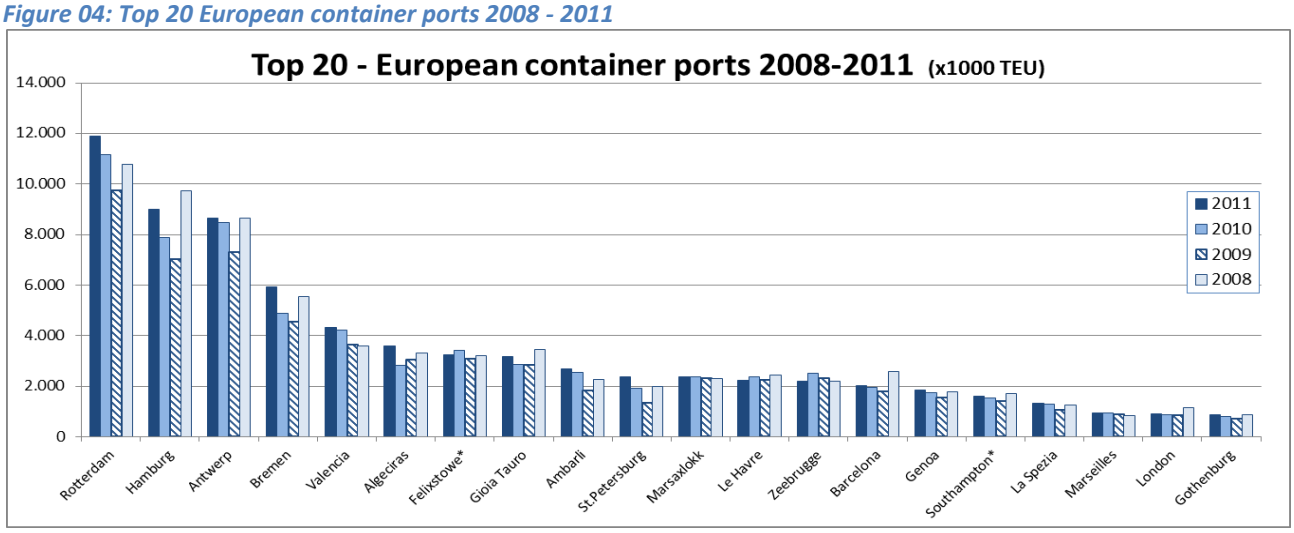
From To	FE NA	NA FE	Total FE-NA	FE EU	EU FE	Total FE-EU	EU NA	NA EU	Total EU-NA	Total East-West
1995	3.97	3.54	7,51	2.40	2.02	4,42	1.68	1.69	3,37	15.30
2008	12.90	6.38	19,28	13.31	5.23	18,54	3.39	2.62	6,01	43.83
2009	10.62	6.12	16,74	11.36	5.46	16,82	2.74	2.04	4,78	38.34
1995-2008	**225%**	**80%**	**157%**	**455%**	**159%**	**319%**	**102%**	**55%**	**78%**	**186%**
2008-2009	**-21%**	**-4%**	**-13%**	**-17%**	**4%**	**-9%**	**-24%**	**-28%**	**-20%**	**-13%**

Source: UNCTAD (2012), in TEU full table and source is to be found in the Appendix

2.3. European Port System

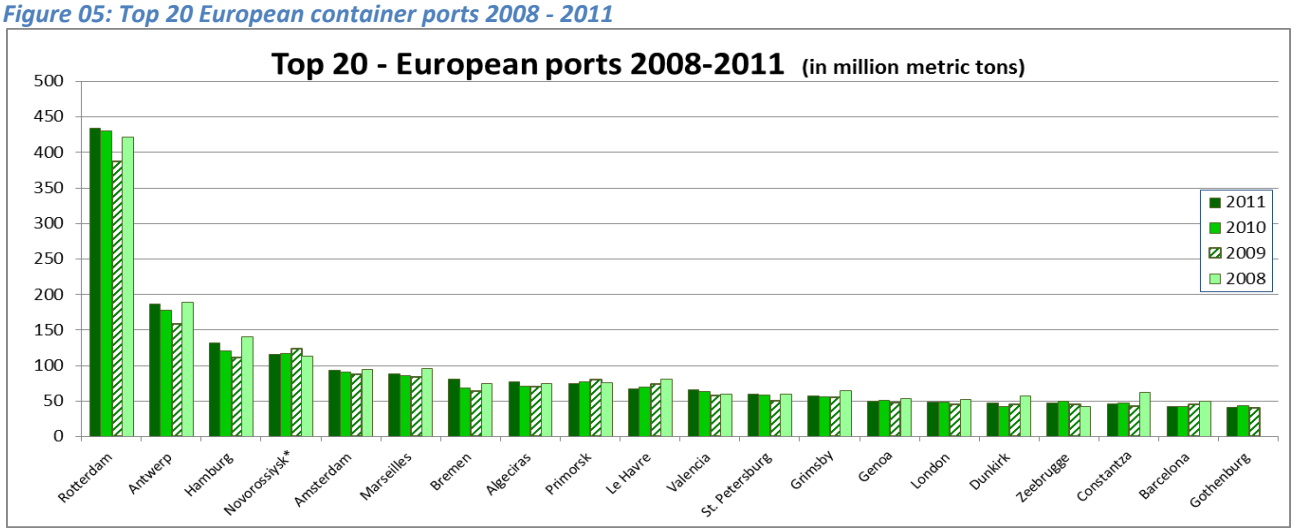
The Hamburg - Le Havre port range can be considered the largest European port range in terms of throughput per metric tonne (mt) and containers. The HLH range houses a couple of the largest European ports that are in competition for the same hinterland. The two figures below display the total tonnage throughput in metric tonne for the top 20 European ports for the years 2008 - 2011. The chosen timeframe highlights the difficult economic period that affected global trade. The timeframe contains the fall of the Leman Brothers in September 2008, which can be regarded as the starting point of the worldwide economic crisis. As a result of the crisis the global trade strongly diminished at the end of 2008 and this effect continued during the entire year of 2009. The drop in global trade affected all segments of maritime trade, including the container segment. The effects of the crisis can be seen at the European ports and a result the throughput of the ports in metric tonne dropped, as did the containerized throughput in TEU. Unlike the throughput measured in metric tonne, the container throughput in the European ports already bounced back as early as 2010 and this continued in 2011.

Figure 04: Top 20 European container ports 2008 - 2011



Source: Port of Rotterdam – Port statistics

Figure 05: Top 20 European container ports 2008 - 2011



Source: Port of Rotterdam – Port statistics

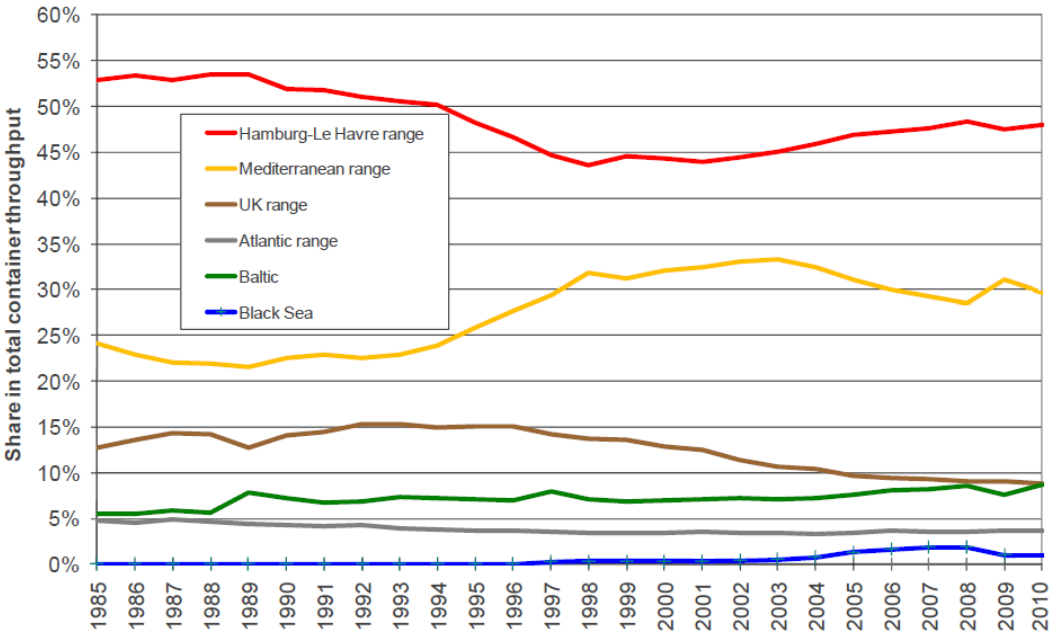
The graph of the European container throughput displays that the crisis struck especially hard at the four ports with the highest throughput in TEUs. The graph displayed that the TEU throughput of most ports in 2011 neared or surpassed the figures of the record year 2008. The graph concerning the total throughput of the each port measured in metric tonne (mt), displays that the port of Rotterdam is the clear market leader of Europe. The graph also displays that most European ports have not neared or surpassed the tonnage throughput from 2008. A more equal distribution displayed at the container segment graph signals for higher competition in this market segment.

2.4. European port ranges

The European port system can be subdivided in a couple of port ranges. Besides the HLH range the other identified European ranges are the Mediterranean, UK, Atlantic (From the South of Portugal to Bretagne France), Baltic and Black Sea range. The Mediterranean range is the second largest port range and has multiple ports listed in the lists of the top 20 European ports. Located along the Mediterranean coast are the ports of Valencia, Algeceiras, Gioia Tauro, Marsaxlokk, Barcelona, Genoa, La Spezia, Marseille. Within the HLH range the ports of Rotterdam, Hamburg, Antwerp, Bremen, Le Havre and Zeebrugge are found. The UK port range has Felixstowe, Southampton and London in the top twenty, while St. Petersburg and Gothenburg represent the largest Baltic ports.

All European port ranges witnessed a strong increase in the TEU throughput in the past decade. When combined all port ranges handled about 45 million TEUs in 2000 and a strongly increased 84 million TEUs in 2008, Notteboom (2009). The evolution of the port range market shares between 1985 and 2010 are displayed in a graph by Notteboom & Rodrigue (2011). The figure below shows quite some fluctuations and especially the sharp increase of the Mediterranean range its market share at the cost of the HLH port range between 1992 and 1998 is remarkable. The growth of the Asia-Europe trade and the shipping route through the Suez Canal provided opportunities for the ports along the Mediterranean Sea. The transshipment role of the Mediterranean ports is one of the explanations for the strong increase in their market share. In the more recent years an upward trend of the HLH range market percentage can be witnessed. Together these two ranges dominate the European container industry in 2010 with a market share of 48 and 30 percent each.

Figure 06: Market share of the European port ranges



Source: Notteboom & Rodrigue (2011)

2.5. Hamburg - Le Havre range

The Hamburg - Le Havre range (HLH) is subject of analysis in this thesis and can be regarded the largest container port range of Europe. Within the range there are six large ports that compete for the majority of the container traffic. In order of TEU throughput in 2010 the largest ports are: Rotterdam, Antwerp, Hamburg, Bremen, Zeebrugge and Le Havre. All of these ports handled more than 2 million TEU in 2010, whereas the remaining smaller ports handled less than 250.000 TEU in 2010. The HLH range is regarded a competitive port range, which comes from the fact that some of the largest ports in Europe are packed in a shoreline of merely 500 nautical miles. This relative close proximity creates a highly contestable hinterland for the ports and their terminal operators. Although the six ports are in close proximity with each other there are some key differences between the ports that can be of influence for the competitiveness of a port. Notteboom (2010) identified the difference between coastal and more upstream located ports and analyzed the differences over the years. The ports of Antwerp, Bremen and Hamburg are categorized as the large upstream container ports. The large coastal ports of the range are: Le Havre, Rotterdam and Zeebrugge. The upstream ports have noticeably increased their throughput between the analyzed timeframe of 1975 till 2008, as is displayed in the Appendix. One of the reasons behind this shift towards the upstream ports is explained by Notteboom as the difference in costs between hauling a large container or Forty Foot Equivalent Unit (FEU) to the hinterland. Upstream ports benefit from longer transportation with a sea vessel, which is a lot cheaper per FEU/km than inland barge transport or truck haulage. In the years 2003-2009 the growth of the upstream ports has halted and the graph displays a stable situation. What the coastal ports lack the benefit of longer sea transport, the ports make up with easier access for large vessels, larger navigable depth and more (Greenfield) terminal space. With the economies of scale pushing for increasing vessel sizes, it might be the coastal ports that will have the competitive advantage over the upstream ports. The throughput of the HLH range ports will be provided in the next paragraph.

2.5.1. Throughput quantity of the HLH range ports

The 1980-2010 time series is displayed with a five year interval for the six largest container ports of the HLH range. others category provides the summation of the ports Dunkirk, Gent, Amsterdam and Oostende, which all transported less than 250.000 TEU in 2010 individually. The full tables in the Appendix provide the individual figures of these smaller ports. The table below displays the accelerating growth of the throughput until the crisis struck at the end of 2008. As a result of the economic crisis the largest TEU increase could be witnessed in the 2000-2005 interval. In this period the flipside of the strong growth also became visible, when most terminals were fighting diseconomies of scale such as congestion and long waiting times.

Table 02: HLH range throughput in TEU, 1980 to 2010 in 5 year time periods

TEU	Rotterdam	%	Antwerp	%	Hamburg	%	Bremen	%	Zeebrugge	%	Le Havre	%	Others	%	Total
1980	1.922.906	39,3%	724.247	14,8%	783.323	16,0%	698.160	14,3%	181.010	3,7%	507.289	10,4%	72.950	1,5%	**4.889.885**
1985	2.713.737	38,9%	1.243.009	17,8%	1.158.776	16,6%	998.247	14,3%	218.258	3,1%	565.914	8,1%	80.592	1,2%	**6.978.533**
1990	3.665.955	38,0%	1.549.113	16,0%	1.968.986	20,4%	1.197.775	12,4%	334.382	3,5%	858.385	8,9%	80.620	0,8%	**9.655.216**
1995	4.786.576	36,3%	2.329.135	17,7%	2.890.181	21,9%	1.518.206	11,5%	528.470	4,0%	970.426	7,4%	146.305	1,1%	**13.169.299**
2000	6.275.000	31,4%	4.082.334	20,4%	4.248.247	21,2%	2.751.793	13,8%	965.345	4,8%	1.464.901	7,3%	211.260	1,1%	**19.998.880**
2005	9.286.757	29,6%	6.482.029	20,7%	8.087.545	25,8%	3.735.574	11,9%	1.407.932	4,5%	2.058.000	6,6%	309.825	1,0%	**31.367.662**
2010	11.145.804	29,6%	8.468.475	22,5%	7.895.736	21,0%	4.888.000	13,0%	2.499.756	6,6%	2.358.077	6,3%	343.408	0,9%	**37.599.256**

Source: Vlaamse Havencommissie, Intercontinentaal containertransport van en naar de Vlaamse havens - 30/06/2009, added with own data.

Table 03: HLH range throughput in TEU, 2005 to 2010 in per year

TEU	Rotterdam	%	Antwerp	%	Hamburg	%	Bremen	%	Zeebrugge	%	Le Havre	%	Others	%	Total
2005	9.286.757	29,6%	6.482.029	20,7%	8.087.545	25,8%	3.735.574	11,9%	1.407.932	4,5%	2.058.000	6,6%	309.825	1,0%	**31.367.662**
2006	9.653.232	28,1%	7.018.799	20,4%	8.861.804	25,8%	4.449.624	13,0%	1.653.493	4,8%	2.137.828	6,2%	552.438	1,6%	**34.327.218**
2007	10.790.604	27,6%	8.176.614	20,9%	9.889.792	25,3%	4.912.177	12,6%	2.020.723	5,2%	2.638.000	6,8%	647.352	1,7%	**39.075.262**
2008	10.784.000	26,9%	8.662.891	21,6%	9.700.000	24,2%	5.529.000	13,8%	2.209.713	5,5%	2.500.000	6,2%	711.656	1,8%	**40.097.260**
2009	9.743.290	28,9%	7.309.639	21,7%	7.007.704	20,8%	4.564.554	13,6%	2.328.198	6,9%	2.240.714	6,7%	478.657	1,4%	**33.672.756**
2010	11.145.804	29,6%	8.468.475	22,5%	7.895.736	21,0%	4.888.000	13,0%	2.499.756	6,6%	2.358.077	6,3%	343.408	0,9%	**37.599.256**

Source: Identical to previous table

The table with the one year intervals provides two points of interest, firstly the drop in throughput due to economic and financial crisis and secondly the dropping throughput in the others category. The effect of the economic crisis was very noticeable at the four largest European container ports, all located in the HLH range. Rotterdam and Bremen saw a drop of about 1 million TEUs throughput when compared with their record year of 2008, whilst Antwerp lost about 1.3 million TEUs of throughput. The port of Hamburg really got hammered by the global debt crisis and lost 2.7 million TEUs in comparison to 2008. The port of Hamburg was the 2nd largest port in the period before 2008 and got surpassed by Antwerp in 2009 and 2010. Interestingly the port of Zeebrugge seemed unaffected by the crisis. The port of Rotterdam recaptured market share in 2009 and 2010, which signaled a trends break for the port that gradually lost 10 percent of market share in the past 30 years.

The second interesting change took place in 'Others' category, a significant drop in throughput was the result of the port of Amsterdam losing a lot of traffic. This port handled 435.000 TEU in 2008 and this shrunk to just above 60.000 TEU in 2010. The drop in throughput for the Amsterdam port is closely related to the fate of its largest terminal originally named Ceres Paragon. Dijkhuizen (2012) reports a scheduled closure the largest and newest container terminal in Amsterdam, with a designed capacity of 1.2 million TEU. This could have an effect on the HLH range ports market concentration index in the years to follow.

2.5.2. Hirschmann–Herfindahl Index

The competitiveness and the market concentration of the HLH range ports will be calculated by the use of the normalized Hirschmann-Herfindahl Index. In the introduction section of the thesis the mechanics behind the normalized H* index were explained. The normalized Hirschman-Herfindahl Index as defined by Notteboom (2010) will be utilized:

$$\mathrm{H}^{*} = \frac{\frac{\sum_{i=1}^{n} TEU^{2}}{\left(\sum_{i=1}^{n} TEU_{i}\right)^{2}} - \frac{1}{N}}{1 - \frac{1}{n}} \qquad and\ 0 \leq H^{*} \leq 1 \qquad (1)$$

Excluding the smallest figures or players is a popular method when (large) datasets are analyzed. These figures are often of lower significance and in some cases hard to retrieve. For the regular and normalized concentration index these figures are of great significance however. A typical example would be a four player market with all having 25 percent of market share each would return as zero, which signals for very low market concentration and a very equally distributed economy. If this same market would have 25 players and the top four all have 24.5 percent of market share, leaving just 2 percent for the other 21 small players, the result would be a highly concentrated market.

When the H* equation is applied to the Hamburg-Le Havre range, it generates the following results for the 2005-2010 period. The smaller ports of Oostende, Amsterdam and Gent are also analyzed in the normalized H* index, given the explanation of the smaller players. Overall the index was slowly moving towards more de-concentration and more competitiveness, however in 2010 the concentration increased a bit. The increasing H* index is both the result of the port of Rotterdam regaining and Amsterdam losing market share, combined with a slower than average recovery in Hamburg.

Table 04: HLH range container ports throughput, HHI and H included*

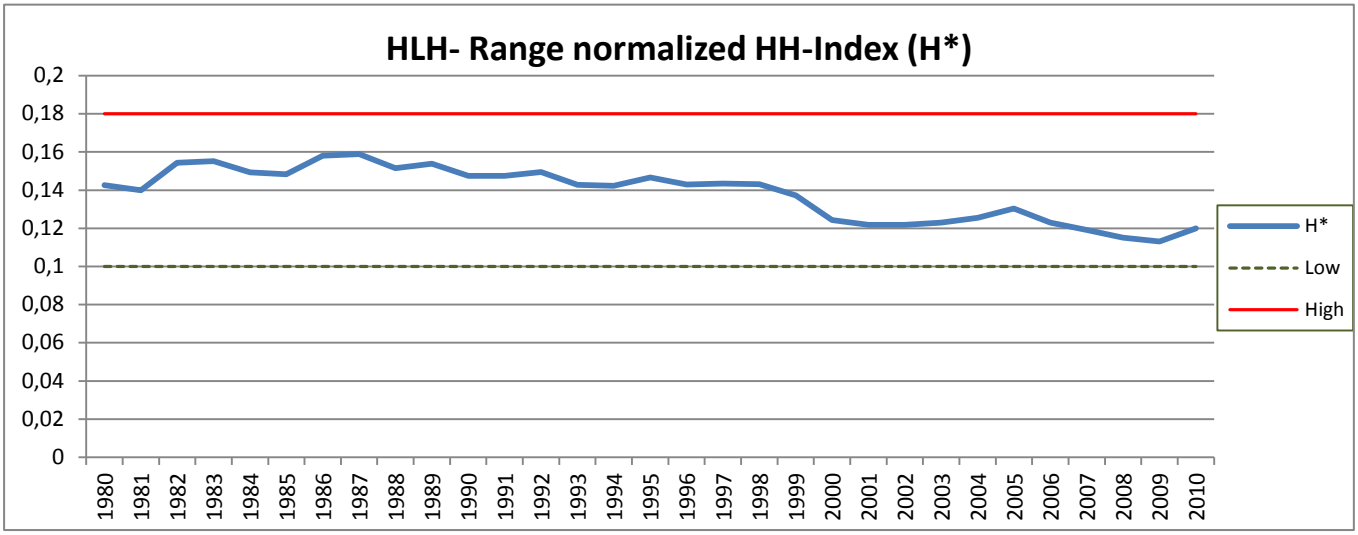
TEU	Rotterdam	Antwerp	Hamburg	Bremen	Zeebrugge	Le Havre	Dunkirk	Gent	Amsterdam	Oostende	Total	HHI	H*
2005	9.286.757	6.482.029	8.087.545	3.735.574	1.407.932	2.058.000	204.562	30.529	65.844	8.890	**31.367.662**	0,217	0,130
2006	9.653.232	7.018.799	8.861.804	4.449.624	1.653.493	2.137.828	206.000	35.888	305.995	4.555	**34.327.218**	0,211	0,123
2007	10.790.604	8.176.614	9.889.792	4.912.177	2.020.723	2.638.000	197.000	60.835	386.236	3.281	**39.075.262**	0,207	0,119
2008	10.784.000	8.662.891	9.700.000	5.529.000	2.209.713	2.500.000	214.000	62.656	435.000	-	**40.097.260**	0,204	0,115
2009	9.743.290	7.309.639	7.007.704	4.564.554	2.328.198	2.240.714	212.000	63.657	203.000	-	**33.672.756**	0,202	0,113
2010	11.145.804	8.468.475	7.895.736	4.888.000	2.499.756	2.358.077	200.300	83.065	60.043	-	**37.599.256**	0,208	0,120

Over a longer period the figures show a relative stable normalized HH-Index for the entire range. This can be identified as a moderate amount of concentration for the HLH range ports and the port authorities. The well cited article by Ellison and Glaeser (2010) provided the rule of thumb for the H* results: “As a general rule, a Herfindahl Index below 0.10 signals low concentration, while above 0.18 signals high concentration, whereas an index between 0.10 and 0.18 shows that the industry is moderately concentrated.” The H* index as well as the above mentioned rule of thumb will be used more frequently throughout this thesis.

2.5.3. Normalized HH-Index from 1980 – 2010 in the HLH range

The normalized HH-index (H*) analysis as has been performed on the 2005-2010 timeframe, will also be performed on the 1980-2010 throughput data on a port level. Given the large dataset the yearly H* index will be provided in a graph rather than a table. The H* will explain whether the HLH range throughput signals for high, moderate or low market concentration for the HLH range ports.

Figure 07: HLH range H rating, time series 1980-2010*



Source: Own data. This is the normalized HH-index based on the container throughput of every large port within the HLH range, e.g. Hamburg, Bremen, Amsterdam, Rotterdam, Antwerp, Gent, Oostende, Zeebrugge, Dunkirk and Le Havre.

The graph above shows a relatively stable normalized H* index, in between the boundaries of high and low concentration. The HLH range can therefore be considered moderately concentrated on a port level, with a light trend towards lower market concentration. The decreasing market concentration was the result of market leader Rotterdam slowly losing market share. The recent upsurge of the graph in the years 2009 and 2010 can therefore also be explained by the port of Rotterdam regaining market share in the last two years of the analyses.

2.6. Concluding remarks - Port and Port Authorities

The research question asks if the market concentration at the terminal operating and liner shipping industry has the ability to threaten the market position of the HLH range port authorities. Interestingly enough the normalized H* index calculated for the ports and the port authorities also indicated moderate market concentration. The index calculated based on the TEU throughput of the HLH range ports and fluctuated between the boundaries of high and low market concentration during the 30 year time frame. This indicates that the port authorities are subject to moderate levels of market concentration.

A recent upsurge in competition amongst the port authorities was noticeable by the usage of pricing instruments by the port authorities. The port authorities used methods such as the freezing of the port dues and large scale use of discounts, in order to attract more cargo during the turbulent years of 2009, 2010 and 2011. With these pricing instruments the port authorities wanted to influence the main utilizers of a port, such as the liner shipping companies, forwarders and logistical companies. These main utilizers of the port also generate the main source of income for a port authority. The port

of Rotterdam Port statistics (2012) revealed that the port generated a revenue of 588 million euro's in 2011. From this revenue 291 million (49.5 percent) was generated by port dues and 267 million (45.4 percent) was generated by contracts such as long-term lease contracts and site rental. The revenue of the port authority therefore depends highly on the liner shipping companies utilizing the port and the terminal operating companies leasing the container terminal sites. For these utilizers of a port various decisional factors can lead to the selection of a port and terminal operating company of which most are rather fixed such as location, access to inland waterways or navigable depth. On the medium to long term port authorities can influence the infrastructure, the terminal lay-out and the active terminal operators that are often bound by long-term lease contracts. One of the few short-term tools that a port authority can use to directly influence the decisional process is the pricing instrument.

The future of the HLH range ports is difficult to determine, on the one hand the TEU throughput shows promising signs of a renewed growth path. On the other hand the throughput figures are well below prior expectations, expectations that have led to investments in the infrastructure and the terminal capacity of the ports. In the upcoming years some of the ports will welcome terminal upgrades and new terminals sites. This can potentially lead to overcapacity and increased competition between the terminal operators within a port and within the HLH range, as well as increased competition amongst the port authorities. Another subject that can determine the success of the port itself is the right selection and presence of the terminal operators. With the globally active terminal operators growing in both size and influence, it is increasingly important to have the right mixture of these operators present within a port. The next chapter will explain the current global terminal operating companies, their connections with shipping lines and their influence on the HLH range and its port authorities.

3. The global terminal operators

The global terminal operators have emerged in the container terminal industry and have spread out amongst the HLH range ports. These terminal operating companies are responsible for the container handling from the vessel to the quay and vice versa and mostly acquired the terminal sites by long-term lease contracts from the Port Authorities. Within the Hamburg Le Havre range it is quite common that one or two dominant terminal operating companies run multiple terminals within a port. In most ports the predominant player was a local terminal operator that evolved together with the port authority through the period of increasing containerization. The paper of Soppe et al. (2009) identified large scale investments by the major shipping lines (carriers) on the landside. The differentiation of the liner shipping companies to the terminal operating industry created a network of port facilities, which created integrated shipping lines. In reaction to the evolving and aggressive strategies, the terminal operating companies also expanded and invested internationally. Since the 1990's most of the local operators are taken over by globally operating terminal operators that have terminals spread around all major trade routes and continents. Over time this developed into a situation in which few global terminal operators acquired a large market share.

The port of Rotterdam provides a good example for the above mentioned evolved situation. The now dominant terminal operator Europe Container Terminals (further ECT) handled the ports first container liner shipment in 1966 and acquired its first terminal in 1967 (ect.nl, 2012). Since those early days the company has grown together with the port. Unlike some other TOC's the ECT remained focused on its home port. That is till it was acquired in 2002 by the Hong Kong based Hutchison Port Holdings, a global terminal operating company. The throughput of the ECT followed the same growth path of the entire container industry and in 2010 the ECT handled more than 7 million TEUs. With the total throughput of the Port of Rotterdam summing up to 11.1 million TEUs in 2010, the ECT had a big market share of 64 percent in this port. It is not uncommon within the HLH range that a terminal operating company acquires such a dominant position within a port. In the neighboring and competing port of Antwerp the main terminal operating company holds an even stronger position. Port Singapore Authority Hesse - Noord Natie (PSA HNN, further PSA) is also a global terminal operator and a close competitor within the range. The PSA terminals in their turn dominate the port of Antwerp, by handling around 7 million TEUs of the total 8.468 million TEUs that were handled in Antwerp in 2010. This provided the Singapore based PSA with a market share of 83 percent. PSA did not originate in Antwerp, it gained control of these terminals by acquisition. The port of Antwerp originally had two big terminal operating companies, the Hesse Natie and Noord Natie. The two companies merged in 2002 and were almost instantly taken over by PSA International. Whereas HPH has confined themselves to one port within the HLH range, PSA also owns terminals in the port of Zeebrugge. In the port of Bremen the global terminal operator Eurogate is the sole terminal operator and with its terminals it handled 4.871.297 TEU, resulting in a 99.9 percent share. In Hamburg the largest operator is Hamburger Hafen und Logistik AG (HHLA), handling 5.548.000 TEUs out of the total 7.787.628, giving them a market share of 71 percent. Surprisingly HHLA is not owned by a global terminal operating company. Terminals from APM Terminals and DP World are also found in various HLH range ports, albeit not in a dominating position.

In general the rise of the global terminal operating companies has resulted in large changes in the HLH range. Most local terminal operating companies have either been pushed out of the market or been taken over by the global or continental terminal operating companies. The 2010 and 2011 market situation represents an industry that is dominated by a handful of companies and can therefore be regarded somewhat oligopolistic of nature. Amongst the 10 largest TOC's measured on TEU throughput are besides pure terminal operating companies also some of the major shipping lines. APM Terminals for example is part of the A.P. Moller- Maersk Group and therefore part of the same conglomerate as the largest shipping line of the world. Most shipping lines entered the terminal operating industry to extend their span of control and support their core business which is the container shipping. APMT however is regarded as a separate business unit, which handles large amounts of cargo for the core business, but also significant amounts for other shipping companies.

The Drewry Shipping Consultants report (2010) identified three different types of global terminal operators and used these groups to identify the ten largest Terminal Operating Companies (TOC's) in the industry:

1) **Global stevedores** – (HPH, PSA, DP World, Eurogate, SSA Marine) These pure terminal operators form the biggest group and with the highest rankings. This group of companies primarily focused on port operations and consider their terminals as profit centers.
2) **Global carriers** – The Global carriers (MSC, CMA CGM and Evergreen) have invested in container terminals to support their core activity, container shipping. These terminals are often managed as cost centers.
3) **Global Hybrids** – The two global hybrids (Cosco and APMT) have their main activity or that of the parent group on container shipping, with the terminal business handling both own traffic as well as a significant amount of third party containers.

Table 05: Global terminal operators 2008 - 2009

TEUs in million	*Gross Throughput* **2008**	**2009**	*Equity Adjusted Throughput* **2008**	**2009**	Market share **2008**	**2009**	HHI **2008**	HHI **2009**
Hutchison Port Holdings [1]	67,6	64,2	34,4	32,2	13,0 %	13,6 %	0,017	0,018
APM Terminals [3]	64,4	56,9	33,8	31,1	12,3 %	12,0 %	0,015	0,014
PSA International [1]	59,7	55,3	50,4	45	11,4 %	11,7 %	0,013	0,014
DP World [1]	46,2	45,2	32,9	31,5	8,9 %	9,5 %	0,008	0,009
COSCO [3]	32	32,5	11,1	10,9	6,1 %	6,9 %	0,004	0,005
MSC [2]	16,2	16,4	7,9	8,2	3,1 %	3,5 %	0,001	0,001
Eurogate [1]	13,2	11,7	7,4	6,1	2,5 %	2,5 %	0,001	0,001
Evergreen [2]	10,3	8,6	8,9	7,2	2,0 %	1,8 %	0,000	0,000
SSA Marine [1]	7,4	7,7	4,6	6,3	1,4 %	1,6 %	0,000	0,000
CMA CGM [2]	7	7	4,1	4,6	1,3 %	1,5 %	0,000	0,000
Ten largest Global TOC's	324,0	305,5	195,5	183,1	62,0 %	64,6 %	0,059	0,063
Remaining Global TOC's	50,1	48,5	37,6	32,5	9,6 %	10,2 %	0,001	0,001
Total	374,1	354	233,1	215,6	71,6 %	74,8 %	0,060	0,064

Source: Drewry Shipping consultants (2010)

The ten largest terminal operating companies dominate the container terminal business with a combined share of 65 percent in 2009. The Global Stevedores group that focus primarily on their terminal operating activities are leading the industry. From a market concentration point of view however, the most interesting companies are those that fall in the Global Hybrids or Global Carriers

category. The A.P. Moller- Maersk group houses the largest container shipping company of the world as well as one of the largest terminal operating companies of the world. The conglomerate therefore has major influence on the entire container industry. Other large shipping lines that also have big stakes in the terminal operating industry are: MSC the 2nd, CMA CGM the 3rd, COSCO the 4th and Evergreen the 6th largest container shipping company of the world (Alphaliner.com, 2011c). The Drewry table also shows the Equity based throughput in which PSA has a clear leading position in the industry. This can be explained by PSA owning 20 percent of the shares of its competitor Hutchison Port Holdings.

3.1. Calculating the global TOC's concentration index

For the calculation of the of the concentration index the actual throughput is utilized and calculated by the normalized Hirschmann-Herfindahl index (H*) analysis is performed on the data and displayed in the table. The H* calculation requires the HHI calculation that is based on the Drewry dataset of the global TOC's. This dataset required several decisions regarding the usage of the two broad categories of 'remaining Global TOC's and a group that is not specifically highlighted in the table, the 'Other non-global TOC's' group. The non-global group is not mentioned in the table, however since the table of the global TOC's does not provide numbers up to 100 percent, the presence of a non-global group is justified. These two categories form the computed result of an unknown number of companies, with an unknown market share. When the data of this unknown number of companies would falsely be seen as one group, it would add greatly attribute to the H* index. To prevent a large bias in the calculation the 2008 figures for the 'remaining Global TOC's' category of 9.6 percent are interpreted as if it were nine companies with 1 percent of the market each and one company being 0.6 percent large. For 2009 the same method was applied, albeit 10 companies with a one percent share hold and one having 0.2 percent. This minimized to minimize the influence of the companies in this summarized group. The regular HHI summed up to 0.06 (2008) and 0.064 (2009). For the remaining non-global TOC's accounting for 28.4 percent in 2008 and 25.2 percent in 2009, the same method is applied.

The decision whether or not to include the other global terminal operating companies, whether or not to include the non-global TOC's or to just focus on the top 10, has an direct influence on the normalized H* index. The concentration index is influenced by the sample size (size of the dataset) and thereby the way that the remaining Global TOC's and remaining TOC's are used in the equation. The three options are displayed below by the 'Drewry Data +', 'Global TOC's' and 'Top 10' columns, in which the dataset was reduced with each of the three options.

Table 06: Concentration index based on Drewry data and Global TOC's

	Drewry data +		Global TOC's		Top 10	
	2008	2009	2008	2009	2008	2009
Ten largest Global TOC's	62.00%	64.60%	86.61%	86.30%	100.00%	100.00%
Remaining Global TOC's	9.60%	10.20%	13.39%	13.70%	0.00%	0.00%
Remaining non-global TOC's	28.40%	25.20%	0.00%	0.00%	0.00%	0.00%
Total - %	100%	100%	100%	100%	100%	100%
HHI	0.063	0.067	0.116	0.114	0.153	0.151
N (= number of TOC's)	49	47	24	24	10	10
H*	0.042	0.046	0.075	0.074	0.061	0.058

Source: Drewry data (2010), own calculations

The table above illustrates the difference between the HHI and the normalized H* calculation and the reason why the H* index is chosen. The HHI increases strongly when the dataset is reduced and fewer TOC's are entered into the equation. The HHI might give the impression that the concentration is the highest in the market situation of 10 players, but with only ten players in the industry who is there to dominate? This is where the normalized H* equation displays its worth by recalculating the HHI value with the number of TOC's (*n*) and putting the result on a zero to one scale. The normalized H* calculation yields the highest numbers when only the Global TOC's are concerned, but never surpasses the 0.10 threshold of moderate market concentration. The choices that were made regarding the usage of the remaining (Global) TOC's category influenced the result of the H* analysis, but did not influence the final conclusion. Low market concentration remains in any of the three calculations.

3.2. Global terminal operators – conclusion

The three different normalized HH-index calculations that were performed on the data of the global terminal operators all delivered results that were below an H* index of 0.10. The calculation of the H* index showed that the choices made with regards to the dataset, can have their influence on the results of the analysis. From the three options the middle of the road option is chosen, since the Top 10 dataset is too small and unrepresentative, whilst the first option adds 28 percent of highly unknown market percentage shares to the analysis. The pure numbers would suggest that enough competition exists within the global container terminal operating industry. The influence of the container shipping industry however provides an extra dimension to the concentration index. Regarding the TOC's that belong to the global carrier and the global hybrid category it is rather obvious that a direct influence of the liner shipping industry can be expected. However also at the pure terminal operators, the global stevedores group, the companies are influenced by the liner shipping companies. The liner shipping companies are increasingly investing in terminal sites in the form of holding shares or setting up joint-ventures with the terminal operators, a trend that is visible both globally as well as in the HLH range. The large liner shipping companies and conglomerates have often not confined themselves to one partner and hold shares of terminals belonging to different global and non-global terminal operating companies.

All the different variables regarding the forms of cooperation, terminal sizes and throughput render the calculation of the real influence on the global terminal operating industry immeasurable. The combined net effect that these cooperative actions have on the concentration index is both immeasurable and regarded outside the scope of the thesis. However note is taken that the influence that the liner shipping companies exert on the global terminal operating industry is present on a global scale. Secondly it is also expected that the combined effect of the collaborations between the shipping lines and the terminal operators have is higher than is measurable right now.

The bargaining power of the terminal operating companies within any given port has increased with respect to the port authorities due to the consolidation within the terminal operating industry. The witnessed vertical integration increases the bargaining power of both the terminal operating lines and the container shipping lines even further. The rather low concentration index on a global scale also does not exclude that concentration can be present on a more local scale. The concentration amongst the HLH range terminal operating companies will be calculated in the next chapter.

4. The market concentration of the HLH range terminals and TOC's

In analyzing the market concentration of the HLH range container terminals and the Terminal Operating Companies (TOC's), the economic environment of the TOC's is of importance. The previous chapters provided this information regarding global trade, global TOC's, the HLH range and its ports. The HLH range was identified as the largest port range of Europe and proved moderately concentrated on a port level. This indicates that the throughput of containerized cargo is not evenly spread amongst the HLH range ports and runs primarily through a couple of these ports. This chapter will determine whether or not there is market concentration taking place within the HLH range ports. The concentration analysis will be determined on the level of the container terminals and the terminal operating companies. A large number of the globally operating TOC's have acquired strategic positions in the HLH ports. These global TOC's are in some cases present in multiple ports within the range. Within the ports these global TOC's compete with each other and the remaining local TOC's. The market concentration on the global TOC's determined that the market concentration was low, when measured on a global scale. This chapter will identify whether the height of the market concentration is different on the local scale, within the HLH range ports. The calculation of the market concentration of the TOC's and terminals within the HLH range will answer the first sub question and is therefore an essential element of this Master's thesis.

The scope of the market concentration analysis was set on the terminal throughput and terminal capacity of the larger HLH container ports. The desired level of detail is therefore higher for this analysis than most prior analyses performed. The market concentration analyses priory performed were mostly conducted on the port and TOC level, for example Notteboom (2010). The article of Ilmer (2005) provided a starting point for the data of the analysis. This article provided the terminal capacity in 2004 for the bigger terminal operators in most of the HLH range ports and in addition provided the forecasted terminal capacity in 2010. With the data mostly providing the capacity of the TOC's in 2004 and only providing the more detailed terminal capacity figures for the German ports of Bremen and Hamburg, this data alone was not enough for desired market concentration analyses. Data collection was required to collect the remaining terminal capacity figures for 2004 and to provide the terminal throughput figures for 2004 and 2010. The forecasted capacity figures for 2010 also needed to be crosschecked with the real capacity figures. This therefore set a high bar for the data gathering stage, since most TOC's are often selective in the information they share or publish.

The capacity and throughput data of the desired terminal level proved to be hard to retrieve for any year, but especially for the 2004 timeframe. This ultimately led to the conclusion that it was not possible to provide a complete set of data for most ports for the year 2004, without using a wide range of rough estimates. The 2004 data was incomplete for all ports with the exception of Bremen and Hamburg. The data of these two ports is shown in the respective paragraph and the incomplete 2004 data for the other ports is displayed in the Appendix. The data collection for 2010 was more successful and resulted in a near complete set of data, containing nearly every desired figure for terminal capacity and throughput. The near complete dataset for 2010 makes it possible to conduct the market concentration analysis on the desired terminal level. The collection and performed analysis on data with such level of detail provides a deeper understanding of the mechanics behind the concentration index and helps to identify the important terminals in each port.

When a complete set of data is available for the market concentration analysis of the HLH range ports and their terminals is in place, there is one issue to be resolved. The issue concerns a conflict between the desire to calculate the concentration index for subsequent years and the lack of data availability on a terminal level. In order to overcome this issue a second analysis is performed with a different timeframe and the scope set on a higher level, the TOC level. The two market concentration analyses will determine the concentration level within the HLH range ports based on two different scopes and timeframes. The two are each handled in a different paragraph:

Chapter 4.1 - Determining the HLH range ports concentration in 2010 on a terminal level
Chapter 4.2 - Determining the HLH range ports concentration for 2008 - 2011 on the TOC's level

In both chapters the amount of concentration will be determined with the normalized Hirschmann-Herfindahl Index (H*). For the second analysis in paragraph 4.2 the Gini coefficient will also be utilized. The analyses of paragraph 4.1 and 4.2 are performed on a selection of HLH range ports that met the requirements set scope and boundaries section of the thesis. Included in the analysis are the ports of Rotterdam, Hamburg, Bremen, Antwerp, Zeebrugge and Le Havre, all surpassing the 250.000 TEU in 2010. No real criteria was set for the terminal operators within these ports, besides the availability of the data. Furthermore there are specific decisions made for each of the calculations, which will be thoroughly explained at the start of each of the two chapters.

Data collection
The data for the research was gathered from various sources such as annual reports, press releases and websites of the terminal operating companies and the port authorities. The collected figures were combined with the original data from Ilmer that provided terminal capacity data for the German ports, but overall provided the capacity per TOC for the other ports. From all the various sources that were utilized during the data gathering stage, two proved to be most valuable:

- The Dynamar (2010) "Container Volumes & Terminal Capacity in Europe"
- The thesis of van der Houwen (2011) "Benchmarking APMTR"

The Dynamar publication provided information regarding the throughput and capacity for both large and small terminals in 2009. While van der Houwen provided accurate throughput figures for the bigger terminals within the range. In the end only a few figures remained classified and were therefore calculated or estimated. Given the wide variety of sources for the data, the origin is marked and explained per table. The HLH range ports market concentration will be determined on the detailed terminal level in the next paragraph.

4.1. Determining the HLH range ports concentration in 2010 on a terminal level

The height of the market concentration in each HLH range port is determined via the normalized Hirschmann-Herfindahl Index, formula (1). This formula will be utilized for all HLH ports and the analysis will be performed on the collected terminal capacity and throughput data for 2010. The 2004 data was only found complete enough for the ports of Bremen and Hamburg and is therefore only displayed and calculated for these two. The Appendix will show all of the collected data for 2004, however no market concentration will be performed on the incomplete data.

Essential for the normalized Hirschmann-Herfindahl Index (H*) analysis is the determination of the regular Hirschmann-Herfindahl Index (HHI), which will be displayed per individual terminal and per TOC for both capacity and throughput (TEU handled) in the tables. The calculation of the HHI for the terminals is based on market share of the analyzed terminals or TOC's. The decision how to calculate and display the HHI and H* values of the larger TOC's with multiple terminals in one port is more difficult. The concentration index value of these larger TOC's can be calculated as the summation of the HHI values of the individual terminals. However this would not take into account that the decisional factor is placed at the TOC level, the TOC controls all the terminals within the analyzed port. Therefore a second method can be utilized which would concern adding all the terminal figures together and then calculate the HHI based on this computed figure. This second method provides that highlight the decisional power of the TOC, whilst providing all the data on a terminal level. Choosing one of these methods will greatly influence the HHI value of the TOC. The second method increases the size of the data and reduces the number of players. This will surely yield higher HHI figures, however the normalized H* figure is more difficult to predict. The normalizing effect will also be very strong when the large sample size of *n* (terminals) is reduced to a smaller one based on the TOC's. The two different methods of handling the TOC's with multiple terminals in one port are as follows:

Method A: First calculate the concentration index per terminal and then add these figures together to form the concentration index of the TOC.

Method B: Acknowledge that the decisional power is at the company level instead of the terminal level and compute the capacity and throughput figures per terminal and then conduct the concentration analysis at the TOC level.

Method B is found more preferable since the decisional power is considered to be at the companies, instead of at the individual terminals. Therefore most value judgments will be made on the calculations as provided by Method B. To illustrate the differences of the two methods, both are displayed in the tables that are produced per port.

The HLH range ports that are part of the analysis are each analyzed for market concentration in a separate paragraph. The tables of all ports will contain the capacity, throughput and utility rate. The difference between the forecasted terminal and/or TOC capacity forecasted by Ilmer and the registered 2010 capacity is displayed in columns labeled 'Ilm Capacity' and 'Capacity*'. Each table also shows the total throughput of containers as derived from the annual report of the respective port authority, to check if the collected data resembles the true situation. The analysis will start with the German Ports of Hamburg and Bremen, followed by Rotterdam, Antwerp, Zeebrugge and Le Havre.

4.1.1. Hamburg – Terminal figures 2004 & 2010

In the figures provided by Ilmer for the port of Hamburg contained an error for the Eurogate terminal capacity in 2004. The terminal capacity figure as provided by Ilmer was lower than the official throughput figures provided by Eurogate for 2004, 2003 and even 2002, Romke (2004). The Eurogate terminal was expanding at that point of time and it was not uncommon for terminals to operate above their designed capacity, as a result of the strong increase in container throughput. Despite considerable effort it proved impossible to retrieve the official 2004 terminal capacity from another source. In the 2004 - 2010 timeframe the throughput as recorded in the annual report has risen 17 percent or 892.257 TEU between 2004 and 2010, whilst the capacity increased with 109 percent with just above 7 million TEUs. The terminal capacity increase was therefore considerably larger than the port of Hamburg's container throughput, which was dampened by the economic crisis.

The calculated regular Hirschman-Herfindahl Index is displayed in the HHI columns and displays the amount that a terminal or operator contributes to the total HHI value of the port. The HHI forms the basis for the calculation of the normalized H* that is calculated with formula (1). The HHI and H* result of the TOC's can be calculated via the two mentioned methods (method A and B). Method B concerns the preferred method which calculates the HHI value based on the sum of the terminals. The Method A concerns the method in which all the HHI values of the individual terminals are summed. The *n* differs for each of the calculations and is therefore shown to the right. For Method B it counts the number of operators, which is three (Eurogate, HHLA and Buss Ports). For method A the number of terminals is used. For the port of Hamburg two tables are produced, one for 2004 and one for 2010.

Table 07: Detailed terminal figures Hamburg for 2004

Terminal figures Hamburg 2004								
Terminal Operator	2004 Ilm Capacity		2004 Handled	2004 Utility %	HHI 2004 Capacity	HHI 2004 Handled	H* 2004 Capacity	H* 2004 Handled
HHLA	5.220.000		4.549.000	87%	0.59	0.44	-	-
CT Burchardkai	2.600.000	(A)	2.558.000	98%	0.15	0.14	-	-
CT Altenwerder (25.1% Hapag)	1.900.000	(A)	1.266.000	67%	0.08	0.03	-	-
CT Tollerort	720.000	(A)	725.000	101%	0.01	0.01	-	-
Eurogate	1.600.000		2.273.722	142%	0.06	0.11	-	-
CT Hamburg	**1.600.000	(B)	2.273.722	142%	0.06	0.11	-	-
Buss Ports	-		-	-	-	-	-	-
Buss Hanse Terminal (multi+RoRo)	-		-	-	-	-	-	-
Total – Method B	**6.820.000**		**6.822.722**	**100%**	**0.64**	**0.56**	**0.46**	**0.33**
Annual Report - Method A			*7.003.479*		0.29	0.30	0.11	0.12

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*) The explanation of the symbols is provided below the Hamburg 2010 table

Table 08: Detailed terminal figures Hamburg for 2010

Terminal figures Hamburg										
Terminal Operator	2010 Ilm Capacity		2010 Capacity*		2010 Handled	2010 Utility %	HHI 2010 Capacity	HHI 2010 Handled	H* 2010 Capacity	H* 2010 Handled
HHLA	10.200.000		9.800.000	(A)	5.548.000	57%	0.47	0.51	-	-
CT Burchardkai	5.200.000	(Δ)	4.800.000	(^*)	2.487.000	52%	0.11	0.10	-	-
CT Altenwerder (25.1% Hapag)	3.000.000	(D)	3.000.000	(^)	2.400.000	80%	0.04	0.09	-	-
CT Tollerort	2.000.000	(D)	2.000.000	(^*)	661.000	30%	0.02	0.01	-	-
Eurogate	3.300.000		4.100.000		2.119.628	52%	0.08	0.07	-	-
CT Hamburg	3.300.000	(C)	4.100.000	(B)	2.119.628	52%	0.08	0.07	-	-
Buss Ports	-		350.000		120.000	52%	0.00	0.00	-	-
Hanse Terminal (multi+RoRo)	-	(Δ)	350.000	(Δ*)	120.000	52%	0.00	0.00	-	-
Total – Method B	**13.500.000**		**14.250.000**		**7.787.628**	**56%**	**0.56**	**0.58**	**0.33**	**0.37**
Annual Report - Method A					*7.895.736*		0.26	0.28	0.07	0.10

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A) Annual Reports of HHLA (2004, 2010)
B) Press releases Eurogate:
- http://www.eurogate.de/live/eg_site_en/eg_news_en/show.php3?id=55&nodeid=46&_language=en
- http://www.eurogate.eu/live/eg_site_en/eg_news_en/show.php3?id=251&nodeid=46&_language=en
C) Handelskammer Hamburg: http://www.hk24.de/linkableblob/367464/.6./data/Port_of_Hamburg_Facts_and_Figures_Stand_Februar_200952064-data.pdf;jsessionid=DD09AF25F1F37851A61D4FD5483F8F74.repl1
D) Port of Hamburg: http://international.hafen-hamburg.de/content/development-and-extension
^) Thesis van der Houwen – Benchmarking APMTR
^*) Combined terminal throughput in Benchmarking APMTR 3.148.000, divided by author
Δ) Dynamar – Container throughput & terminal capacity
Δ*) Estimated based on Dynamar 2009 figures
** Ilmer capacity altered

The market concentration analyses performed on the Hamburg data provided four H* results for each table. The H* value was determined for the capacity and the throughput in the port with both the method A and B for handling the TOC's with multiple terminals. The port of Hamburg is dominated by the terminal company HHLA, which is more than twice as big as its nearest competitor Eurogate. When the market concentration of the TOC's (method B) is calculated, it is observed that terminal operating companies are concerned the H* index for both throughput and capacity stays well above the 0.18 benchmark that indicates high concentration. The high market concentration is observed in both years and is a direct result of HHLA's dominance in the port. The capacity increases during the 2004 - 2010 timeframe have changed the market concentration in the port.

When the market concentration is determined for each terminal individually (method A) the 2004 index figures return in between the 0.18 and 0.10 thresholds for moderate concentration. In the analysis performed on the 2010 data, low market concentration is found for both the throughput and the capacity. The detailed terminal figures show that the Altenwerder and Burchardkai terminals add the most to the HHI and H* figures of the port. Based on the TOC data (method B) of the market concentration the capacity concentration has been reduced, whilst the throughput (handled) concentration has increased. The additional capacity that terminal enhancements provided has lowered the utility grade of the Hamburg terminals, which was too high in 2004. Ilmer provided the following statement regarding the utilization ratio: "In general, a container terminal starts getting congested when its utilization exceeds 70 percent. Utilization is the ratio between the actual throughput and the designed capacity of the terminal."

4.1.2. Bremen – Terminal figures 2004 & 2010

The container terminal capacity in Bremen is solely provided by the Eurogate terminals. Eurogate managed to increase its terminal capacity with 58 percent in the period between 2004 and 2010. The throughput in the port increased with 1.407.000 (40.6 percent) between 2004 and 2010, which is much higher than in the neighboring port of Hamburg. Like in Hamburg the growth in throughput was lower than the growth in capacity. This resulted in a lower utility grade for the port, however it also provides more room for future growth. The TOC Eurogate operates three terminals in the port of Bremen and two of them are joint-ventures with liner shipping companies. The NTB terminal is cooperation with APMT, a sister company of Maersk Line, the largest container shipping line in 2010 and operated by Eurogate. The second terminal MSC Gate is in cooperation with the second largest shipping line MSC. The throughput and capacity data for these terminals are derived from the thesis 'Benchmarking APMTR' and are slightly altered based on an official press statement of Eurogate. The press statement reported lower annual values than the 'Benchmarking APMTR' report. Since this

report is developed in cooperation with APMT, these figures are expected to be correct and therefore the MSC Gate and Eurogate throughput is reduced pro rata with 62.703 TEU.

Table 9: Detailed terminal figures Bremen for 2004

Terminal figures Bremen								
Terminal Operator	2004 Ilm Capacity	2004 Handled	2004 Utility %	HHI 2004 Capacity	HHI 2004 Handled	H* 2004 Capacity	H* 2004 Handled	
Eurogate	3.800.000	(B) 3.447.668	91%	1.00	1.00	1.00	1.00	
NTB (50% APMT)	-	-	-	-	-	-	-	
Eurogate Bremerhaven	-	-	-	-	-	-	-	
MSC Gate (50% MSC)	-	-	-	-	-	-	-	
Total – Method B	**3.800.000**	**3.447.668**	**91%**	1.00	1.00	1.00	1.00	**1**
Annual Report - Method A		*3.469.000*		1.00	1.00	1.00	1.00	3

Table 10: Detailed terminal figures Bremen for 2010

Terminal figures Bremen									
Terminal Operator	2010 Ilm Capacity	2010 Capacity*	2010 Handled	2010 Utility %	HHI 2010 Capacity	HHI 2010 Handled	H* 2010 Capacity	H* 2010 Handled	
Eurogate	6.000.000	6.900.000	(B) 4.871.297	71%	1.00	1.00	1.00	1.00	
NTB (50% APMT)	-	(^) 3.400.000	(^) 3.023.000	89%	0.24	0.39	-	-	
Eurogate Bremerhaven	-	(^) 2.000.000	(^*) 697.343	35%	0.08	0.02	-	-	
MSC Gate (50% MSC)	-	(^) 1.500.000	(^*) 1.150.954	77%	0.05	0.06	-	-	
Total – Method B	**6.000.000**	**6.000.000**	**4.871.297**	**71%**	**1.00**	**1.00**	**1.00**	**1.00**	**1**
Annual Report - Method A			*4.876.000*		0.37	0.46	0.06	0.19	3

B) Press releases Eurogate:
- http://www.eurogate.de/live/eg_site_en/eg_news_en/show.php3?id=55&nodeid=46&_language=en
- http://www.eurogate.eu/live/eg_site_en/eg_news_en/show.php3?id=251&nodeid=46&_language=en

^) Thesis van der Houwen – Benchmarking APMTR

^*) Altered figures from the Thesis of A. van der Houwen – Benchmarking APMTR

In the port of Bremen no new TOC's entered the port during the 2004 - 2010 period and therefore the unique situation persists that one operator handles all container throughput in Bremen, albeit with two joint-ventures. Resulting in full market concentration with a normalized H* index result of 1. The H* index that is determined on a terminal level (method A) was not calculable for 2004, due to the lack of data. The 2010 terminal figures indicate that there is no concentration based on the terminal capacity, whilst there is high concentration in the throughput. This is the result of the two joint-ventures capturing substantially more container traffic than the multi-user terminal under full Eurogate control.

4.1.3. Rotterdam – Terminal figures 2004 & 2010

Starting with the port of Rotterdam, the following paragraphs will only contain the Ilmer capacity for the year 2004. As a result of the poor data availability for the 2004 throughput, the data is excluded from the market concentration analysis. The incomplete throughput data gathered for 2004 is placed in the Appendix for informational purposes. The annual report figures provided by the Rotterdam port authority indicate that the annual throughput increased with 2.863 million TEUs (34 percent), from 8.282 million in 2004 to 11.145 million TEUs in 2010. Gathering the 2010 data for the TOC's proved difficult for C. Steinweg Handelsveem its terminals, as well as the total figures for the third largest TOC of the port. As a last resort the data of this considerable player is calculated as the difference between the Annual Report figures of the port authority minus the figures of the other TOC´s. The division between the two Steinweg terminals is based on the estimated 2009 figures as provided in the Dynamar report. In this report the Steinweg throughput for 2009 is estimated at: Uniport 700.000 TEU

(38.9 percent) and RST 1.100.000 TEU (61.1 percent of the total Steinweg throughput). The same percentage was utilized for the computed figures of 2010.

Table 11: Detailed terminal figures Rotterdam for 2004

Terminal figures Rotterdam				
Terminal Operator	2004 Ilm Capacity	HHI 2004 Capacity	H* 2004 Capacity	
ECT Terminals Total	6.800.000	0.72	-	
ECT Terminals	6.800.000	0.72	-	
Euromax Terminal (ECT)	-	0.00	-	
APM Terminals	1.200.000	0.02	-	
APM Terminal Delta	1.200.000	0.02	-	
Total – Method B	**8.000.000**	**0.75**	**0.49**	
Annual Report - Method A		0.75	0.49	

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Table 12: Detailed terminal figures Rotterdam for 2010

Terminal figures Rotterdam								
Terminal Operator	2010 Ilm Capacity	2010 Capacity*	2010 Handled	2010 Utility %	HHI 2010 Capacity	HHI 2010 Handled	H* 2010 Capacity	H* 2010 Handled
ECT Terminals Total	10.000.000	11.400.000	(F) 7.320.000	64%	0.45	0.43	-	-
Euromax Terminal (ECT)	2.000.000	(I) 2.300.000	(^) 1.720.000	75%	0.02	0.02	-	-
City Terminals	1.000.000	(G) 1.100.000	(^) 1.000.000	91%	0.00	0.01	-	-
Delta Terminals	8.000.000	(G) 8.000.000	(^) 4.600.000	58%	0.23	0.17	-	-
APM Terminals	1.500.000	(^) 3.519.000	(^) 2.413.000	71%	0.04	0.05	-	-
APM Terminal Delta	1.500.000	3.400.000	(H) 2.410.000	71%	0.04	0.05	-	-
C. Steinweg Handelsveem	-	(J) 2.000.000	(#) 1.412.000	71%	0.01	0.02	-	-
Uniport (ø)	-	(Δ) 1.800.000	(#) 550.000	31%	0.01	0.00	-	-
RST	-	(Δ) 1.400.000	(#) 862.000	62%	0.01	0.01	-	-
Kramer Groep	-	500.000	100.000	20%	0.00	0.00	-	-
Rotterdam Container Terminal	-	500.000	(Δ*) 100.000	20%	0.00	0.00	-	-
Interforest	-	200.000	50.000	20%	0.00	0.00	-	-
Interforest Terminal	-	200.000	(Δ*) 50.000	20%	0.00	0.00	-	-
Total – Method B	**11.500.000**	**16.919.000**	**11.145.000**	**66%**	**0.51**	**0.49**	**0.39**	**0.37**
Annual Report - Method A			*11.145.000*		0.31	0.26	0.21	0.15

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F) "More than 7 million" ECT Fast Forward Munich (May 2011)
G) ECT Focus on Brochure
H) http://www.porttechnology.org/news/apm_terminal_to_use_moerdijk_harbor_to_ease_port_of_rotterdam_traffic_conge
I) http://www.tba.nl/uploads/files/euromax,_a_new_standard_in_container_handling.pdf
J) http://www.shortsea.nl/main/news_down4.php?id=1816&language=1
ø) Hanno Terminal transferred from ownership between 2004 and 2010 from ECT to Uniport
^) Thesis van der Houwen – Benchmarking APMTR
Δ) Dynamar – Container throughput & terminal capacity
Δ*) Dynamar 2009 figures utilized for 2010
#) Calculated difference

The concentration index in the port of Rotterdam is strongly influenced by its largest terminal operator ECT. The HHI figures for the TOC's are almost primarily generated by the ECT, which is explainable by the company handling 66 percent of the ports throughput. The original data as provided by Ilmer did not include all the terminals in the port and excluded the smallest terminals. Other data than the 2004 capacity data retrieved from Ilmer proved impossible to gather. The capacity data of 2004, albeit with less terminals, does indicate a much higher market concentration than in 2010.

The throughput H* figure for the TOC's (method B) is very high for both capacity and throughput and well above 0.18 threshold. Even when the terminal operating companies are taken out of the equation and Method A is utilized for the terminal concentration index, it remains moderately concentrated. As the HHI figures clearly display, this is mostly generated by the massive Delta terminal complex at the

Maasvlakte 1. The main terminal expansion that has been performed between 2004 and 2010 is provided by the construction of the new Euromax Terminal on the Maasvlakte 1. This terminal provided the ECT and the port of Rotterdam with 1.7 million TEUs of growth in throughput and 2.3 million TEUs in capacity. The real expansions for the port of Rotterdam can be expected from the year 2013 on, when three Greenfield terminals at the Maasvlakte 2 will provide the port with just over 10 million TEU of capacity. This will strongly affect the market concentration in the port as well as the utility rate. The utility rate in 2010 is around the 70 percent utilization benchmark for most of the TOC's and terminals, although differences exist.

4.1.4. Antwerp – Terminal figures 2004 & 2010

The terminal capacity in the port of Antwerp grew strongly when the Deurganckdok became operational in 2006. The increase in TEU terminal capacity was high in Antwerp with 102 percent or 7.085 million TEU. The Antwerp port authority reported a throughput of 6.064 million TEU for 2004 and 8.468 million TEU for 2010, therefore the port throughput increased with 40 percent or 2.404 million TEUs.

Table 13: Detailed terminal figures Antwerp for 2004

Terminal figures Antwerp				
Terminal Operator	2004 Ilm Capacity	HHI 2004 Capacity	H* 2004 Capacity	*n*
PSA operated terminals	6.265.000	0.57	-	
PSA operated terminals	6.265.000	0.57	-	
P&O operated terminals	2.000.000	0.06	-	
P&O operated terminals	2.000.000	0.06	-	
Total – Method B	**8.265.000**	**0.63**	**0.27**	**2**
Annual Report - Method A		0.63	0.27	2

Table 14: Detailed terminal figures Antwerp for 2010

Terminal figures Antwerp									
Terminal Operator	2010 Ilm Capacity	2010 Capacity*	2010 Handled	2010 Utility %	HHI 2010 Capacity	HHI 2010 Handled	H* 2010 Capacity	H* 2010 Handled	*n*
PSA operated terminals	10.015.000	12.500.000	7.000.000	58%	0.68	0.69	-	-	
MSC Home Terminal (50% MSC)	-	(K) 5.400.000	(P) 4.500.000	83%	0.13	0.28	-	-	
Deurganck Terminal	-	(K) 2.600.000	(^) 288.000	11%	0.03	0.00	-	-	
Noordzee Terminal	-	(L) 2.000.000	(^) 1.360.000	68%	0.02	0.03	-	-	
Europa Terminal	-	(L) 1.700.000	(^) 375.000	22%	0.01	0.00	-	-	
Churchill Terminal	-	(Δ) 450.000	(^) 372.000	83%	0.00	0.00	-	-	
DP World	5.500.000	2.400.000	1.301.000	54%	0.03	0.02	-	-	
Antwerp Gateway	-	(Δ) 1.800.000	(^) 811.000	45%	0.01	0.01	-	-	
Delwaide dock	-	(Δ) 600.000	(^) 490.000	82%	0.00	0.00	-	-	
ICL	-	200.000	130.000	65%	0.00	0.00	-	-	
Independant container line	-	(Δ) 200.000	(Δ) 130.000	65%	0.00	0.00	-	-	
Total –Method B	**15.515.000**	**16.500.000**	**8.431.000**	**58%**	**0.71**	**0.71**	**0.56**	**0.57**	**3**
Annual Report - Method A			*8.468.000*		0.21	0.33	0.10	0.23	*8*

K) PSA International website
L) PSA International presentation – Filip Merckx (2006)
M)Ninneman (2006) http://www.port-net.net/activities/pdf/ninnemann_bpt_container_09052006.pdf
N) Cosco Annual Report – Container Terminals (2005)
P) Minimum efficient scale of terminal (Notteboom 2010)
Q) http://www.internationalpsa.com/psanews/pdf/nr050613_antwerp.pdf
Δ) Dynamar – Container throughput & terminal capacity
^) Thesis A. van der Houwen – Benchmarking APMTR

The port of Antwerp is dominated by PSA, the largest operator in the port of Antwerp. The dominance of PSA is prominently visible in the determination of the concentration index for 2010. The TOC market concentration as calculated with Method B indicates normalized H* figures of 0.59 and 0.57 are well above the 0.18 threshold and indicate strong market concentration within this port's boundaries. When the normalized H* index is calculated for the individual terminals in 2010, the throughput figure still indicates high concentration, as a result of the large MSC home terminal. The terminal based capacity H* is lower and signals for moderate concentration. This indicates that the terminal throughput is more concentrated at a couple terminals than the terminal capacity. When the 2004 capacity figures of Ilmer are compared with the 2010 capacity figures the lack of the ICL terminal becomes visible. When the 200.000 TEU large terminal would have also been included in the analysis of Ilmer, it would have changed the H* capacity number in 2004 to 0.41. This would still indicate a strong rise of the capacity market concentration in the 2004 - 2010 period.
In the 2004 - 2010 timeframe the MSC Home Terminal was expanded and new terminals were constructed at the Deurganckdok. The new container terminal of PSA is named the Deurganck Terminal and DP World's terminal is named the Antwerp Gateway. The Deurganckdok is not troubled by the tidal locks that are present in other areas of the port and can receive the world's largest container vessels When fully completed and all terminals are utilized, the Deurganckdok can handle an estimated at 7-8 million TEU of throughput per year. This however did not instigate a big shift of throughput from the older terminals towards the two new Deurganckdok terminals. As a result of the added terminal capacity the utility rate dropped from a high 82 percent in 2004 to 58 percent in 2010.

4.1.5. Zeebrugge – Terminal figures 2004 & 2010

The throughput in Zeebrugge has risen from 1.196.755 million to 2.500.000 million, growing with 109 percent or 1.303.245 million TEUs. Noteworthy is also that Zeebrugge did not see a drop in container throughput in 2009, whilst the other ports lost serious amounts of throughput in that year. Within the 2004-2010 timeframe the Zeebrugge port authority intervened and cancelled the Flanders terminal long-term lease agreement, after years of underutilization. The port authority granted the concession to APM Terminals, which after some construction planned to handle its first vessel in May 2006 (apmterminals.com, 2006). The Zeebrugge port has a large sum of RoRo (Roll on Roll off) container throughput that cannot be linked to the dedicated container terminals. The port is specialized in the unaccompanied transport of trucks and 45 foot containers.

Table 15: Detailed terminal figures Zeebrugge for 2004

Terminal figures Zeebrugge			
Terminal Operator	2004 Ilm Capacity	HHI 2004 Capacity	H* 2004 Capacity
Flanders container terminal	1.000.000	0.50	-
Flanders container terminal	1.000.000	0.50	-
PSA Terminals	1.000.000	0.50	-
OCTHZ	1.000.000	0.50	-
Total – Method B	**2.000.000**	**0.50**	**0.00**
Annual Report - Method A		0.50	0.00

n
2
2

Table 16: Detailed terminal figures Zeebrugge for 2010

Terminal figures Zeebrugge								
Terminal Operator	2010 Ilm Capacity	2010 Capacity*	2010 Handled	2010 Utility %	HHI 2010 Capacity	HHI 2010 Handled	H* 2010 Capacity	H* 2010 Handled
APM Terminals	2.000.000	1.000.000	562.000	56%	0.29	0.09	-	-
APMT Zeebrugge (25% SIPG)	2.000.000	(^) 1.000.000	(^) 562.000	56%	0.29	0.09	-	-
PSA	1.000.000	1.700.000	966.000	57%	0.21	0.15	-	-
PSA ZIP	-	600.000	-	-	0.03	0.00	-	-
PSA CHZ (35% CMA CGM)	1.000.000	1.100.000	(^) 966.000	88%	0.09	0.15	-	-
RoRo Total		-	936.000	-	-	0.15		
RoRo – P&O Ferries		-	(*) 234.000	-	0.00	0.01	-	-
RoRo – DFDS		-	(*) 234.000	-	0.00	0.01	-	-
RoRo – Searo		-	(*) 234.000	-	0.00	0.01	-	-
RoRo – Ico Terminals		-	(*) 234.000	-	0.00	0.01	-	
Total – Method B	**3.000.000**	**2.700.000**	**2.500.000**	**64%**	**0.53**	**0.35**	**0.07****	**0.03**
Annual Report - Method A			*2.500.000*		0.35	0.24	0.03**	0.11

n
2 or 3
3 or 7

^) Thesis A. van der Houwen – Benchmarking APMTR

*) Calculated average

**) For the capacity H* calculation different *n* is used, as explained in the text.

Determining the concentration index for the port of Zeebrugge is difficult since about 37 percent of the throughput is provided by the RoRo activities of the port, of which no data could be retrieved. For the HHI and H* index however it does make a big difference how these RoRo figures are utilized within the calculation, are they equally divided over the RoRo terminals or taken at once under the unaccounted category. The Ilmer TOC capacity data excluded the RoRo terminals for 2004 and thereby provides a situation of a totally equal distribution of the TOC capacity. The 2010 dataset is included with the newly constructed Zeebrugge International Port (ZIP) terminal and with the estimated data of the RoRo terminals. The TEU capacity of the RoRo facilities is however unknown and should therefore be utilized with a different *n* in the H* analysis. For the TOC capacity analysis the *n* is two, whilst for the TOC handled analysis the *n* is three. The terminal based analysis (method A) also makes use of different sample size figures resulting in a capacity *n* of three and a throughput *n* of seven.

The large percentage of unaccounted throughput and capacity provides this analysis with a lot of variables and difficult decisions. The two different methods of analysis in this case provide the difference between handling the RoRo terminals as one big unaccounted pool of data or utilize each RoRo terminal as a separate 'TOC' and equally divide the amount of TEUs. The downside of the equal division of the RoRo container throughput is that it lowers the concentration index. The port of Zeebrugge explains that using a different method of accounting for the RoRo figures could therefore result in the difference between low market concentration and moderate market concentration. Provided the fact that up till 2010 none of the dedicated TOC's is in a dominating position, the market concentration is regarded low. The remark is provided that with more complete data the TEU throughput could reach the minimum requirement for moderate market concentration.

The latest and potentially largest addition for Zeebrugge is the PSA terminal called Zeebrugge International Port (ZIP). The first phase of this terminal became operational at the end of 2010 and when fully completed the terminal has a designed maximum handling capacity of 1.5 million TEUs. The takeover of the struggling Flanders terminal by APMT also provided a positive contribution to the port its growth in throughput.

4.1.6. Le Havre – Terminal figures 2009

The terminals in the port of Le Havre can be split into two parts, the established terminals in the North and the Port 2000 terminals in the South. Data collection proved very difficult for the Le Havre based TOC's and terminals. The article of Ilmer also lacked any data regarding the Le Havre TOC capacity in 2004 or the forecasted capacity for 2010. Therefore the only option proved to be utilizing the 2009 figures provided by Dynamar (2010). In the port of Le Havre there are more joint-ventures active than in the other ports. The Dynamar report provided the information regarding the following TOC's:

- CNMP – Compagnie Nouvelle de Manutention Portuaire, a family owned company;
- GMP – Generale de Manutention Portuaire, a subsidiary of PortSynergie, which is a joint-venture (50/50 percent) between CMA CGM and DP World;
- Societe des Terminaux Normandie (TN), a subsidiary of Perrigault, TN also has a joint-venture with MSC called TN MSC;
- Terminal Porte Oceane (TPO) a joint venture of Perrigault with APM Terminals

The port of Le Havre handled 2.150 million TEUs in 2004, a number that increased to 2.356 million TEUs in 2010. The port of Le Havre therefore reported a modest growth of 206.000 TEU or 9.58 percent over this time period. The throughput for 2009 was published as 2.241 million TEU for the port of Le Havre. The Dynamar estimates are almost 400.000 higher than the official annual report figures, however since these are the only detailed figures found, the data is used regardless of this deviation. The list above shows that the Perrigault group is active with the APMT joint-venture TPO, as well as the MSC joint-venture Termineaux Normandie. Although these joint-ventures both include Perrigault, the decision is made to report them separately, because the joint-ventures involve different liner shipping companies. Within the 2004 - 2010 timeframe the capacity of the port increased with 136 percent as the result of the Port 2000 expansion project.

Table 17: Detailed terminal figures Le Havre 2009

Terminal figures Le Havre							
Terminal Operator	2009 Capacity*	2009 Handled	2009 Utility %	HHI 2009 Capacity	HHI 2009 Handled	H* 2009 Capacity	H* 2009 Handled
CNMP	845.000	443.000	52%	0.03	0.03	-	-
Terminal d' Atlantique	(Δ) 650.000	(Δ) 290.000	45%	0.02	0.01	-	-
Quai des Ameriques (50/50 GMP, CNMP)	(Δ) 195.000	(Δ) 153.000	78%	0.00	0.00	-	-
GMP	1.778.333	1.071.000	60%	0.15	0.17	-	-
Quai des Ameriques (50/50 GMP, CNMP)	(Δ) 195.000	(Δ) 153.000	78%	0.00	0.00	-	-
North Terminal – Quai de l'Europe	(Δ) 250.000	(Δ) 140.000	56%	0.00	0.00	-	-
øTerminal de France (50% CMA CGM)	(Δ*) 1.333.333	(Δ) 778.000	58%	0.08	0.09	-	-
Terminaux Normandie – Perrigault	1.450.000	755.000	52%	0.10	0.10	-	-
L' Ocean (50% MSC)	(Δ) 1.000.000	(Δ) 680.000	68%	0.05	0.07	-	-
Normandie (L'Asie and d'Osaka)	(Δ) 450.000	(Δ) 75.000	17%	0.01	0.00	-	-
Perrigault	544.000	346.000	68%	0.01	0.02	-	-
øPorte Oceane (50% APMT)	544.000	(Δ) 346.000	68%	0.01	0.02	-	-
Total – Method B	**5.073.333**	**2.615.000**	**40%**	**0.29**	**0.30**	**0.06**	**0.06**
Annual Report - Method A*		2.241.000		0.06	0.06	0.06	0.08

n
4
8

Δ) Dynamar – Container throughput & terminal capacity

Δ*) Deviation from Dynamar data , author's figures used

ø Located in Port 2000

** Instead of the Annual report , the Rotterdam port statistics data is utilized.*

The port of Le Havre is the only port in the range in which no real difference is seen between the normalized H* index calculated for the TOC's and the individual terminals. The normalized H* figures only marginally differ between 0.06 and 0.08. All four numbers signal for low market concentration, indicating that both capacity and throughput figures are evenly distributed in the port of Le Havre. The Port 2000 expansion project provided the port of Le Havre with necessary terminal space, since it was working at maximum capacity in 2004. This is confirmed by the press statement that explains that additional quay equipment was brought in to reach the throughput of 2.150.000 TEUs, Giron-Urquiola (2005). The Port 2000 expansion provided 4 million TEU divided in 12 berths, resulting in a maximum capacity per berth of 333.333 TEU, Dayasena (2009). The large number of joint-ventures and the lack of a dominant player make the port of Le Havre a special port within this analysis. These two features would provide the port of Le Havre with a high amount of equal competition, the growth has however been modest in the 2004 - 2010 timeframe. It is therefore very regrettable that the data availability is very low for the port of Le Havre.

4.1.7. Conclusion

The economic crisis affected global trade and resulted in a drop in throughput in 2009 and slowed down the growth of the TEU throughput in the subsequent years. This resulted in a deviation between the originally forecasted throughput and the actual throughput. The terminal expansions or Greenfield terminal projects that were planned or already commenced have in most cases been continued, regardless of the lower throughput due to the economic crisis. The lowered utility grade at most ports is the result of the deviation between the increased terminal capacity and the TEU throughput that is lower than previous forecasts.

Detailed terminal throughput and capacity information of the HLH range ports was needed for the market concentration calculation on the terminal level. Gathering accurate terminal information on such a high level of detail proved to be very difficult in this highly competitive industry and might be one of the reasons why such a detailed analysis has not been performed before. The normalized Hirschmann Herfindahl Index was utilized to determine the market concentration for each of the HLH ports in this chapter. For the ports that had one or multiple TOC's that operated more than one terminal in a port, two methods were applied to calculate normalized H* index value. From the two methods named A and B, the latter was preferred since this took into account the decisional power at the TOC. When method B calculated the H* all ports noted very high amounts of market concentration for throughput and capacity, with the sole exception of Le Havre. The HHI and H* results are displayed in the next table.

Table 18: The 2010 HLH range normalized concentration index calculated per TOC (Method B)

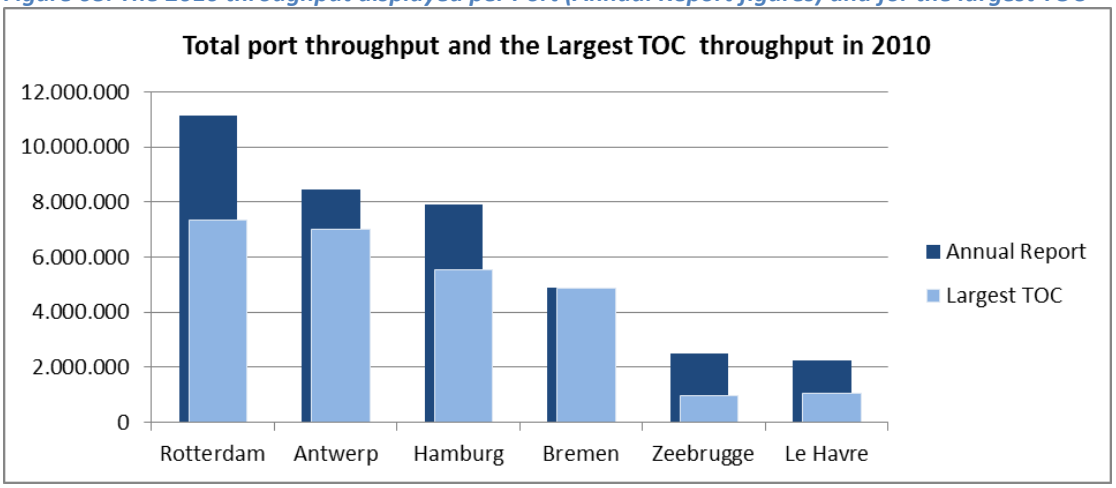
Terminal Operating Companies - Normalized Concentration index - 2010							TOC figures 2004	
	Hamburg	Bremen	Rotterdam	Antwerp	Zeebrugge	Le Havre*	Hamburg	Bremen
HHI - capacity	0.56	1.00	0.52	0.61	0.35	0.29	0.64	1.00
HHI - throughput	0.58	1.00	0.49	0.74	0.34	0.30	0.56	1.00
H*- capacity	0.33	1.00	0.39	0.41	0.24	0.06	0.46	1.00
H*- throughput	0.37	1.00	0.37	0.57	0.21	0.06	0.33	1.00
n – # of TOC's	**3**	**1**	**5**	**3**	**6**	**4**	**3**	**1**

Source: Own calculations

The difficulties at the data gathering stage resulted in an incomplete dataset for 2004 and only Hamburg and Bremen were evaluated as complete enough to be analyzed. In Hamburg the non-dominant TOC Eurogate expanded its terminal between 2004 and 2010. This lowered the capacity H* in the port of Hamburg from 0.46 in 2004 to 0.33 in 2010. The H* calculation for the throughput per TOC has grown in the same period from 0.33 to 0.37. This indicates that although the terminal capacity would allow for a more leveled distribution of competition, e.g. less market concentration, the opposite has occurred. The largest terminal operator HHLA managed to attract more cargo, resulting in a higher throughput H* index figure for Hamburg. For all the HLH range ports the H* figures displayed in the blue rows are well above the 0.18 benchmark that indicates high concentration.

With the exception of Le Havre almost all ports had one TOC that was considerably larger than its competitors, which often operated multiple terminals. The figure below displays the Annual throughput in TEU for the port and its largest TOC. The visual representation shows that a large amount of throughput can be accounted for by the large TOC, leading to high H* values.

Figure 08: The 2010 throughput displayed per Port (Annual Report figures) and for the largest TOC



Largest TOC: Rotterdam – ECT, Antwerp – PSA, Hamburg – HHLA, Zeebrugge – PSA, Le Havre – GMP
Source: Previous tables

The concentration index per terminal (Method A)

Method A calculates the concentration effect of each terminal within the port regardless of the TOC. The HHI values belonging to one TOC are then summed to form the HHI value of that TOC. The H* value is then determined from the summation of all terminal HHI's or the summation of the HHI of the TOC's, which is in this case exactly the same. Calculating the H* index value with method A therefore disregards the market concentration and power that a TOC has when it operates all these terminals. This calculation disregards the before mentioned decisional power of the TOC. On the other hand Method A makes better use of the detailed terminal figures. As a result of this different calculation the HHI values are lower, but the number of terminals and therefore the *n* is larger. The larger *n* makes sure that normalizing effect is less severe, bringing the HHI and H* result closer together. Interesting with regards to the results is that this method of summing the terminal figures still yields values that signal for moderate or even high concentration, as is displayed in the table below.

Table 19: The 2010 HLH range normalized concentration index calculated per terminal (Method A)

Terminals (Method A) - Normalized Concentration index - 2010							TOC figures 2004	
	Hamburg	Bremen	Rotterdam	Antwerp	Zeebrugge	Le Havre*	Hamburg	Bremen
HHI - capacity	0,26	0,37	0,31	0,21	0,35	0,29	0,29	-
HHI - throughput	0,28	0,46	0,26	0,33	024	0,30	0,30	-
H*- capacity	0,07	0,06	0,21	0,10	0,24	0,06	0,11	-
H*-throughput	0,10	0,19	0,15	0,23	0,11	0,06	0,12	-
n - # of terminals	**5**	**3**	**8**	**8**	**7**	**4**	**5**	**3**

Source: Own calculations

The high levels of market concentration that are found with the terminal based calculation are explainable for the ports of Rotterdam and Antwerp. The port of Rotterdam provides a high capacity H* figure as the result of the large Delta terminal complex and in Antwerp the high throughput H* can be explained by the large MSC Home terminal. No real trend can be found amongst the HLH range ports regarding the H* distribution of this calculation method. The market concentration calculated by method A is significantly lowered, but still moderate to high market concentration is found at the throughput of four out of the total six ports. In the case of the terminal capacity moderate to high market concentration is determined in two out of six ports.

The bottom line conclusion is that the HLH range ports provide very high levels of market concentration on the level of the TOC's (method B), with the exception of the port of Le Havre. The market concentration analysis on the level of the TOC's provided the best representation of the market concentration. The analysis is however merely performed on one dataset and for more conclusive results an analysis of multiple years is required. In the upcoming chapter, chapter 4.2, the market concentration for the HLH range TOC's throughput is determined for the years 2008 - 2011.

The tables that provided the terminal information in this chapter also highlighted whether a terminal was part of a joint-ventures and shareholdership agreement. The container shipping lines have taken interest in the terminal operations resulting in a growing number of cross industry partnerships. This vertical integration of the liner shipping companies is increasingly witnessed in the HLH range and is further discussed in chapter 4.3.

4.2. Determining the HLH range ports concentration from 2008 - 2010 on a TOC level

The previous model covering the years 2004 and 2010 provided difficulties regarding the accurate collection of terminal figures. The desire remained to cover a sequence of years and especially a sequence that also covered 2009, the year that the container industry was hit hard by the economic crisis. In this chapter a second concentration analysis is performed that solely focusses on the TOC's and the throughput figures of these TOC´s in the 2008 - 2011 period. This second analysis will be performed on each year in the 2008 - 2011 timeframe. The altered scope improves the data availability for the market concentration analysis. The capacity of the TOC's is not part of this second analysis, since the data proved hard to collect and also because terminal expansions occur infrequently, adding large amounts of capacity in one time. The strength of this analysis lays in the four year time series, which also enable the utilization of the Gini coefficient analysis, another instrument of identifying market concentration. The results of the Gini calculations, the Gini coefficients are similar to the normalized H* index result. The Gini coefficient ranges from 0 to 1, with 0 being full competition with all players having the exact same throughput and 1 being a single firm completely dominating the market. On that zero to one scale there are no bandwidths set for the Gini coefficient like there are for the H* calculation, no bandwidths for low, moderate or high concentration. The Gini coefficient is calculated with the following formula:

$$G = \left| 1 - \sum_{i=0}^{N} (\sigma Y_{i-1} + \sigma Y_i)(\sigma X_{i-1} + \sigma X_i) \right| \quad (2)$$

The now familiar normalized H* analysis will also be used to determine the market concentration in each of the HLH range ports for the 2008 - 2011 timeframe. The data will also be displayed per port and in contrast with the previous paragraph the origins of the figures are not provided for every data point. Since most TOC throughput data is easily found on the websites and in the annual report of the companies themselves, only the exceptions are marked and explained.

4.2.1. Hamburg

In Hamburg the terminal operators of HHLA, Eurogate and Buss Ports are active. The terminal information of the Buss Ports company proved hard to find and therefore estimates were made based on the overall throughput of the port. The Annual Report row of the table displays the annual report figures that are derived from the port authority. In most cases the difference between the annual report figures and the figures gathered per TOC is small. This indicates that the data gathering phase proved successful and almost exactly the same data as provided by the port authority was retrieved for all TOC's. The total row shows the HHI values for the port in the given years, whilst the Annual Report row shows the H* figures. In chapter 4.1. much effort has been put in listing the various sources of the diverse sources this is not performed for this chapter. For this second analysis of the market concentration the exceptions are listed and therefore a figure its source is explained when it is not directly derived from the TOC. In the port of Hamburg the TOC throughput figures are provided by HHLA and Eurogate for the entire 2008 - 2011 period. For Buss Ports the data is partially provided but mostly estimated.

Table 20: Hamburg terminal figures 2008 - 2011

Terminal figures Hamburg 2008 - 2010								
Terminal Operator	2008	2009	2010	2011	2008 HHI	2009 HHI	2010 HHI	2011 HHI
HHLA	6.913.300	4.900.000	5.548.000	6.769.000	0.50	0.47	0.51	0.57
Eurogate	2.690.636	2.138.103	2.119.628	2.054.421	0.08	0.09	0.07	0.05
Buss Ports	(*) 130.000	(Δ) 100.000	(*) 120.000	(*) 130.000	0.00	0.00	0.00	0.00
Total	9.733.936	7.118.103	7.787.628	8.953.421	0.58	0.56	0.58	0.62
Annual Report + H* figures	**9.737.110**	**7.007.704**	**7.895.736**	**9.014.165**	**0.37**	**0.35**	**0.37**	**0.44**

n
3

Δ) Dynamar – Container throughput & terminal capacity

*) Estimated figure

In Hamburg the largest terminal operator HHLA has increased its position in the port based on the figures displayed in the table above. The crisis year of 2009 provided a year in which Eurogate managed to increase its market share and HHI figure. This resulted in a lower normalized H* index for the port of Hamburg in the year 2009. The lowered market concentration was only short lived, since the 2010 and 2011 throughput figures and the HHI figures reveal that HHLA strongly increased in these years. The dominating position of HHLA results in very high market concentration percentages, well above the 0.18 threshold for high competition.

The normalized Hirschmann-Herfindahl calculation is followed by the determination of the Gini coefficient, based on the above displayed TOC throughput figures. For the port of Hamburg all the steps that are taken to generate the Gini coefficient are fully displayed. Since this involves large tables the summary is placed for all ports but Hamburg and the detailed tables are displayed in the Appendix. In the Gini calculation the X represents one terminal operator, divided by the total number of terminal operators (Hamburg = 3), resulting in 1/3 for every TOC. The numbers for Y are derived from the terminal operators throughput, divided by the total throughput. Used for this calculation is the summation of the gathered throughput figures per TOC, not the annual report figures.

Table 21: Gini coefficient for Hamburg 2008 - 2011

Gini coefficient Hamburg – 2008 & 2009											
Operator.	X	Y 2008	σX	σY 2008	$\sigma X_{i-1} - \sigma X_i$ (B)	$\sigma Y_{i-1} + \sigma Y_i$ (A) 2008	A*B 2008	Y 2009	σY 2009	$\sigma Y_{i-1} + \sigma Y_i$ (A) 2009	A*B 2009
Eurogate	0,333	0,28	0,33	0,28	0,33	0,28	0,09	0,30	0,30	0,30	0,10
HHLA	0,333	0,71	0,67	0,99	0,33	1,26	0,42	0,69	0,99	1,29	0,43
Buss Ports	0,333	0,01	1,00	1,00	0,33	1,99	0,66	0,01	1,00	1,99	0,66
Total							**1,18**				**1,19**

Gini coefficient Hamburg – 2010 & 2011											
Operator.	X	Y 2010	σX	σY 2010	$\sigma X_{i-1} - \sigma X_i$ (B)	$\sigma Y_{i-1} + \sigma Y_i$ (A) 2010	A*B 2010	Y 2011	σY 2011	$\sigma Y_{i-1} + \sigma Y_i$ (A) 2011	A*B 2009
Eurogate	0.333	0.27	0.33	0.27	0.33	0.27	0.09	0.23	0.23	0.23	0.08
HHLA	0.333	0.71	0.67	0.98	0.33	1.26	0.42	0.87	1.10	1.33	0.44
Buss Ports	0.333	0.02	1.00	1.00	0.33	1.98	0.66	0.02	1.12	2.21	0.74
Total							**1.17**				**1.26**

Hamburg 2008 Gini coefficient: $G = |1 - 1.18| = 0.18$

Hamburg 2009 Gini coefficient: $G = |1 - 1.19| = 0.19$

Hamburg 2010 Gini coefficient: $G = |1 - 1.17| = 0.17$

Hamburg 2011 Gini coefficient: $G = |1 - 1.26| = 0.26$

The Gini coefficient analysis for Hamburg therefore fluctuates between 0.17 and 0.26 and especially the last year it showed a sharp increase. The same increase was visible in the HHI and H* index for 2011 and can be explained by the sharp increase in throughput of the dominant player HHLA. Unlike the normalized H* figures, the Gini coefficient signals that the least amount of competition is in 2010, where the H* calculation pointed out the year 2009. Provided that HHLA increased its year on year throughput in 2010 and Eurogate lost throughput in 2010, the result should have been a more concentrated port in 2010. In that case the values of the normalized Hirschmann-Herfindahl Index (H*) appears to be drawing a better conclusion.

4.2.2. Bremen

The concentration index figures for Bremen are relatively straightforward, the HHI shows 1.00 and the H* index provides the figure of 0.00. The normalized Hirschmann Herfindahl Index therefore indicates perfect division amongst the players, since there is only one. Therefore this figure should be interpreted as 1.00 or full competition, since the entire port is controlled by one company.

Table 22: Bremen terminal figures 2008 - 2011

Terminal figures Bremen 2008 - 2010								
Terminal Operator	2008	2009	2010	2011	2008 HHI	2009 HHI	2010 HHI	2011 HHI
Eurogate	5.500.709	4.535.842	4.871.297	5.900.341	1.00	1.00	1.00	1.00
Total	5.500.709	4.535.842	4.871.297	5.900.341	1.00	1.00	1.00	1.00
Annual Report + H* figures	**5.448.000**	**4.579.000**	**4,888,655**	**5,915,487**	**0.00**	**0.00**	**0.00**	**0.00**

n
1

Table 23: Gini coefficient for Bremen 2008 - 2011

Gini Coefficient Bremen				
	2008	2009	2010	2011
Bremen	0.000	0.000	0.000	0.000

The Gini coefficient calculation provides the same result as the H* Index, a perfect distribution of the throughput, full equality in the 1 player market. Therefore should be interpreted as the other side of the spectrum, full market concentration.

4.2.3. Rotterdam

Data gathering of the small and mostly local TOC's often proved to be the most difficult, this is also the case in the port of Rotterdam. For the smaller operators like the Kramer Groep and the multi-functional terminal of Interforest it was very difficult to derive the TEU throughput for the desired number of years. These figures are therefore estimated and since these smaller terminal operators do not strongly affect the concentration index this is a good solution. Excluding these operators from the analysis is however a completely different story. Reducing the sample size has a big effect on the normalized H* index, since it increases the normalizing effect.

For the port of Rotterdam a substantial part of the figures are derived from the Dynamar Report. In general this report provided good explainable figures and estimations for most ports, terminals and TOC's, that were in line with other sources. An exception was found in the 2009 throughput of APM Terminals that was said to be 1.800.000 TEU, while the official press statement states 2.400.000 TEU (apmterminals.com, 2010b). The official APMT figures are therefore 600.000 TEU higher and since the total TEU amount for the Port of Rotterdam is almost the same in the Dynamar report simply raising the APMT number would create a deviation elsewhere. The Dynamar report provides the only source

of data for the Steinweg terminal and TOC figures. No other sources than the Dynamar estimates for 2009 were available and could therefore not be cross referenced. The Dynamar report estimated the 2009 throughput as 1.1 million TEU for the Rotterdam Shortsea Terminal (RST) and 700.000 TEU for the Uniport Terminals. Although this is not the preferred course of action, the estimated Steinweg figures were lowered with the 600.000 TEU that was found to be incorrect at the APMT figures. The Steinweg TOC figures were also unknown for 2008, 2010 and 2011, these are therefore utilized as calculated estimates. These figures are produced with great consideration since the throughput of the Steinweg company is high enough to influence the concentration results.

The dominance of ECT Terminals in the port of Rotterdam provided a high level of market concentration in the previous analysis. In the 2008 - 2011 timeframe the market concentration of the port hovers around the highly concentrated 0.32 index figure, with a peak in 2010. The table clearly displays that the dominant ECT Terminals adds the most to the HHI and therefore H* of the port.

Table 24: Rotterdam terminal figures 2008 - 2011

Terminal figures Rotterdam 2008 - 2010								
Terminal Operator	2008	2009	2010	2011	2008 HHI	2009 HHI	2010 HHI	2011 HHI
ECT Terminals	6.300.000	6.000.000	7.320.000	7.500.000	0.35	0.38	0.43	0.40
APM Terminals	2.600.000	(Δ*) 2.400.000	2.413.000	2.700.000	0.05	0.06	0.05	0.05
C. Steinweg Handelsveem	(*) 1.500.000	(Δ*) 1.200.000	(*) 1.412.000	(*) 1.500.000	0.02	0.02	0.02	0.02
Kramer Groep	(*) 150.000	(Δ) 100.000	(*) 100.000	(*) 125.000	0.00	0.00	0.00	0.00
Interforest	(*) 50.000	(Δ) 50.000	(*) 50.000	(*) 75.000	0.00	0.00	0.00	0.00
Other								
Total	10.600.000	9.750.000	11.145.000	11.900.000	0.42	0.45	0.49	0.46
Annual Report + H* figures	***10.784.000***	***9.743.000***	***11.145.000***	***11.900.000***	***0.27***	***0.32***	***0.37***	***0.33***

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Δ) Dynamar – Container throughput & terminal capacity

Δ*) Dynamar – Container throughput & terminal capacity, altered

*) Estimated figure

Table 25: Gini coefficient for Rotterdam 2008 - 2011

Gini Coefficient Rotterdam				
	2008	2009	2010	2011
Rotterdam	0.564	0.583	0.618	0.586

The Gini coefficient shows an increasing pattern from 2008 – 2010 and then a drop in 2011, it is exactly in line with the H* results. When the Gini and H* numbers are compared with the port of Hamburg it is interesting that the H* figures of 2010 are exactly the same. This is not the case with the Gini coefficient, which is not producing the same numbers in both ports. In Rotterdam the Gini coefficient is 0.618, whilst in Hamburg it is 0.117. Since these numbers are both on a zero to one scale the Gini coefficient indicates that the market concentration is much higher in Rotterdam than in Hamburg. The difference seems to be made in the number of players that are in the two ports. In Rotterdam the ECT is dominating the other four TOC's and in Hamburg HHLA dominates two.

4.2.4. Antwerp

The terminal operators of PSA and DP World did not always report their exact throughput for a specific port in a given year, often the figures for an entire region, continent or even only the global throughput figures were communicated. For DP World and PSA the official throughput figures for 2010, 2009 and 2007 (outside of scope) were recovered. Based on the throughput figures of these three years and the annual throughput provided by the port authorities, the figures for 2008 and 2011 were determined as calculated estimates. In the years that the data of PSA was provided, the market percentage was determined. This resulted in a for PSA almost stable, but slightly lowering trend of the throughput percentage. This started with 85.7 percent of the port's throughput in 2007, 83.5 percent in 2009 and 83 percent in 2010. The figures of 2008 and 2011 are estimated based on these three figures and are 83.7 percent for 2008 and 82 percent for 2011. The TEU throughput is calculated as the percentage computed with the annual report figures and after the PSA figures were in place, calculated estimates were made for the DP World and ICL figures.

The port of Antwerp has one real dominant player that based on the market share is even more dominant than the leading TOC in the ports of Hamburg and Rotterdam. The dominance of PSA in Antwerp also remains relatively constant over the years. In the detailed terminal analysis in 2010 it was uncovered that the terminals of DP World have quite some unutilized capacity, if fully utilized the concentration index can significantly be lowered in Antwerp.

Table 26: Antwerp terminal figures 2008 - 2011

Terminal figures Antwerp 2008 - 2010								
Terminal Operator	2008	2009	2010	2011	2008 HHI	2009 HHI	2010 HHI	2011 HHI
PSA-HNN	(†) 7.250.000	(Δ) 6.100.000	7.000.000	(†) 7.100.000	0.70	0.67	0.68	0.67
DP World	(†) 1.200.000	(Δ) 1.200.000	1.301.000	(†) 1.400.000	0.02	0.03	0.02	0.03
ICL - Independent Maritime Terminal	(†) 200.000	(Δ) 130.000	(†) 167.000	(†) 170.000	0.00	0.00	0.00	0.00
Total	8.650.000	7.430.000	8.468.000	8.670.000	0.72	0.70	0.71	0.70
Annual Report + H* figures	***8.663.736***	***7.309.639***	***8.468.000***	***8.664.243***	***0.58***	***0.55***	***0.57***	***0.55***

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3

Δ) Dynamar – Container throughput & terminal capacity

†) Calculated estimate

Table 27: Gini coefficient for Antwerp 2008 - 2011

Gini Coefficient Antwerp				
	2008	2009	2010	2011
Antwerp	0.543	0.536	0.543	0.533

The Gini coefficients of Antwerp are exactly in line with the H* figures of the port, they both indicate a slight lowering trend of market concentration. When the two results are compared with the port of Rotterdam the H* values are higher in Antwerp, suggesting a more concentrated port of Antwerp. The Gini coefficients however signal the opposite a lesser concentrated port of Antwerp. The results of the H* index and the Gini coefficient have been different in all of the three ports and the Gini coefficient has been questioned in the past paragraphs. The fact that the Gini coefficients of Antwerp with its strongly dominating PSA-HNN are lower than Rotterdam is decisive. In 2011 the Antwerp based PSA-HNN is about five times larger than its next competitor DP World, whilst in Rotterdam ECT is only 2.7 times larger than APM Terminals. In Rotterdam there is also a third medium sized competitor in the form of Steinweg. When compared the analysis should indicate that there is more competition and less concentration in Rotterdam. The H* value confirms that statement, whilst the Gini signals for the

opposite. The H* calculation is therefore regarded as more plausible and preferable than the Gini coefficient.

4.2.5. Zeebrugge

In the Port of Zeebrugge the RoRo figures that influenced the first analysis, tend to do the same in the analysis for multiple years. The total number of the unaccounted group of TEUs that fall in the RoRo category, are dropping based on the 2008, 2009 and 2010 data. This results in a growing number of TEUs being handled by the dedicated container terminals. The 2010 annual report of PSA provided the figure reported as 'over 1 million TEU' throughput in 2010, the PSA introduction website provided the 2011 figure of 0.891 million TEU (psa-zeebrugge.be, 2012). Regrettably the 2011 throughput numbers for APM Terminals were not retrieved, the 2012 throughput was retrieved however. The 2012 throughput was reported as a lot lower than the 2010 numbers, at 576.000 TEU, APM Terminals (2013). The calculated estimate for the APMT figures in 2011 is placed right in between these figures at 650.000 TEU. The throughput development in the measured timeframe is different in Zeebrugge than in the previous ports. The port of Zeebrugge was the only port that handled more TEUs in 2009 than in 2008. It is however also the only port that recorded a loss of throughput in 2011.

Table 28: Zeebrugge terminal figures 2008 - 2011

Terminal figures Zeebrugge 2008 - 2010												
Terminal Operator	2008		2009		2010	2011		2008 HHI	2009 HHI	2010 HHI	2011 HHI	
APM Terminals	(Δ)	685.000	(Δ)	550.000	749.000	(†)	650.000	0.10	0.06	0.09	0.09	
PSA	(A)	608.785	(Δ)	932.000	1.000.000	(B)	891.000	0.08	0.16	0.16	0.16	
RoRo - P&O Ferries	(†)	228.983	(†)	211.458	(†) 187.689	(†)	170.250	0.01	0.01	0.01	0.01	
RoRo - DFDS	(†)	228.983	(†)	211.458	(†) 187.689	(†)	170.250	0.01	0.01	0.01	0.01	
RoRo - Sea-Ro	(†)	228.983	(†)	211.458	(†) 187.689	(†)	170.250	0.01	0.01	0.01	0.01	
RoRo - Ico Terminals	(†)	228.983	(†)	211.458	(†) 187.689	(†)	170.250	0.01	0.01	0.01	0.01	
Total		1.293.785		1.482.000	1.749.000		1.711.250	0.21	0.25	0.24	0.27	
***Annual Report* + H* figures**		**2.209.715**		**2.327.831**	**2.499.756**		**2.222.000**	**0.06**	**0.10**	**0.09**	**0.12**	

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A) Tractabel Engineering (2009) - MKBA oostkaai westelijk schiereiland Zeebrugge, 20/03/2009
B) PSA belgium webpage – introduction
Δ) Dynamar – Container throughput & terminal capacity
†) Calculated estimate

Table 29: Gini coefficient for Zeebrugge 2008 - 2011

Gini Coefficient Zeebrugge				
	2008	2009	2010	2011
Zeebrugge	0.154	0.185	0.154	0.265

The H* results for Zeebrugge show an increasing amount of concentration taking place within the ports, which is according to the above mentioned increase in throughput at the container terminals. The concentration figures are much lower than in other, due to the fact that up till now no real dominant company is active in Zeebrugge and large sums of RoRo traffic exist. With the delivery of their second terminal, the operator PSA is a potential candidate to dominate this port and to raise the concentration figures in the future. The Gini coefficient follows the exact same pattern as the H* results, with a sharp increase in the final year of the analysis.

4.2.6. Le Havre

The data availability of the Le Havre figures proved quite problematic and no other figures could be collected besides the 2009 Dynamar figures. With only one year of data collected creating a (calculated) estimate for the other years would be highly arguable and is therefore not performed. The low market concentration in 2009 is explained by the large number of TOC's and their relative equal division of the throughput. However since this is only based purely on figures from one year, coming from a trusted but only one source, it is difficult to provide a conclusion for the port of Le Havre.

Table 30: Le Havre terminal figures 2009

Terminal figures Le Havre 2009		
Terminal Operator	2009	2009 HHI
CNMP	443.000	0.03
GMP	1.071.000	0.17
Terminaux Normandie – Perrigault	755.000	0.08
Perrigault	346.000	0.02
Total	1.482.000	0.30
***Annual Report* + H* figures**	**2.615.000**	**0.07**

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4

Table 31: Gini coefficient for Le Havre 2008 - 2011

Gini Coefficient Le Havre				
	2008	2009	2010	2011
Le Havre	-	0.100	-	-

4.2.7. Conclusion

The market concentration analysis that has been performed in this chapter is a more slimmed down and focused analysis, when compared with the previous analysis performed in chapter 4.1. The concentration is determined per port and purely focused on the throughput figures of the TOC's. The analysis is however performed on multiple and subsequent years, running from 2008 - 2011. The height of the market concentration as determined by the normalized Hirschmann Herfindahl Index only marginally differed per year and was relatively stable during the period of analysis. For some of the ports a slight pattern towards higher or lower concentration was visible.

The Gini coefficient analysis was performed as a control analysis and one that could potentially lead to different insights. The Gini coefficient analysis generally picked up the same trends as the normalized H* calculation in the multi-year analysis. The results were also placed on a zero to one scale, but provided different figures than the H* calculation for some of the ports. It seems that the Gini coefficient reacted stronger on a dominant position of a single terminal operator in a port and provided higher levels of concentration when compared with the H* analysis. When the results of Antwerp, Hamburg and Rotterdam are compared the height of the H* index often has a more logic or plausible result. The normalized Hirschmann-Herfindahl Index calculation is therefore more favorable, especially since there are also bandwidths determined for low, moderate and high market concentration.

The current research in this thesis has focused itself on intra port competition, the competition between the terminal operating companies within the boundaries of the port itself. These high levels of market concentration that were measured in almost all of the HLH range ports, suggest that the competition is taking place outside the ports. Kaselimi (2011) explains: "Terminal competition can take

place within the same port (intra-port competition) and between TOCs located in different ports (inter-port competition).” Midoro et al. (2005) explain that the European inter-port competition is often as strong as intra-port competition, mainly due to the large, overlapping hinterland of major north continental ports. Notteboom (2002) also acknowledges that inter-port competition is present in the HLH range: “intra-port monopolists in highly competitive port ranges such as the Le Havre-Hamburg port range are forced to price competitively and to continuously innovate and upgrade terminal operations, even if it is not possible for other operators to enter the stevedoring business in these ports (e.g. due to high entry barriers).”

Therefore the intra-port dominance that can be witnessed in most of the HLH range ports is actually taking place in a port range that partially neutralizes this effect. The competitive and compact HLH port range has lots of inter-port competition for the same hinterland, thereby dampening the ability to levy supra-normal rents. A number of the large global TOC’s have both invested in multiple European ports, as well as multiple HLH range ports, thereby taking a potentially dominant position in the range. Notteboom identified in 2002 that: “Competition is gradually shifting from port authorities to private terminal companies who are building regional terminal networks. The process is in its early stages, but the trend is clear.” The concentration analysis in chapter 4.3 will be performed on all of the Terminal Operating Companies in the HLH range, without taking the boundaries of the terminal operating companies into account. This will provide the answer whether or not the HLH range is concentrated based on the Terminal Operating Companies.

4.3. Determining the overall HLH range concentration index

The inter-port market concentration is determined on the throughput of the TOC’s in the entire HLH range and by doing so the boundaries of the ports are taken out of the equation. The previous chapters used the normalized Hirschmann-Herfindahl Index to calculate the market concentration in a specific port, this chapter will see the HLH range container market as one big market. The market concentration analysis sets out to discover if the inter-port analysis for 2008 - 2011 provides a different perspective than the intra-port analyses. Regrettably the figures of the Le Havre based TOC’s are excluded, since these are only available for 2009. By excluding Le Havre the market concentration analysis is basically delimited to the Hamburg-Zeebrugge range, but will still be named HLH range in this chapter.

The market concentration analysis is performed on all the HLH range container terminals, disregarding the boundaries of the port. The market concentration is determined by the normalized Hirschmann-Herfindahl Index (H*), which was preferred over the Gini coefficient in chapter 4.2. The terminal operating companies in the table below are sorted based on the 2011 throughput, with the largest company on top. The RoRo figures of the port of Zeebrugge are highly estimated and therefore displayed on the bottom. The TOC’s, PSA, Eurogate and APMT are active in more than one of the HLH range ports and the information per specific port is displayed in the white rows. The market concentration however is determined on the throughput numbers of the TOC’s in all the HLH range ports and will therefore be calculated according to the same principle as Method B in chapter 4.1.

Table 32: HLH range TOC figures 2008 - 2011

Hamburg - Le Havre range - corporate level									
Terminal Operator	Port	2008 Handled	2009 Handled	2010 Handled	2011 Handled	2008 HHI handled	2009 HHI handled	2010 HHI handled	2011 HHI handled
PSA	-	7.858.785	7.032.000	7.966.000	7.991.000	0.05	0.06	0.06	0.05
	Antwerp	7.250.000	6.100.000	7.000.000	7.100.000				
	Zeebrugge	608.785	932.000	966.000	891.000				
Eurogate	-	8.191.345	6.673.945	6.990.925	7.954.762	0.05	0.05	0.04	0.05
	Hamburg	5.500.709	4.535.842	4.871.297	5.900.341				
	Bremen	2.690.636	2.138.103	2.119.628	2.054.421				
ECT	Rotterdam	6.300.000	6.000.000	7.320.000	7.500.000	0.03	0.04	0.05	0.04
HHLA	Hamburg	6.913.300	4.900.000	5.548.000	6.769.000	0.04	0.03	0.03	0.04
APMT	-	3.285.000	2.950.000	2.975.000	3.350.000	0.01	0.01	0.01	0.01
	Rotterdam	2.600.000	2.400.000	2.413.000	2.700.000				
	Zeebrugge	685.000	550.000	562.000	650.000				
DP World	Antwerp	1.200.000	1.200.000	1.301.000	1.400.000	0.00	0.00	0.00	0.00
ICL	Antwerp	200.000	130.000	130.000	170.000	0.00	0.00	0.00	0.00
Buss Ports	Hamburg	130.000	80.000	120.000	130.000	0.00	0.00	0.00	0.00
Kramer Groep	Rotterdam	150.000	100.000	100.000	125.000	0.00	0.00	0.00	0.00
Interforest	Rotterdam	50.000	50.000	50.000	75.000	0.00	0.00	0.00	0.00
RoRo - P&O Ferries	Zeebrugge	228.983	211.458	243.000	170.250	0.00	0.00	0.00	0.00
RoRo - DFDS	Zeebrugge	228.983	211.458	243.000	170.250	0.00	0.00	0.00	0.00
RoRo - Sea-Ro	Zeebrugge	228.983	211.458	243.000	170.250	0.00	0.00	0.00	0.00
RoRo - Ico Terminals	Zeebrugge	228.983	211.458	243.000	170.250	0.00	0.00	0.00	0.00
Total – HHI	-	35.194.360	29.961.776	33.472.925	36.145.762	0.185	0.183	0.185	0.186
H*						**0.122**	**0.120**	**0.123**	**0.123**

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Source: Previous tables

The normalized Hirschmann Herfindahl Index performed on the TOC throughput figures of the HLH range provides very stable results in the 2008 - 2011 timeframe. The market concentration only marginally changes between 0.120 and 0.123 fitting in the moderate market concentration bandwidth. The market concentration is fueled by the six largest TOC's all handling between 1.2 and 8 million TEU per year. Especially the largest four companies all handling more than 6.7 million TEU in 2011 make their contribution to the H* analysis index figures.

In a test-model the Le Havre figures for 2009 have been entered to see whether or not having the four years of data of this port, would affect the concentration index. The overall index is not strongly affected by the terminal figures of Le Havre, since this port lacks a dominating player, the average size terminals do not add much to the HHI values. The biggest change provided by including the Le Havre based terminals is that the *n* is raised from 14 to 18. This reduces the normalizing effect and raises the 2009 H* from 0.120 to 0.138, reducing the gap between the HHI and H*. This indicates that one very important aspect of the market concentration is the size of the sample or *n*. Removing the smaller players out of the equation is not an option if the concentration index is to be determined accurately. The exclusion of the Le Havre based TOC's is therefore regrettable but not insurmountable, since with or without the Le Havre range figures the TOC's the overall figure between the 0.10 and 0.18 bandwidth of moderate market concentration.

Previous research in the form of Midoro et al. (2005) and Notteboom (2002) indicated that inter-port competition has the ability to take over the role of the intra-port competition. Notteboom pointed out that the compact HLH range is especially suitable for inter-port competition. This analysis of the inter-port competition has taken the edge of the very high levels of intra-port market concentration that

where witnessed in the chapters 4.1 and 4.2. The inter-port competition is not strong enough to completely remove the market concentration and signal for almost full market competition. Therefore moderate levels of market concentration remain within the entire HLH range, resulting from the dominant position of one TOC in most of the HLH range ports.

4.4. Concluding remarks – HLH range terminals and TOC's

The determination of the market concentration of the HLH range Terminal Operating Companies (TOC's) play a vital role in order to answer the research question and the sub questions. This is the reason why this calculation has been performed on multiple years and with multiple tools for determining the actual market concentration. The market concentration index is determined with the help of two different formulas in this chapter. The already familiar the normalized Hirschmann-Herfindahl Index (H*) and the Gini coefficient were used to determine the market concentration. Generally the two methods of analysis picked up the same trends in the dataset for the multi-year analysis. The height of the concentration number that is placed on a zero to one scale differed strongly however. The figures provided by the normalized Hirschmann-Herfindahl Index analysis were believed to be more logical and plausible. The Gini coefficient provided a good check for the H* index, which can be seen as the preferred method of analysis for the market concentration index.

The market concentration was determined on the intra-port level, within the ports, in chapter 4.1. This high level of detail was not seen before in academic literature and the data gathering stage proved difficult for this analysis. The analysis performed on the 2010 data provided an insight in the mechanics behind the market concentration analysis and which of the terminals add most to the HH-index. The analysis also unveiled the large number of jointly shared terminals and the strong differing utility rates of the terminals and TOC's. The analysis however also highlighted that although the terminal level provided a large amount of information, is not the place where the decisional power resides. The calculation based on the TOC's throughput (and capacity for 2010) was preferred, since this took better account the decisional power of the TOC's. The analysis was however only fully performed on one year and that a subsequent analysis based the years 2008 – 2011 was performed in chapter 4.2. This analysis was performed on the TOC throughput figures and determined the market concentration for each year in the 2008 - 2011 dataset.

The results of the two intra-port market concentration analyses identified high levels of intra-port concentration for most of the ports, with the sole exception of the port of Le Havre. The presence of one dominant TOC in almost all of the ports pushed the H* index to these high levels. The dominant TOC was often one of the large global TOC's that can be seen as a large logistical service provider, often operating multiple terminals in Europe and the HLH range. The up rise of the global TOC's has changed the perspective of the competition within the range. The contestable hinterland of the HLH range and the presence of global TOC's in multiple ports raise questions of who is competing with each other and on what scale. The academic literature identified that inter-port market concentration takes place within compact port ranges such as the HLH range. The analysis performed in chapter 4.3 has been performed on the HLH as if it was one big internal market. The inter-port market concentration that is determined on the TOC's active within the range is lower than the intra-port market concentration, but still remains within the moderate market concentration bandwidth.

In order to partially answer the first sub question and thereby providing a partial answer to the research question, the knowledge gathered by performing the different analyses is used. Based on the various analyses performed within the HLH range ports and the inter-port analysis in the HLH range there can only be one answer to the first sub question. There is indeed market concentration within the HLH range, both within the ports and within the range itself.

SQ1: Are the HLH range terminal operating companies subject to market concentration?

With the market concentration determined for the HLH range terminal operating companies, the question is whether this will progress further or diminish. The development of the container terminal capacity could provide an insight in how the market concentration would develop in the upcoming years. The data of the 2004 and 2010 TOC capacity do not provide a clear trend for all of the ports. The market concentration of the TOC capacity has been reduced in the ports of Hamburg and Rotterdam. In Antwerp however the figures actually raised and the difficult to determine capacity in Zeebrugge was indicated as perfect equality in 2004, therefore this market concentration figure also increased. No conclusive remark can therefore be made on this subject, other than that the port authorities are in the position to steer in this respect.

Within ports the only opportunities to effectively influence the market concentration within the port are when new terminal land is provided and when large scale terminal improvements are performed. The Maasvlakte 2 expansion project in Rotterdam provides an example of the port authority its desire for more competition within the port. The concession bidding on the first three terminals of about 4 million TEU in capacity was structured to allow at least one new entrant. After the bidding process the long-term lease contracts have been awarded to already present global TOC's APMT and HPH (ECT) a new entrant in the form of DP World. When fully constructed APMT will pose a bigger rival for ECT and DP World has entered the port as the third largest player. The liner shipping influence is also visible with these expansions, with APMT being a sister company of Maersk Line, the Euromax expansion involving the CKYH alliance (49%) and the Rotterdam World Gateway terminal involving: DP World (30%) and APL (20%), MOL (20%), HMM (20%) and CMA-CGM (10%), (Rotterdamworldgateway.nl, 2013). In Wilhelmshaven a new terminal of Eurogate and APMT (70/30 share) has become operational September 2012 (Kotug, 2012). The terminal has a designed capacity of 2.7 million TEU.

The up rise of the global TOC's within the HLH range and the growth of their networks is very likely to progress, since basically all large planned or recently finished construction projects involved global TOC's. Within the entire HLH range the Hamburg based HHLA is the only independent local TOC that is large enough to fully compete with the Global TOC's. As a result of the above mentioned terminal expansions, the inter-port market concentration will likely increase in the future.
The detailed terminal analysis as performed in chapter 4.1 highlighted the various joint-ventures and shareholdership agreements that were already present in the HLH range. On top of this most of the new terminal projects also involve joint-ventures or other forms of shareholdership between shipping lines and (Global) TOC's. The net effect of these vertical relationships is however hard to calculate and to quantify. What is clearly visible is that the large liner shipping companies such as Maersk Line, MSC, CMA-CGM and several shipping alliance members are increasingly active on the (HLH range) terminal operating market. The vertical alliances and agreements between these two industries will likely provide a higher concentration in the range and is therefore described in chapter 5.1.

5. The market concentration of the Shipping Lines and Alliances

5.1. Changes in the container shipping industry

The liner shipping companies are according to Heaver et al (2001) regarded as one of the principal players of a port. The container liner shipping industry has seen a growth path that is quite similar to the container terminal industry. The two industries departed from the predominant traditional general cargo industry towards an increasingly specialized container industry. As was the case at the chapter of the TOC's, the focus will be on calculating the market concentration of the liner shipping industry. However unlike the terminal operating industry the liner shipping industry is much more footloose, with shipping companies having the option to change their service loops and ship allocation. In order to provide better value judgments when the market concentration of the liner shipping industry is determined, the underlying developments that have led and still lead to the increase of market concentration are explained. Song (2003) placed these developments into three identifiable business patterns, which are handled in separate paragraphs:

5.1.1 **- Seeking greater operational coverage and scale economies**
5.1.2 **- Restructuring**
5.1.3 **- Differentiation**

The three identified business patterns cover most of the important developments that have taken place in the liner shipping industry for the past five to ten years and are still occurring at the moment. The first business pattern concerns the growing trends of globalization, internationalization and the economies of scale, which can be seen as the underlying motives for the restructuring of the industry. The business pattern of restructuring concerns the consolidation of the industry in the form of take-overs, mergers and alliance formations. Pushed by the globalization and internationalization of the first business strategy, several consolidation rounds have taken place in the industry. The restructuring has a strong influence on the market concentration of the liner shipping industry. The last paragraph named differentiation will provide the information regarding the expansion of the liner shipping industry towards the terminal operating industry. The desire to influence a larger part of the supply chain is a propelling force behind the differentiation of the liner shipping companies. The differentiation creates linkages between the two industries and therefore this strategy provides a partial answer for the comprehensive third sub-question.

5.1.1. Seeking greater operational coverage and scale economies

The business strategy of seeking greater operational coverage and generating the advantages of scale economies is driven by internationalization and globalization. Slack et al. (2002) pointed out that the internationalization and globalization of the economy made it essential for the shipping lines to extend their services towards global networks and provide global services. The provision of these global services together with the maturation of the container industry both enabled and required the provision of larger vessels. The economies of scale generated by these newer and larger vessels provide lower costs per shipped container and thereby generate a competitive advantage. The increased vessel size also helped in the implementation of the slow steaming strategy, which was adopted as a reaction on both the high fuel prices and the economic crisis that unfolded at the end of 2008. Slack et al. point out that these larger vessels result in higher costs per vessel. This makes it more capital intensive to operate a liner shipping company and more difficult for new entrants.

The evolution of the world´s container ship in the 25 year period of 1988-2013 puts the strong growth of the vessel capacity and vessel sizes in perspective. The data for the first table below is derived from the Alphaliner (2011a) figure in the Appendix. The data is supplemented with information regarding the CMA CGM Marco Polo, which is the current record holding vessel for deadweight tonnage (DWT) and TEU capacity (marinetraffic.com, niewsblandtransport.nl, 2012). Maersk Line has the delivery for its first series of Triple E class vessels scheduled for 2013 (Maersk.com, 2011 and worldslargestship.com, 2012). The evolution of the container ship is also visible at the actual fleet of containerships deployed by the liner shipping companies. BRS-Paris (2012) categorically displays the entire cellular container fleet capacity on the 31st of December 2011 with great detail in the second table below.

Table 33: Evolution of the world's largest containerships from 1988 – 2011

	Introduction	TEU	DWT	LOA (m)	Width (m)	Draft (m)
Triple E Class*	*2013*	18.000	165.000 – 200.000	400	59,0	14,5
CMA CGM Marco Polo	2012	16.020	187.626	396	53,6	16,0
Emma Maersk	2006	15.200	175.000	397	56,4	16,0
Gudrun Maersk	2005	9.500	115.700	367	42,8	15,0
Sovereign Maersk	1997	8.200	105.000	347	42,8	15,0
Regina Maersk	1997	7.403	90.500	318	42,8	14,5
NYK Altair	1994	4.953	63.000	300	37,1	13,0
President Truman	1988	4.538	55.500	275	39,4	12,5

Source: Alphaliner Weekly newsletter, 2011a. ** Planned introduction Triple E class*

Table 34: The cellular fleet on 31 December 2011

	31 December 2011 – Existing					31 December 2011 – Order book					O/E
	All ships		Chartered			All ships		Chartered			
TEU	Ships	TEU	Ships	TEU	%Chrt	Ships	TEU	SHIPS	TEU	% Chrt	
10000-18000	118	1.485.640	45	580.082	39,0%	156	2.097.450	37	477.588	22,8%	141,2%
7500-9999	290	2.495.320	111	944.795	37,9%	111	984.465	30	266.725	27,1%	39,5%
5100-7499	463	2.840.841	197	1.207.095	42,5%	47	302.788	34	214.920	71,0%	10,7%
4000-5099	701	3.167.294	387	1.742.004	55,0%	113	516.629	52	246.205	47,7%	16,3%
3000-3999	322	1.098.896	176	605.599	55,1%	48	172.876	37	132.786	76,8%	15,7%
2000-2999	715	1.818.340	534	1.361.561	74,9%	36	92.576	19	48.600	52,5%	5,1%
1500-1999	594	1.007.885	383	649.062	64,4%	43	75.288	30	52.004	69,1%	7,5%
1000-1499	700	824.027	439	517.157	62,8%	50	54.528	21	23.747	43,6%	6,6%
500-999	797	591.447	510	385.669	65,2%	16	13.541	13	11.185	82,6%	2,3%
100-499	238	77.439	64	21.582	27,9%						
Total	**4.938**	**15.407.129**	**2.846**	**8.014.606**	**52,0%**	**620**	**4.310.141**	**273**	**1.473.760**	**34,2%**	**28,0%**

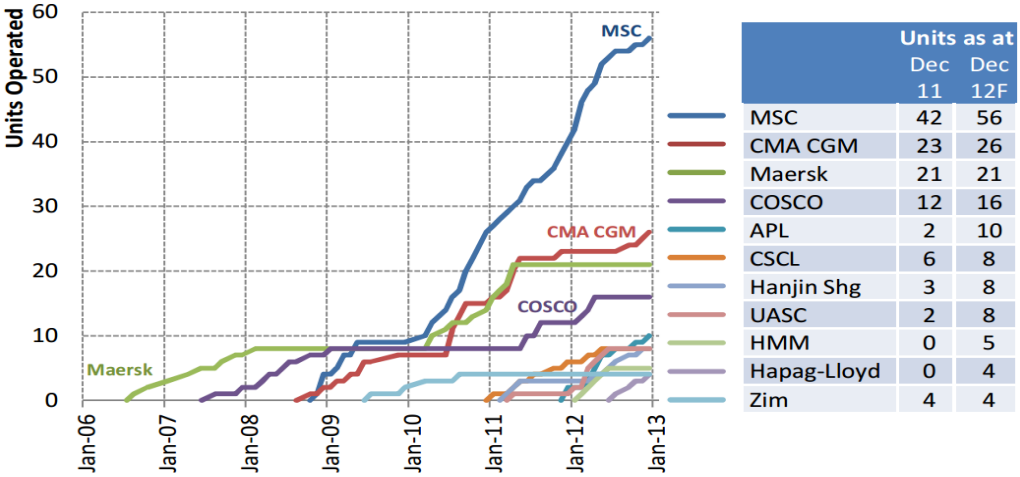
Source: BRS-Paris (2012) 'A race for capacity in lean times' – Annual Review 2012

The BRS-Paris table is based on the cellular slot capacity, which concerns all the container vessels that are purposely built to carry ocean containers in specially constructed vertical slots. At the end of 2011 the cellular container fleet represented 97 percent of the total container fleet capacity. The detailed table of BRS-Paris also shows the amount of chartered capacity and the order book capacity of the shipyards. The order books reveal that the largest TEU increase of the fleet is to be expected in the largest two categories. Therefore a large increase in the average vessel size can be expected for the upcoming years.

The vessels in the largest categories are more capital intensive per vessel and surprisingly the table reveals that vessels from these two categories have a lower tendency to be chartered. It is therefore expected that these vessels are mostly constructed for the largest liner shipping companies. Alphaliner

(2012a) provided figure 07 that displays the number of 10.000+ TEU vessels that are received or expected (forecasted) in the January 2006 to January 2013 period.

Figure 09: Number of containerships >10,000 TEU breakdown by carrier 2006-2013



	Units as at Dec 11	Dec 12F
MSC	42	56
CMA CGM	23	26
Maersk	21	21
COSCO	12	16
APL	2	10
CSCL	6	8
Hanjin Shg	3	8
UASC	2	8
HMM	0	5
Hapag-Lloyd	0	4
Zim	4	4

Source: Alphaliner Weekly Newsletter issue 8 (2012a)

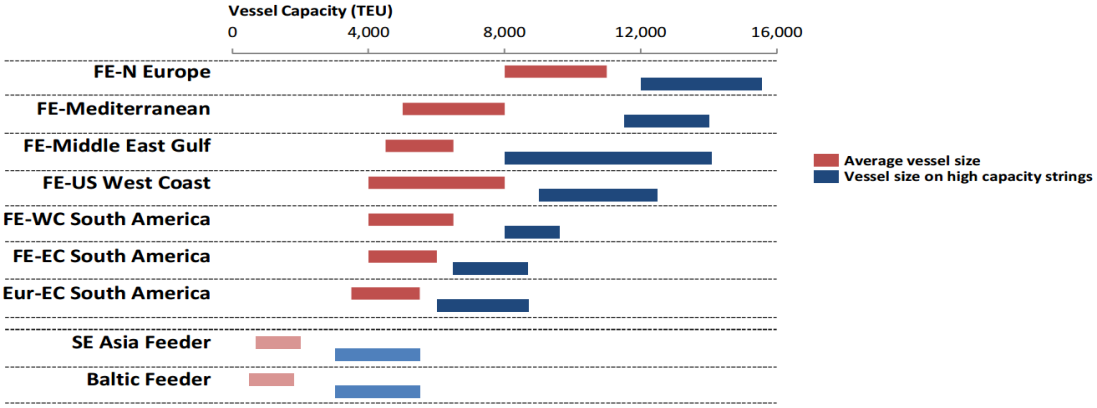
The figure above displays the vessels larger than 10.000 TEU, vessels that can be placed in the largest category of the table provided by BRS-Paris. The statement that the largest liner shipping companies only have the capital to acquire these vessels is confirmed by Figure 07. The largest five liner shipping companies also dominate this graph and all of these companies that already operate or expect these vessels are amongst the largest 20 container shipping companies of the world.

Based on the data from the figure above especially MSC will benefit from the scale advantages, e.g. lowest costs per shipped container that the largest category of vessels provides. Whilst the Triple E class vessels of the market leader Maersk Line have been drawing a lot of attention in the industry, it is the runner up MSC that has steadily been building a fleet of vessels larger than 10.000 and 12.500 TEU. Alphaliner forecasted that MSC will have 56 ships larger than 10.000 TEU and 52 ships larger than 12.500 TEU at the end of 2012. In contrast it is forecasted that Maersk Line has 21 ships larger than 10.000 TEU at the end of 2012 and the 20 long awaited triple E class vessels arrive in 2013 and 2014. The large fleet of Ultra Large Container Ships (ULCS) can provide MSC an edge over its competitors, affecting the market competition in the process. The next paragraph will explain what the increasing vessel sizes implicate for the HLH range TOC's and Port Authorities.

5.1.1.1. Implications for the HLH range

The increasing vessel size and the growing number of ULCS have consequences for the HLH range ports and terminal operating companies. The width of these new vessels requires for some the largest gantry cranes at the terminals and for the port authorities especially the increasing draft can provide problems for some upstream located ports and older terminals. Also the infrastructure of the port will have to be able to cope with the large volume that is loaded and unloaded by these vessels. The liner shipping companies have stated that most ULCS are to be deployed on the Far East – Northern Europe trade, the most important trade for the HLH range ports. The average vessel size and the vessel size on high capacity strings is displayed in figure 08, derived from Alphaliner (2012c).

Figure 10: Number of containerships >10,000 TEU breakdown by carrier 2006-2012 (Forecast)



Source: Alphaliner Weekly Newsletter issue 12 (2012c)

The high average vessel capacity on the FE-N Europe trade is generated by the frequent usage of vessels with capacities of above 10.000 and 12.500 TEU. This indicates that the largest liner shipping companies of the world are highly active on the important FE-N Europe trade and actively benefit from the economies of scale. The HLH range port authorities and terminal operating companies are as a result confronted with larger growing vessels that will call at their ports.

The globalization and internationalization pushed the liner shipping companies towards seeking greater operational coverage. This strategy together with the desire of reaching economies of scale have for a large part instigated the restructuring of the liner shipping industry, that is explained in the next paragraph.

5.1.2. Restructuring

The restructuring business pattern in the liner shipping industry took place in the form of a couple consolidation rounds that were shaped by takeovers, mergers and alliance formations. Slack et al. (2002) identified that the growth of world trade, a result of globalization and internationalization, pushed the liner shipping companies towards a global provision of their services. Slack et al. also noted the increased provision of larger and more capital intensive vessels and new entrants to the industry (mostly Asian). These developments increased the competition in the industry. The combined effect of the new entrants, the globalization and the maturation of the industry created an economic environment in which the liner shipping companies moved to restructure. The restructuring of the liner shipping industry took place in the form of mergers, take-overs and alliance formations.

The growth of the largest container liner shipping company Maersk Line for a considerable part the result is merger and acquisition activities. This involved the acquisitions of Sealand (1999), Safmarine (1999) and P&O Nedlloyd (2005). Interestingly Maersk first formed a strategic horizontal alliance with P&O Nedlloyd and Sealand before it actually acquired these companies. The fast growth of the third largest liner shipping company in 2011 CMA CGM is for a large part also the result its merger and acquisition activities. The restructuring of the industry that formed large companies such as Maersk and CMA CGM, also led to the formation of a number of large scale alliances between the liner shipping companies. The liner shipping alliances are a form of a strategic partnership that is formed between two or more companies. Bronder and Pritzl (1992) provided the definition of a strategic partnership in the literature: “We speak of a strategic partnership when value chain activities between at least two companies with compatible goal structures are combined for sustaining and/or achieving

significant competitive advantages." Bronder and Pritzl further conclude that the strategic alliance are not formed at once, they need to emerge from an evolutionary process of mutual learning and continuous adaptation. The formation of strategic alliances can occur horizontally, vertically or diagonally. Bronder and Pritzl explain that: "*Vertical* strategic alliances can be formed with suppliers or customers in several value chain activities. The joint-ventures and shareholding agreements between liner shipping companies and TOC's are an example of vertical alliances. *Horizontal* strategic alliances are formed with competitors within the same industry and *diagonal* strategic alliances are formed with partners from other industries." The liner shipping alliances are a form of horizontal strategic alliances, which is the most common direction of an alliance. The authors Panayides and Wiedmer (2011) explained the shipping alliances as follows: "These agreements involve ocean carriers co-operating on certain major global routes (e.g. Europe-Asia, Asia-Us, Us-Europe). Strategic (horizontal) alliances aim at co-operation in the employment and utilization of ships over particular routes including type/size of ship, sailing schedules and itineraries, use of joint terminals and container co-ordination on a global scale." The shipping alliances have been formed since 1994 and the number and size of the alliances has grown to represent considerable parts of the global liner shipping industry. The effect that these shipping alliances have on the liner shipping industry will be calculated later on in this chapter. As a result of the restructuring the HLH range terminal operating companies and port authorities will be facing liner shipping companies with growing market power during tariff and service negotiations.

Panayides and Wiedmer also noted that within the global alliances or in addition to the alliances, various other agreements between carriers have been developed, such as vessel sharing and slot sharing agreements. Given the wide diversity of these smaller scale agreements, this thesis will only focus on the shipping alliances. The HLH range terminal operating companies and port authorities are however also increasingly confronted with the differentiation strategy of the liner shipping companies and shipping alliances.

5.1.3. Differentiation

The differentiation of the liner shipping industry towards the terminal operating industry has reached the point that all of the large container ports in the HLH range have at least one terminal that is the direct object of this diversification strategy. These vertical alliances between TOC's and shipping companies can also be witnessed at nearly every single port expansion project in the HLH range at this time. The vertical alliances are often formed as joint-ventures and shareholdership agreements. The abundance of these vertical alliances was noticeable in the detailed tables that were shown during the market concentration analysis of the TOC's. The HLH range terminals that had a form of liner shipping influence during this prior analysis are placed in the table below.

Table 35: HLH range TOC's – shipping line involvement in 2010

Port	Terminal	Capacity	Throughput	Shares for the TOC	Shipping line(s) involvement
Antwerp	Antwerp Gateway	1.800.000	811.000	42,50% - DP World	20,00% - ZIM Ports, 20,00% Cosco Pacific, 10,00% Terminal Link (CMA CGM), 7,50% Duisport
Antwerp	MSC Home	5.400.000	4.500.000	50,00% - PSA	50,00% - MSC
Bremen	MSC Gate	1.500.000	1.150.954	50,00% - Eurogate	50,00% - MSC
Bremen	NTB	3.400.000	3.023.000	50,00% - Eurogate	50,00% - APM Terminals
Hamburg	Altenwerder	1.900.000	1.266.000	74,90% - HHLA	25,10% - Hapag Lloyd
Le Havre	De France	1.333.333	778.000	50,00% - DP World	50,00% - CMA CGM
Le Havre	L'Ocean	1.000.000	680.000	50,00% - Perrigault	50,00% - MSC
Le Havre	Porte Oceane	544.000	346.000	50,00% - Perrigault	50,00% - APM Terminals
Rotterdam	APM Rotterdam	3.519.000	2.413.000	100,00% - APM	100,00% - APM Terminals
Rotterdam	Euromax	2.300.000	1.720.000	51,00% - ECT	49,00% - CKYH Alliance
Zeebrugge	CHZ	1.100.000	966.000	65,00% - PSA	35,00% - Terminal link (CMA CGM)
Zeebrugge	APM Zeebrugge	1.000.000	562.000	75,00% - APM	75,00% - APM Terminals

The table above displays that the diversification strategy is especially performed by the largest liner shipping companies of the world. In the case of CMA CGM and Maersk Line the diversification strategy is performed via a daughter or sister company named Terminal Link and APM Terminals. The table that displays the terminals with liner shipping influence contains eleven terminals out of the total 35 container terminals that were analyzed in chapter 4.1. Interestingly most of the recently constructed HLH range terminals are part of the same conglomerate as a liner shipping company or set up as a joint-venture or a shareholding agreement with one or more liner shipping companies. All of the following terminals that are recently constructed have some liner shipping company influence: the Altenwerder terminal in Hamburg (2003), Euromax in Rotterdam (2008), the Antwerp Gateway (2008), the Terminal de France (2006), Porte Oceane (2008) and L'Ocean (2012) at Le Havre Port 2000 project and the Eurogate terminal at Wilhelmshaven (2012). The same trend is also seen at the three terminals that are currently under construction at the Maasvlakte 2 in Rotterdam. Each of the three Maasvlakte 2 terminals are influenced by one of the described forms of liner shipping company involvement.

The table displays that the diversification strategy has in most cases unfolded into a joint-venture between one shipping line and one terminal operating company. Besides the 50/50 joint-venture agreements the table also shows a diversity of shareholding agreements. In a couple of occasions this resulted in strategic partnerships formed between multiple companies or even a shipping alliance. This wide diversity of the way these partnerships are formed and the fact that this covers two different industries, makes it very difficult to calculate the effect of the vertical alliances on the market concentration. Therefore no market concentration analysis will be performed on the vertical alliances. However provided the number of vertical alliances that can be witnessed in the HLH range, it can be assumed it will positively attribute to the market concentration of the range. The wide range of horizontal and vertical alliances between several different partners really increases the complexity and reduces the transparency of the industry. Notteboom & Rodrigue (2010) visualized the complexity of ownership models in 2010 for Rotterdam, Antwerp and Zeebrugge, in the Appendix.
The increasing differentiation of the liner shipping industry into the terminal operating industry is therefore noted. Ideally this relation could be quantified and would greatly attribute to answering the third sub question. This third sub question can however also be answered based on the market concentration of the terminal operating and the liner shipping industry. The three business patterns as described by Song helped in understanding the recent developments and especially the complexity of the liner shipping industry. This will improve the value judgements that can be taken from the market concentration analysis of the liner shipping industry that is performed in the next chapter.

5.2. Determining the market concentration of the liner shipping industry

The market concentration of the liner shipping industry is calculated by using the normalized Hirschmann-Herfindahl Index. The data that will provide the input for this market concentration analysis, is the cellular slot capacity of the liner shipping companies. Alphaliner provided the TEU slot capacity of the largest 100 liner shipping company's on the 10th of December 2011. The Alphaliner data is provided in such detail that the distinction between the slot capacity owned, chartered and the combined total for each company is displayed. The delimited table below displays the top 20 and the original table that contains all the 100 largest liner shipping companies is placed in the Appendix.

The Alphaliner data in table 34 displays that the top 20 is responsible for 88.5 percent of the total TEU slot capacity of the top 100, with only 68.5 percent of the total number of active ships. This indicates that the largest 20 shipping companies have considerably larger vessels at their disposal than the bottom 80 companies. Based on the total number of ships and the TEU slot capacity the three largest shipping companies are especially large. Each of these three companies has more than 1 million TEU of slot capacity at its disposal. Together these companies utilize 39.6 percent of the total TEU slot capacity, of which more than 50 percent is chartered. The market concentration analysis is performed in threefold, for the largest 3, the largest 20 and the largest 100 liner shipping companies. On the right side of the table the calculated HHI and H* values are displayed for the top 3 (n=3) and the top 20 (n=20). The HHI and H* value that is calculated for the entire top 100 (n=100) is shown in the Appendix and this number is shown at the bottom row of the table.

Table 36: Alphaliner Top 100 liner shipping companies measured by slot size – 10 December 2011

		Total		Owned		Chartered			Order book			*n*=3	*n* =3	*n*=20	*n*=20
Rnk	Operator	TEU	Ships	TEU	Ships	TEU	Ships	% Chart	TEU	Ships	% Total	HHI	H*	HHI	H*
1	APM-Maersk	2.523.620	658	1.178.482	218	1.345.138	440	53.3%	530.106	49	21.0%	0.179	-	0.04	-
2	Mediterranean Shg Co	2.096.382	478	983.373	205	1.113.009	273	53.1%	490.862	43	23.4%	0.123	-	0.02	-
3	CMA CGM Group	1.346.433	401	505.558	93	840.875	308	62.5%	70.070	8	5.2%	0.051	-	0.01	-
4	COSCO Container L.	646.310	147	348.005	95	298.305	52	46.2%	244.168	32	37.8%	-	-	0.00	-
5	Hapag-Lloyd	643.667	146	292.590	63	351.077	83	54.5%	132.000	10	20.5%	-	-	0.00	-
6	APL	617.424	146	179.167	45	438.257	101	71.0%	290.810	28	47.1%	-	-	0.00	-
7	Evergreen Line	614.278	166	330.167	88	284.111	78	46.3%	308.000	35	50.1%	-	-	0.00	-
8	CSCL	533.867	149	329.938	77	203.929	72	38.2%	159.822	19	29.9%	-	-	0.00	-
9	Hanjin Shipping	468.952	99	220.895	37	248.057	62	52.9%	243.864	30	52.0%	-	-	0.00	-
10	MOL	435.469	99	215.352	36	220.117	63	50.5%	109.620	11	25.2%	-	-	0.00	-
11	OOCL	405.126	85	281.432	46	123.694	39	30.5%	132.576	12	32.7%	-	-	0.00	-
12	Hamburg Süd Group	402.944	115	199.923	46	203.021	69	50.4%	196.788	31	48.8%	-	-	0.00	-
13	NYK Line	402.901	101	304.354	57	98.547	44	24.5%	61.908	6	15.4%	-	-	0.00	-
14	CSAV Group	383.008	85	52.221	11	330.787	74	86.4%	36.000	4	9.4%	-	-	0.00	-
15	Yang Ming Marine	355.182	86	206.965	48	148.217	38	41.7%	89.038	14	25.1%	-	-	0.00	-
16	K Line	337.002	78	104.332	20	232.670	58	69.0%	45.200	5	13.4%	-	-	0.00	-
17	Zim	324.781	93	158.129	34	166.652	59	51.3%	153.216	13	47.2%	-	-	0.00	-
18	Hyundai M.M.	296.367	62	100.646	17	195.721	45	66.0%	156.075	15	52.7%	-	-	0.00	-
19	PIL (Pacific Int. Line)	275.911	144	171.923	96	103.988	48	37.7%	71.900	21	26.1%	-	-	0.00	-
20	UASC	231.533	55	126.696	28	104.837	27	45.3%	104.800	8	45.3%	-	-	0.00	-
#	Top 3	5.966.435	1.537	2.667.413	516	3.299.022	1.021	55,29%	1.091.038	100	18,29%	0.353	0.03	-	-
	In percentage (%)	39,60%	31,00%	37,70%	24,80%	41,20%	35,60%	-	28,20%	19,70%	-	-	-	-	-
#	Top 20	13.341.157	3.393	6.290.148	1.360	7.051.009	2.033	52,85%	3.626.823	394	27,19%	-	-	0.09	0.04
	In percentage (%)	88,50%	68,50%	88,80%	65,40%	88,20%	70,80%	-	93,70%	77,70%	-	-	-	-	-
#	Top 100 (Total)	15.153.679	4.863	7.049.185	2.061	8.104.494	2.802	53,48%	3.836.153	497	25,31%	-	-	0.07	0.06

Source: Alphaliner

The market concentration as calculated by the H* index is low for all the three sample sizes and stays well below the threshold of 0.11 for moderate market concentration. The table highlights that there are large differences in the way that the slot capacity is ascertained, by either owning or chartering vessels. Within the top 20 the chartered vessel percentage varies from 24.5 (NYK-line) to 86,4 percent (CSAV Group), whilst both have an almost equal 400.000 TEU of slot capacity at their disposal. Also remarkable is that 93.7 percent of the vessels in the order book are ordered by firms in the top 20. Ships are capital intensive investments and the full table shows that the bottom 80 companies have a higher tendency to charter vessels. However it might also indicate a slower growth path or a higher tendency to buy vessels from the secondhand market.

The market concentration in the liner shipping industry can be considered low based on the H* results presented in the analysis performed in this chapter. This would provide a negative answer for the second sub-question. However the performed analysis does not take the important development of the shipping alliances into account. Within the top 20 the liner shipping companies are actively participating in these horizontal alliances on important trade routes. From all the liner shipping routes the important Europe-Asia trade seems to be a hotspot for shipping alliances and a large number of alliances have been forged on this route over the years. The next chapter will perform a market concentration analysis that includes the shipping alliances.

5.3. Determining the liner shipping industry market concentration - alliances included

5.3.1. The formation of the first shipping alliances

The formation of the first liner shipping alliances is described in detail by Song and Panayides (2012): “The first strategic alliance was formed in 1994 by four mega-carriers: namely, APL, OOCL, MOL and Royal Nedlloyd Lines. The alliance was named `Global Alliance’ and its major objective was specified as the establishment of an integrated Europe-Far East service. The formation of the Global Alliance was followed by the formation of the Hanjin/Tricon Alliance (Hanjin, DSR Senator and Cho Yang), and the Grand Alliance of Haplag-Lloyd, NYK, NOL and P&O in 1996. In addition, the companies Maersk and Sealand formed an alliance between them (Maersk-Sealand).” Slack et al. (2002) added the grouping of COSCO, Yangming and K-Line to this list of four alliances. Most of these alliances were purposely formed for the important Europe-Asia trade. Slack et al. investigated the alliance formations by studying the 1989, 1994 and 1999 yearbooks (annual reports) of the liner shipping carriers that were actively participating in one of the five active alliances in 1999. These years were not randomly chosen, in the base year of 1989 the alliances had to be formed, in 1994 the alliances took form and in 1999 the five alliances were established. The formation of liner shipping alliances had a positive effect on the number of services (loops) that the shipping companies provided. Slack et al. pointed out that the number of joint-services increased and the number of individual services decreased to a lesser degree. As a result the total number of services increased and so did the service frequency.

The alliance formation is one of the elements of restructuring that took place in the industry. The restructuring took place in a number of consolidation rounds which involved mergers, acquisitions, changes in the alliance composition and the formation of new alliances. From the five shipping alliances formed in the early 1990´s three have remained in 2010. The table provided by Payanides and Wiedmer (2011) displays the strong growth and changes in the alliance members for the three

alliances that remained in 2010. The table displays the development of the alliances in four timeframes: 1996, 2000, 2006 and 2010.

Table 37: Development of the big three strategic alliances

1996	Global Alliance	Grand Alliance	Hanjin/Tricon
Main Partners	APL, Nedlloyd, MOL, OOCL, MISC	Hapag-Lloyd, NYK, NOL, P&OCL	Cho Yang, DSR/Senator, Hanjin
Capacity (TEU)	209.645	255.705	199.404
No. Vessels	65	72	72

2000	New World Alliance	Grand Alliance	Unted Alliance
Main Partners	APL-NOL, MOL, HMM	Hapag-Lloyd,P&O Nedlloyd, OOCL, MISC	Cho Yang, DSR/Senator, Hanjin
Capacity (TEU)	325.487	350.197	277.000
No. Vessels	90	93	85

2006	New World Alliance	Grand Alliance	CKYH
Main Partners	APL, MOL, HMM	Hapag-Lloyd, OOCL, MISC Berhad, NYK Line	Hanjin, Yang Ming, K Line, COSCO
Capacity (TEU)	712.082	966.570	1.046.991
No. Vessels	223	approx. 350	354

2010	New World Alliance	Grand Alliance	CKYH
Main Partners	APL, MOL, HMM	NYK, Hapag-Lloyd, OOCL	Hanjin, Yang Ming, K Line, COSCO
Capacity (TEU)	1.161.468	1.187.607	1.548.508
No. Vessels	282	288	400

Source: Payanides and Wiedmer

Besides MISC exiting the Grand Alliance as the result of operational losses and the increasing requirement of investments in larger vessels, the industry did not witness any big re-compositions in the alliances or any large takeovers in the past few years. This all changed at the end of 2011 when the industry again entered a new phase of restructuring as is explained in the next subchapter.

5.3.2. 2011- A new phase of restructuring

One single event has likely been the trigger that set the new round of restructuring in motion at the end of 2011. On 12 September 2011 the market leader Maersk Line announced their new game changing service called Daily Maersk. This new service on the Asia-Europe trade distinguishes itself in such a way that vessels will arrive on a daily basis on each of the ports and at exactly the same time (Maersk Line, 2011). The Daily Maersk service will call at the following ports: Ningbo, Shanghai, Yantian and Tanjung Pelepas in Asia and Felixstowe, Rotterdam and Bremerhaven in Europe. The Daily Maersk service started on the 24th of October 2011 and is operated by 70 vessels that are scheduled to act as a giant conveyor belt between Asia and Europe. On this service Maersk Line will use its biggest vessels of the fleet, ranging from the largest post-Panamax class of vessels to the Emma Maersk-type container vessels. From 2013 onwards the newly constructed 18.000 TEU big Triple-E class vessels will also be deployed. Two of the game changing elements of the new service are the daily cutoff and the punctuality that Maersk Line guarantees to its customers. The article of Maersk Line noted that the industry average is only 56 percent on time, meaning that 44 percent of all containers are late. The industry on average delivers 11 percent of the containers more than two days late and a staggering 8 percent is more than eight days late. The article states that Maersk Line already achieved best in class punctuality, with 75 percent of the container delivered on time and only 10 percent of the shipments were more than 2 days late. With Daily Maersk a delay of 1-3 days will result in Maersk Line paying a 100 US Dollar refund per container and when delayed by four days or more the payback fee is set to

300 USD per container. With the promise of bringing fixed transportation time and even restitutions for late cargo, this service can be seen as a big chance for Maersk Line and therefore a big threat for its competitors. This single event sent shockwaves through the liner shipping industry at the end of 2011, especially on the Europe-Asia trade. The other liner shipping companies replied to this new Daily Maersk service by joining forces. The most important changes in the alliance structure of the liner shipping industry are displayed below in a chronological order.

01 DECEMBER 2011 – MSC AND CMA CGM ALLIANCE – The first big response on the newly announced Daily Maersk service came when the second and third largest container shipping lines in the world announced their cooperation on key shipping routes. The partnership of MSC and CMA CGM covered the Europe-Asia trade, as well as the Asia-South Africa and Latin America trades. In a promise to match Maersk's Asia-Europe service, MSC and CMA CGM announced they would jointly operate 53 vessels on this key trade route, including 33 ships with a capacity between 13,800 and 14,000 TEUs. This is a large part of the ULCS capacity of both shipping lines, based on the information in paragraph 5.1.1. (CMACGM.com, 2011 & nieuwsbladtransport.nl [1], 2011).

20 DECEMBER 2011 – FORMATION OF THE G6 ALLIANCE – The second reaction of the industry came three weeks later, when the Grand Alliance and the New World Alliance announced a merger. The new alliance named G6 was formed out of the Grand Alliance members (NYK, Hapag-Lloyd and OOCL) together with the New World Alliance members (APL, Hyundai Merchant Marine and Mitsui OSK Lines). Together these six partners announced to operate more than 90 vessels on the key Europe-Asia route. The large number of vessels enabled the G6 alliance to match the number of weekly departures of Daily Maersk. (niewsbladtransport.nl [2], 2011 & porttechnology.org, 2011)

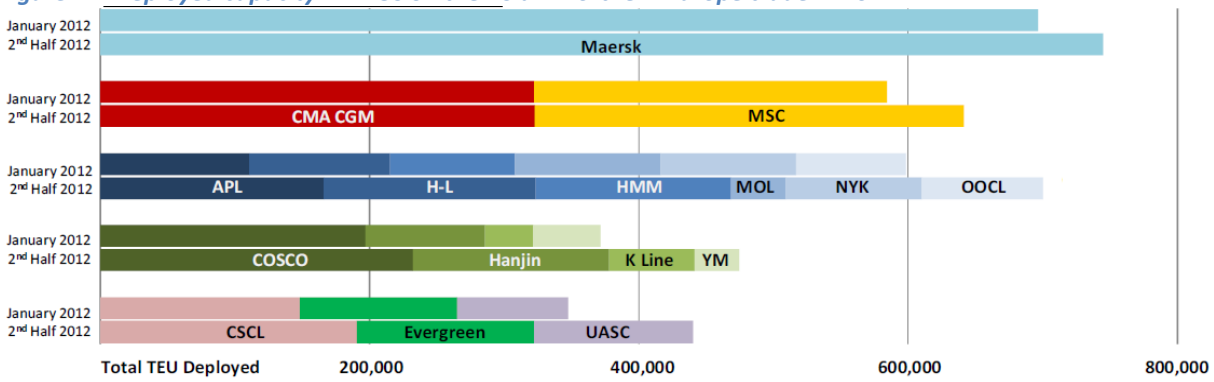
27 DECEMBER 2011 – PARTNERSHIP BETWEEN CKYH ALLIANCE AND EVERGREEN – The third reaction on the game changing Daily Maersk service was the announcement of CKYH 'The Green Alliance' partnering with Evergreen. Evergreen has long remained an independent shipping line and also in this case it is partnering with, not joining the alliance of Cosco, K-Line, Yangming and Hanjin. The partnership covers slot sharing agreements and aligning the departure schedules on the Europe-Asia trade. (niewsbladtransport.nl [3], 2011)

28 DECEMBER 2011 – PARTNERSHIP BETWEEN COSCO AND CSCL – A day later on the 28th of December the next vessel and slot sharing agreement is announced between the Chinese liner shipping companies CSCL and Cosco. The agreements focused on the Europe-Asia trade and will increase the slot capacity, weekly departures and service loops of both liner shipping companies. Rumors that this a prelude towards an alliance were already mentioned: "China's top two carriers, China Shipping Container Lines (CSCL) and China Ocean Shipping (Group) Co (Cosco) are found to be moving closer together in what seems to end up in a merger", Richardson (cargonewsasia.com, 2012).

These are four most prominent and direct reactions on the introduction of the Daily Maersk program. Overall it can be seen that the main competitors of Maersk joined forces, increased their weekly departures and placed their biggest vessels on the Europe-Asia trade. Directly after the first two reactions from the market, the formation of the MSC-CMA CGM and the G6 Alliance, Alphaliner expressed their concern regarding an upcoming price war on the Europe-Asia trade. The article named

'All gloves are off in the Europe-Asia fight' provided a graph which visualizes the situation in mid-December 2011 (Alphaliner, 2011a). Although this graph lacks the last two reactions of the industry, it provides a good general overview of the newly developed market situation on the Northern Europe-Asia trade. The original graph also included Mediterranean-Asia trade and be found in the Appendix.

Figure 11: Deployed capacity in TEUs on the Asia – Northern Europe trade in 2012



Source: Alphaliner 2012c

Especially when a part of the Evergreen capacity is added to that of the CKYH alliance, four large players emerge on the Northern Europe-Asia trade, based on slot capacity. The new phase of restructuring that took place on the NE-Asia trade has without a doubt had an increasing effect on the market concentration on the trade that has grown to be the largest trade of the world in 2009. Therefore a new market concentration calculation that takes the alliance formations into account has to be performed.

5.3.3. Determining the concentration of the liner shipping companies - alliances included

The market concentration analysis that takes the alliances into account will again be using the Alphaliner Top 100 as the basic data for the analysis. Since no prior model existed for the calculation of the H* analysis, one had to be created. The liner shipping company data had to be adjusted to accommodate the slot capacity allocated to the alliances, as well as the capacity allocated to their own liner shipping activities. However there were some discrepancies between the data that was available and data that was desired. Most of the problems with the data originated from the different scope of the data:

- The Alphaliner Top 100 is based on the total fleet capacity of a company
- Most alliances are forged for one trade route (often Asia-Europe) or a few of trade routes

In order to resolve the abovementioned difference in the scope of the data, a more detailed list of missing characteristics of the data had to be listed and resolved:

- The part of the liner shipping companies fleet that is allocated to the North Europe-Asia trade
- The slot capacity commitment to an alliance
- The large diversity in Slot and Vessel Sharing Agreements (VSA's) outside the alliances

No accessible written source or database was found that provided straightforward answers to the missing characteristics. The extensive desk research that was conducted for the terminal operating companies, has taught us that it is not always possible to gather this kind of critical data from the companies themselves. With no data publicly available, it is decided that assumptions and estimation had to be made to solve the discrepancies that are presented above.

5.3.3.1. Preparing the data for the market concentration analysis

The different scope of the data that is provided for the entire industry, whilst the shipping alliances are mostly focused on the important (North)Europe-Asia trade provides the first challenge for the data. Estimating the percentage of resources that each shipping company has focused on the NE-Asia trade can only be performed with detailed data from all the liner shipping companies. A source of data that would provide the liner shipping companies focus on the HLH range or on the (Northern) Europe-Asia trade was not retrieved however. Any attempt to estimate the focus of the companies on this trade or the HLH range was found to be highly arbitrary, or would result in a percentagewise reduction of all the liner shipping companies. A percentagewise reduction for all the companies would not change the market percentages of these companies, since the proportions remain the same. Therefore since no specific data of the focus of the individual companies could be retrieved, the original dataset is utilized. In reality strong differences of a liner shipping company its focus on certain trade routes is expected, which could strongly influence the market concentration on certain trade routes.

The mismatch with the data resides from the fact that the liner shipping companies do not have a 100 percent commitment to an alliance. The alliance commitment of the companies was retrieved in the article of Yap (2009), which provided the alliance commitment for 2006. The 200+ data on alliance commitment was the most recent data available. The data that Yap provided can be seen in the table below:

Table 38: Commitment of container shipping lines to their Respective Alliances in 2006

Year 2006	World Rank	Fleet Capacity (TEUs)	Share of World Fleet (%)	Capacity committed to Alliance (TEUs)	Share of world fleet (%)	Share of capacity committed (%)	Distribution of capacity within alliance (%)
CHKY Alliance		*1.202.613*	*13.1*	*916.873*	*10.0*	***76.2***	
Cosco	6	369.749	4.0	270.404	2.9	73.1	29.5
Hanjin	8	341.600	3.7	277.706	3.0	81.3	30.3
K Line	13	255.485	2.8	192.905	2.1	75.5	21.0
Yangming	15	235.779	2.6	175.858	1.9	74.6	19.2
Grand Alliance		*1.073.715*	*11.7*	*650.670*	*7.1*	***60.6***	
Hapag-Lloyd	5	442.343	4.8	238.898	2.6	54.0	36.7
NYK	10	308.281	3.4	193.374	2.1	62.7	29.7
OOCL	12	283.893	3.1	202.860	2.2	71.5	31.2
MISC	25	39.198	0.4	15.538	0.2	39.6	2.4
New World Alliance		*757.766*	*8.3*	*489.084*	*5.3*	***64.5***	
APL	9	308.424	3.4	210.881	2.3	68.4	43.1
MOL	11	288.059	3.1	141.716	1.5	49.2	29.0
Hyundai	18	161.283	1.8	136.487	1.5	84.6	27.9
Independent Operators							
Maersk Line	1	1.661.200	18.1				
MSC	2	964.541	10.5				
CMA CGM	3	631.615	6.9				
Evergreen	4	544.752	5.9				
CSCL	7	358.276	3.9				

Source: Yap W.Y. (2009)

The average alliance commitment to the three large shipping alliances was around 60 to 77 percent in 2006. The restructuring that took place in the liner shipping industry at the end of 2011 marked a new phase of alliance compositions and therefore the above displayed table of Yap is reproduced with the 2011 data. The 2006 data from Yap provided the latest information regarding the percentagewise alliance commitment of the liner shipping companies and therefore these percentages were also

utilized for the 2011 data. In the new alliance commitment table there are three new alliance partners in the form of Evergreen Line, MSC and CMA CGM. For these companies the commitment to their new alliance or partnership was unknown. Since no data was available regarding the alliance commitment of these companies, the commitment is estimated at 50 percent.

Table 39: Commitment of container shipping lines to their Respective Alliances in 2011

Year 2011	Total		Alliance		Non-Alliance		Alliance commitment		
							2006	2011	change
CKYH Alliance + Evergreen	2.421.724	576	1.680.415	394	741.309	182	-	69,4%	-
COSCO Container L.	646.310	147	472.453	107	173.857	40	73,1%	73,1%	
Hanjin Shipping	468.952	99	381.258	80	87.694	19	81,3%	81,3%	
Yang Ming Marine Transport Corp.	355.182	86	268.162	65	87.020	21	75,5%	75,5%	
K Line	337.002	78	251.403	58	85.599	20	74,6%	74,6%	
Evergreen Line	614.278	166	307.139	83	307.139	83	0,0%	50,0%	+ 50,0%
G6 Alliance	2.800.954	493	1.777.159	325	1.023.795	235	-	63,4%	-
Hapag-Lloyd	643.667	146	347.580	79	296.087	67	54,0%	54,0%	
APL	617.424	146	422.318	100	195.106	46	68,4%	68,4%	
MOL	435.469	99	214.251	49	221.218	50	49,2%	49,2%	
OOCL	405.126	85	289.665	61	115.461	24	71,5%	71,5%	
NYK Line	402.901	101	252.619	63	150.282	38	62,7%	62,7%	
Hyundai M.M.	296.367	62	250.726	52	45.641	10	84,6%	84,6%	
MSC/CMA CGM	3.442.815	879	1.721.408	440	1.721.408	440	0,0%	50,0%	-
Mediterranean Shg Co	2.096.382	478	1.048.191	239	1.048.191	239	0,0%	50,0%	+ 50,0%
CMA CGM Group	1.346.433	401	673.217	201	673.217	201	0,0%	50,0%	+ 50,0%

Not allocated to the alliances	
Mediterranean Shipping Co	1.048.191
CMA CGM Group	673.217
Evergreen Line	307.139
Hapag-Lloyd	296.087
MOL	221.218
COSCO Container L.	173.857
APL	195.106

Not allocated to the alliances	
NYK Line	150.282
OOCL	115.461
Hanjin Shipping	87.694
Yang Ming Marine Transport Corp.	87.020
K Line	85.599
Hyundai M.M.	45.641

Source: Own calculations

When compared with the original tables of Yap the tables above from 2011 show a considerable increase of the TEU slot capacity numbers of the individual liner shipping companies. The table above presents the important changes in alliance structure that took place in December 2011. In the same period new Vessel Sharing Agreements (VSA's) and slot sharing arrangements were also arranged. The VSA´s can be seen as cooperative agreements between liner shipping companies that lack the scale and the commitment of the alliances. The wide abundance of these VSA's and the different agreements on various routes led to the exclusion of the VSA's for the market concentration analysis. This concludes the preparation of the Alphaliner Top 100 data for the improved market concentration analysis, which will be performed in the next paragraph.

5.3.3.2. Calculating the market concentration – Alliances included

Table 40: Alphaliner Top 100 liner shipping companies as per 10 December 2011 - adjusted for alliances

		Total			N=4	N=4	N=23	N=23
Rnk	Operator	TEU	Ships	Alliance	HHI	H*	HHI	H*
1	APM-Maersk	2.523.620	658	-	0,11	-	0,04	-
2	G6 alliance	1.777.159	369	G6	0,05	-	0,02	-
3	MSC/CMA CGM	1.721.408	440	MSC/CMA	0,05	-	0,02	-
4	CKYH alliance + E	1.680.415	415	CKYH+E	0,05	-	0,02	-
5	Mediterranean Shg Co	1.048.191	239	MSC/CMA	-	-	0,01	-
6	CMA CGM Group	673.217	201	MSC/CMA	-	-	0,00	-
7	CSCL	533.867	149	-	-	-	0,00	-
8	Hamburg Süd Group	402.944	115	-	-	-	0,00	-
9	CSAV Group	383.008	85	-	-	-	0,00	-
10	Zim	324.781	93	-	-	-	0,00	-
11	Evergreen Line	307.139	83	CKYH + E	-	-	0,00	-
12	Hapag-Lloyd	296.087	53	G6	-	-	0,00	-
13	PIL (Pacific Int. Line)	275.911	144	-	-	-	0,00	-
14	UASC	231.533	55	-	-	-	0,00	-
15	MOL	221.218	40	G6	-	-	0,00	-
16	APL	195.106	32	G6	-	-	0,00	-
17	COSCO Container L.	173.857	32	CKYH + E	-	-	0,00	-
18	Wan Hai Lines	173.035	77	-	-	-	0,00	-
19	NYK Line	150.282	28	G6	-	-	0,00	-
20	OOCL	115.461	16	G6	-	-	0,00	-
21	HDS Lines	87.746	23	-	-	-	0,00	-
22	Hanjin Shipping	87.694	14	CKYH + E	-	-	0,00	-
23	Yang Ming Marine Trans. Corp.	87.020	17	CKYH + E	-	-	0,00	-
#	Top 4	7.702.602	1.881	-	0,26	0,01	-	-
	In percentage (%)	39,6%	31,0%	-	-	-	-	-
#	Top 23	13.470.699	3.375	-	-	-	0,10	0,06
	In percentage (%)	88,5%	68,5%	-	-	-	-	-
#	Top 103 (Total)	15.153.679	4.770	-	-	-	0,08	0,07

Source: Own calculations

The addition of the shipping alliances to the market concentration analysis did not provide large differences when compared with the previous analysis performed in chapter 5.2. The market concentration has only marginally risen in each of the three groups that are analyzed. The normalized Hirschmann Herfindahl analysis indicates low market concentration in all the three categories, with 0.08 as the highest H* number. The table that provides the entire top 100 and the three alliances MSC/CMA CGM, G6 and the CKYH+E can be retrieved in the Appendix.

The addition of the alliances to the slot capacity analysis of the largest 100 container shipping companies did not bring the expected results. Although it raises the market concentration, it is not as high as was anticipated. The hypothetical situation of full alliances is also investigated in the Appendix, in which the shipping lines have a 100 percent commitment to their alliance. This resulted in the only situation in which moderate market concentration was found. The improved market concentration analysis of the liner shipping companies that is performed in this paragraph confirms the same as the prior analysis performed. The H* analysis indicates for low market concentration regardless of the fact that the shipping alliances are taken into account.

5.4. Concluding remarks – Shipping lines and alliances

The three business patterns that were derived from Song (2003) provided the background information regarding the changes that influenced and continue to influence and the liner shipping industry. The scale enhancements that led to the strong increase of the vessel size in the course of the years can also potentially affect the market concentration of the industry. The largest category of container vessels proved to be controlled only by a handful of liner shipping companies, which benefit the most from the economies of scale. This can potentially affect the market concentration of the industry in the near future. The restructuring of the liner shipping industry led to the formation of alliances, takeovers and mergers. These events all had a contributing effect on the market concentration of the industry. The market concentration was researched with the HLH range in mind. This however proved difficult since whilst the ports and port authorities can be confined to a certain area, the liner shipping companies are more footloose. The ports of the HLH range are part of shipping loops (also named service loops), which can be seen as a chain of ports at which the vessels call. These loops are subjective to change and therefore the liner shipping industry can be regarded more flexible and footloose than the other industries that are involved.

The Alphaliner dataset provided the container slot capacity of the liner shipping companies in great detail. The data of choice would have been the actual throughput of the liner shipping companies, as which was also utilized for the TOC and terminal concentration analysis. The reasons behind the choice for the capacity based data of Alphaliner was the level of detail, the completeness, the frequent usage in other literature e.g. United Nations reports and the fact that the desired throughput data per liner shipping company was not readily available. The market concentration analysis performed by the normalized Hirschmann Herfindahl Index on this data provided results of low market concentration. This analysis however did not take the shipping alliances into account, as well as the fact that this concerned worldwide slot capacity, not the capacity utilized on the trades involving the HLH range or Northern Europe. The second analysis performed for the liner shipping companies attempted to take the alliances into account. This analysis returned with slightly higher levels of market concentration. This little increase was not enough to pass the benchmark of moderate market concentration. Therefore the same conclusion could be drawn from the second market concentration analysis, low market concentration. Based purely on the market concentration figures the answer to the second sub question is relatively straightforward, the first and the second analysis both indicated low market concentration. The final results need to be taken with some reservation regarding the fact that it was not able to incorporate the allocation to the HLH range and the allocation to the Northern Europe-Asia trade. Like the analysis performed on the TOC's, the market concentration can be considerable higher on a local scale. The large average vessel size and the formation of multiple alliances and VSA's on the NE-Asia trade indicate that this trade route is mostly served by the industry leaders and the shipping alliances. These considerations are noted, however since these cannot be calculable these are hard to take into account. Therefore the answer to the second sub question should be that there is no market concentration taking place in the global container liner shipping sector.

SQ2: Is market concentration taking place in the container liner shipping industry?

The low market concentration in the liner shipping industry can also indicate that there is a lot of competition within the liner shipping industry. The analysis of the Northern Europe-Asia trade seems

to confirm that the competition is very high on this trade route. The restructuring that took place at the end of 2011 has dramatically increased the slot capacity on this trade. All the large players have placed their largest vessels on this trade and have increased their service level. The fact that the introduction of the Daily Maersk service led to a new round of consolidation suggests that in order to compete successfully in this industry a minimum efficient scale is required. The increased competition on the (Northern) Europe-Asia trade could lead to increased market concentration, when the competitive battle is won or lost by a couple of the players. The scale advantages can lead to a price based competition, which would quite possibly signal the exclusion of smaller players on this trade.

The differentiation of the liner shipping companies towards the container terminal operating industry provides a partial answer to the third sub question of this Master's Thesis. In more than one third of the analyzed container terminals liner shipping influence was noticed. This often concerned the newer and larger container terminals. Since the actual effect of these vertical alliances cannot be calculated due to its complexity, it is therefore regarded to be beyond the scope of this Master's Thesis. The vertical alliances will however have a contributing effect on the market concentration of the liner shipping companies within the HLH range, to what degree however remains unknown. Therefore what remains is the belief that the differentiation will increase the already measured market concentration in both industries and especially in the differentiating liner shipping industry. To answer the third sub question the effect of the principal players on the market position of the port authorities is to be researched.

SQ3: Is the market position of the port authorities worsened by the market concentration at the container terminal operating and liner shipping sector?

The third sub question therefore consists of three elements that influence the port authorities position: the concentration in the liner shipping industry, the concentration in the terminal operating industry and the effect of vertical alliances between these two industries. This chapter, the liner shipping industry provided the results of low market concentration in the liner shipping industry, albeit with some considerations. Whilst low concentration was measured on a global scale, the experience from the terminal operating industry taught us that moderate and high market concentration could occur on a more local scale such as the HLH range or the Northern Europe – Asia trade. However with four large scale players of almost equal size in the form of Maersk Line, MSC/CMA CGM, the G6 alliance and the CKYH alliance the market concentration index will remain relatively low. The HLH range is at the cutting edge of these competitive battles, with all the global TOC's present and all of the large players in the liner shipping industry calling at their ports, the HLH range market concentration is likely very comparable with that of the entire industry.

Regarding the third sub question it is witnessed that the market concentration of the TOC's and the liner shipping companies is rising and expected to rise further in the near future. The vertical alliances of the principal players provide an additional increase of the market concentration. There is no model or calculation for the influence that these various elements exert on the market position of the port authorities. Although no model for these influences exists, the increasing market concentration and the horizontal as well as vertical integration that takes place at the principal players, is expected to negatively affect the market position of the port authorities.

6. Conclusion and recommendations

6.1. Conclusions

The central research question was formulated as: "**Is market concentration in the terminal operating and liner shipping industry threatening the market position of the HLH range port authorities?"** The objective of the performed research was to identify whether or not market concentration was taking place in each of these two industries. During this research the vertical integration of the liner shipping industry and the terminal operating industry became apparent. The vertical alliances that take place in the form of the liner shipping companies differentiating into the terminal operating industry can potentially increase the market concentration. The main tool for the market concentration determination was the normalized Hirschmann-Herfindahl Index (H*). The performed analyses assisted in answering the following three sub questions:

SQ1: Are the HLH range terminal operating companies subject to market concentration?
SQ2: Is market concentration taking place in the container liner shipping industry?
SQ3: Is the market position of the port authorities worsened by the market concentration at the container terminal operating and liner shipping sector?

To provide an answer to the research question and the sub questions the different scopes of the three different actors were identified. The scope of the port authorities is on the port itself and its immediate hinterland. A local TOC would roughly has the same focus as the port authority. A global terminal operating company often maintains a network of terminals and therefore has a more widespread focus, reach and power. The liner shipping companies and especially the largest 20 liner shipping companies are active on every important trade route and have the ability to shift shipping loops to other ports or terminals. The liner shipping companies also differentiated into the terminal operating industry, providing them more control in the supply chain. The liner shipping companies therefore have a worldwide focus, have quite some market power and are more footloose than the other two players.

SQ 1: Are the HLH range terminal operating companies subject to market concentration?

In order to answer the first sub question the HLH range container terminals and TOC's were analyzed for the presence of market concentration. The ambitious goal was set to determine the market concentration of the terminal throughput and capacity for the years 2004 and 2010. This level of detail was not used in prior research and provided a good insight in the contribution of the individual terminals to the HH-index and the mechanics behind this analysis. Considerable effort was put in the data gathering phase, in order to collect all the terminal throughput and capacity figures for both 2004 and 2010. This however proved impossible for most of the 2004 data. The 2010 data was analyzed for market concentration on a terminal and terminal operating company level. The latter was preferred since although the detailed analysis on a terminal level provided more information, the decisional power resides at the level of the TOC. The market concentration proved to be high on the TOC level for almost all HLH range ports both based on the capacity and the throughput. The detailed analysis proved valuable in providing an insight in the mechanics behind the market concentration analysis and which of the terminals add most to the HH-index. The analysis also unveiled the large number of jointly shared terminals and the strong differing utility rates of the terminals and TOC's.

The second analysis was performed on the throughput figures of the terminal operating companies for the years 2008 - 2011. This second intra-port market concentration analysis confirmed the findings of the prior analysis and mostly provided moderate to high levels of market concentration. The large contestable hinterland of the compact HLH range provides an ideal situation for inter-port competition. Inter-port competition can counterweigh the market concentration that is active on an intra-port level. For the inter-port market concentration analysis all HLH ports where regarded as operating in one big market and thereby placed in one big concentration analysis. The H* results indicated moderate market concentration based on the throughput of the TOC's on the inter-port level. The inter-port market concentration can partially be explained by the fact that nearly every port has a large dominant TOC. The other part can be explained by the growing presence of the global TOC's within the HLH range. Almost all of the recently constructed or planned Greenfield terminal projects involve a global terminal operating company. Therefore it can be expected that the inter-port market concentration level will increase in the near future. The first sub question can therefore be confirmed as a result of the moderate to high figures of market concentration within the ports and even moderate concentration in the HLH range itself. Therefore indeed market concentration is present amongst the HLH TOC's.

SQ2: Is market concentration taking place in the container liner shipping industry?

The second sub question focused on the liner shipping industry, an industry that was shaped by several big consolidation rounds. The consolidation rounds formed large liner shipping companies as the result of mergers and acquisition, as well as a couple of horizontal alliances.

The first market concentration analysis determined was performed on the cellular slot capacity of the largest 100 liner shipping companies. The normalized H* index provided the result of low market concentration for the liner shipping industry. A second analysis was performed on the same cellular slot capacity data, albeit with an adjustment for the liner shipping alliances. The second analysis that included the shipping alliances only marginally increased the H* results of the previous research. There where however some limitations regarding the scope of the data. It would have been preferred to utilize liner shipping companies data that would focus on the HLH range ports or the (Northern) Europe-Asia trade and also include the various Vessel Sharing Agreements (VSA's) into the market concentration analysis. The differentiation of the liner shipping companies towards the terminal operating industry will also attribute to the market concentration, however with an incalculable amount. When the three limitations could have been incorporated into the calculation, the effect of the market concentration on the HLH range port authorities would have been even more explicit and as a result of the VSA's and the differentiation might have been slightly higher.

From the three limitations one might actually lower the market concentration, which is the focus on the (Northern) Europe-Asia trade. The recent restructuring at the end of 2011 dramatically increased the competition and the slot capacity on this trade. All the large players have placed their largest vessels on this trade and have increased their service level. The restructuring created four very large players in the form of Maersk Line, MSC/CMA CGM, the G6 alliance and the CKYH alliance. These four players are much larger than the other players, however since these four are almost equal in their slot capacity size and therefore choice and competition remain in the industry. This would result in a

relatively low market concentration index and therefore dampen the effect of the other two limitations. Based on the results of the performed market concentration analyses and the explanation of the limitations, the market concentration in the liner shipping industry can be regarded low.

SQ3: Is the market position of the port authorities worsened by the market concentration at the container terminal operating and liner shipping sector?

The third sub question consists out of four different elements that influence the final answer to this sub question. The market concentration analysis of the two principal players forms two of these elements that answer this sub question. The vertical alliances and the linkages between the two industries provide the third element, whilst the fourth element consists of the matter in which these three elements influence the market position of the port authorities. The vertical integration of the liner shipping companies into the terminal operating industry was described in chapter 5.1.3 – Differentiation. The calculation of these vertical alliances provided too many variables with the differing sizes of the liner shipping and terminal operating companies and the differences in the degree of the cooperation in monetary and operational terms. The effect that these variables have on the market concentration is also unknown and not found in previous research. Although the effect of these vertical alliances on the market concentration is unknown, the direction is known. The vertical alliances will always be attributing to the market concentration that was determined for the individual industries. In the case of the differentiation of the liner shipping industry it will mostly add to the liner shipping industry market concentration, since this is the dominant industry that differentiated.

The HLH range terminal operating industry analysis recorded very high levels of market concentration for the TOC throughput within most of the HLH range ports. The performed analysis of the inter-port market concentration only partially reduced the concentration to moderate market concentration. The liner shipping industry with its increasing economies of scale and its liner shipping alliances, actually recorded low levels of market concentration. The vertical alliances as described above attribute to the market concentration of the liner shipping companies, albeit with an unknown degree. The combination of the high and moderate market concentration in the HLH range operating industry and the low concentration within the shipping industry provide mixed signals for the final answer of this sub question. What is certain however is that the market position of the port authority has been reduced in comparison with a few decades ago. The growing and changing containerized industry is now increasingly led by the globally operating principal players of the port and this trend is likely to continue. Therefore the sub question is confirmed and the market position with regards to its chain steering position is indeed worsened by the growing power and market concentration at the terminal operating and liner shipping industry.

RQ: "Is market concentration in the terminal operating and liner shipping industry threatening the market position of the HLH range port authorities?"

The final conclusion for the central research question overlaps for a large part with the conclusion drawn for the third sub question. The growing market power as a result of the growing market concentration at the local level for both the terminal operating and the liner shipping industry, indeed affects the market position of the port authorities within the HLH range. Especially the liner shipping industry is gearing towards more control of the supply chain and more control in the terminal

operating industry. The last big consolidation round that took place in December 2011 resulted in bigger and more clustered alliances and also increased the number of VSA's.

The presence of market concentration can influence the negotiation power of the principal players and as a result reduce the market power of the port authority. The captive hinterland of the HLH range ports makes the ports substitutes for each other, which also affects the market position. As a reaction to the economic uncertainties and in an attempt to attract more cargo almost all ports provided discounts for the port dues in the 2008-2013 time frame. The port dues and the revenue of the contracts are the two main sources of income for the port authorities and as a consequence of high market concentration this could lead to the principal players putting more pressure on the prices of the port authority. In that regard the port authorities have a special relationship with the terminal operating companies within their port. At first the port authority and the terminal operating companies will negotiate strongly about the long-term lease contract and the concession fee. Their role changes when the TOC has signed a long-term lease agreement, from that point of the mutual interest of the port authority and the terminal operating company will be attracting the containers shipped by the liner shipping companies.

In the early days of containerized shipping the port authority and the local terminal operators played a very important role in the development of the containerized cargo for the port. The HLH range port authorities often have developed the container throughput in cooperation with the dominant TOC of the port. The increasing growth of the containerized industry has in most ports developed into a situation that one dominant TOC has grown considerably larger than the other companies. The port authority and the TOC together thereby generated quite some market power within the port, within the immediate hinterland and even within the port range. Although this situation still remains for some part, it are the large networks of the global terminal operators and the large liner shipping companies that have taken over the control in the supply chain. The large liner shipping and terminal operating companies often have multiple choices within the HLH range and if they are able to persuade logistical companies, buyers and sellers of the goods, the companies are able to direct a significant part of the good flow to the port of their pleasing. Especially the large liner shipping companies have an important role in the chain, since these companies are increasingly participating in container terminals in the form of shareholding and joint-ventures. This makes it increasingly important for the port authority to have the right TOC('s) present within the port. It would therefore be important to put their eggs in multiple baskets and when possible have a couple of the large global TOC's within the boundaries of their port.

Whilst it seems that the large scale global operators and global liner shipping companies are increasingly dominating the containerized industry, the port authorities still have one important card up their sleeve. Besides a ports size its importance and popularity within the industry is also determined by its amenities such as its location, infrastructure and available Greenfield area for container terminal development. The construction of the Maasvlakte 2 at the port of Rotterdam provided these amenities, resulting in multiple companies showing interest in the terminals. By means of concession bidding procedure the port authority managed to receive a concession fee and was even able to put strict rules for the modal split in the contract requirements.

The HLH range and the Northern Europe-Asia have proven to be good candidates for the performed research, since both proved to be very important within the containerized trade and often the location where new innovations and the newest ships are utilized. The conclusion for the HLH range port authorities therefore is that the position of the global TOC's and the liner shipping companies has improved and this has therefore diminishes the port authorities market power and negotiating power to some degree. Regarding the steering position in the supply chain the position of the HLH range port authorities has weakened. On the other hand the port authorities still have a card up their sleeve regarding the locational factor. Good terminal is still highly valuable for both the terminal operating companies and the liner shipping companies.

6.2. Recommendations and limitations

For the recommendations of further research one could improve the research data and provide a larger and in some cases more complete dataset. Expanding the dataset with more years of analysis and replacing the estimated values will improve the findings of the research. This could be performed for the market concentration analysis of the HLH range terminal operating and the liner shipping industry. The analyses of the terminal operating companies could be improved by replacing the estimated values and adding the Le Havre data. For each of the analyzed ports adding data for the years before or after the researched 2008 - 2011 period will provide a bigger picture of the development of the TOC market concentration.
For the liner shipping industry analysis detailed data regarding the HLH range or the (Northern) Europe-Asia trade would improve the analysis. Data regarding the slot capacity that the liner shipping companies and alliances deploy on these two areas would provide a more focused market concentration analysis. When a complete dataset regarding the actual transported and transshipped containers by the liner shipping companies and alliances would be available for these two areas, the analysis would be improved even further. The current analysis is only performed on one year, when the liner shipping analysis is performed for multiple years and with for instance a two or a five year interval trends within the market concentration development could be witnessed. As a recommendation a study can also be made on the vertical alliances, the differentiation of the liner shipping companies towards the terminal operating industry.

As a recommendation for the HLH port authorities the main recommendation has been provided by answering the research question. The port and the port authority still have a lot to offer to the liner shipping and terminal operating industry, in the form of good terminal space, hinterland connections and other services that the port authority provides. The developments that take place in the terminal operating and especially the liner shipping industry are unstoppable and will have to be faced by the port authorities. The industry leaders have grown strongly in the past couple of decades and now control hundreds of ships or dozens of terminals around the world. The changing and increasing company and industry size, the increases in cooperation, market concentration and market power are strong forces within the industry. The HLH range port authorities are directly connected to the strong European consumer market as well as the strong industrial market, both generating a high supply and demand of containerized cargo. When the port authority provides the right conditions, the terminal operating companies can be persuaded to outbid each other for a terminal position in the port. The same can be said for the liner shipping companies, with the right terminal operating companies present and the right conditions met, these will include the port in their service loop.

The limitations of the research are well defined within the overall conclusion of the Master's Thesis. The data availability provided a limitation for both the terminal operating and the liner shipping industry analysis. With the data of the liner shipping companies on the HLH range level or on the (Northern) Europe-Asia trade the market concentration analyses would have been more accurate. The exclusion of the VSA's and other forms of cooperation also provides limitations to the research. The research has focused on three important players, however the logistical companies and the industries that are responsible for the demand and the supply of the goods are not taken into the equation. In the prior research it is anticipated that the liner shipping companies determine the service loops, which is true to some degree. On the other hand given that it is a homogeneous service that is provided, the buyers and the sellers can very well choose to work with a competitor that uses another port that is cheaper or significantly faster. Therefore the chain steering ability of the liner shipping companies is also not to be overestimated.

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APPENDIX

Appendix A: Introduction, Changing Environments, Ports and Port Authorities

Full table: The three major containerized trade flows: Transpacific, Europe – Asia, Transatlantic in 1995 to 2009

	Transpacific		*Europe-Asia*		*Transatlantic*	
From To	Far East N.America	N.America Far East	Far East Europe	Europe Far East	Europe N.America	N.America Europe
1995	3.97	3.54	2.40	2.02	1.68	1.69
1996	3.99	3.65	2.61	2.21	1.71	1.60
1997	4.56	3.45	2.96	2.32	2.06	1.72
1998	5.39	2.86	3.58	2.10	2.35	1.66
1999	6.11	2.92	3.90	2.34	2.42	1.50
2000	7.31	3.53	4.65	2.46	2.69	1.71
2001	7.43	3.40	4.71	2.47	2.58	1.55
2002	8.35	3.37	5.10	2.64	2.63	1.43
2003	9.00	3.61	6.87	3.76	3.03	1.64
2004	10.58	4.09	8.17	4.30	3.53	1.88
2005	11.89	4.48	9.33	4.42	3.72	1.99
2006	13.16	4.71	11.21	4.46	3.74	2.05
2007	13.54	5.30	12.98	4.97	3.51	2.41
2008	12.90	6.38	13.31	5.23	3.39	2.62
2009	10.62	6.12	11.36	5.46	2.74	2.04

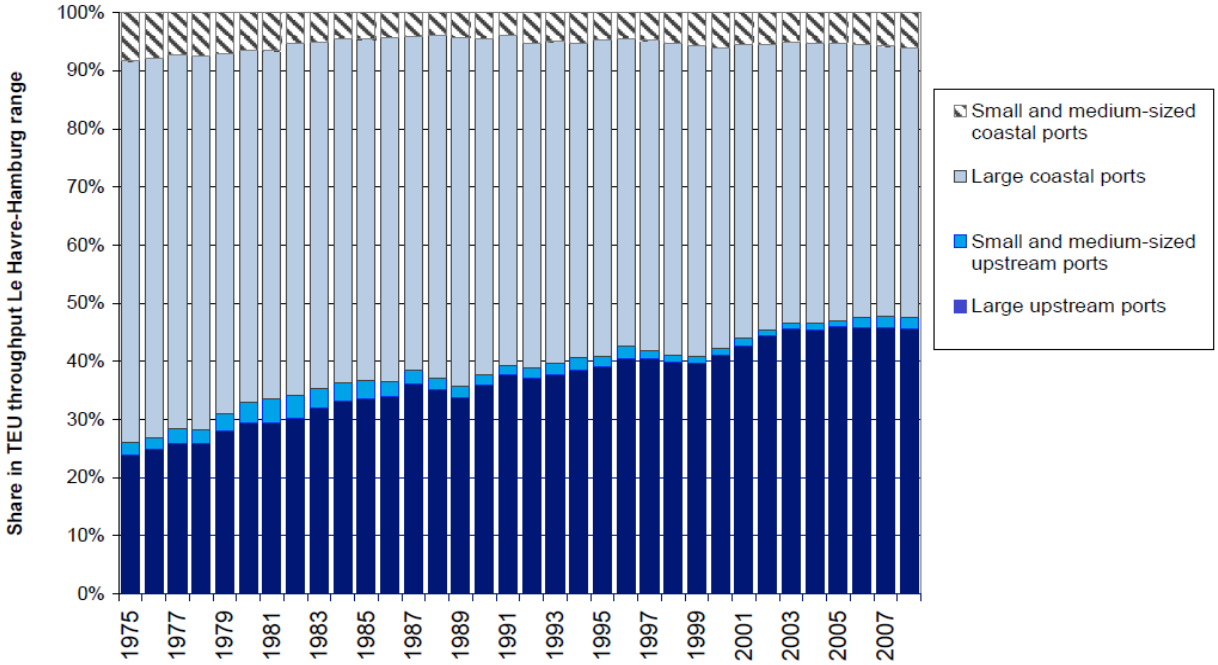
Source: UNCTAD (2012): Based on Global Insight Database as published in the "International Maritime transport in Latin America and the Caribbean in 2009 and projections for 2010". Bulletin FAL, Issue No. 288 – Number 8/2010, ECLAC.

Different types port governance models

	Ownership	Port admin	Nautical mgmt.	Port infrastr.	Super-structure	Cargo handling	Pilotage	Towage	Mooring	Dredging
Public service port							Pr	Pr	Pr	Pr
Tool port						Pr	Pr	Pr	Pr	Pr
Landlord port				Pr	Pr	Pr	Pr	Pr	Pr	Pr
Corporatized port		Pr	Pr	Pr	Pr	Pr	Pr	Pr	Pr	Pr
Private Service Port	Pr	Pr	Pr	Pr	Pr	Pr	Pr	Pr	Pr	Pr

Source: Rodrigue et al. (people.hofstra.edu, 2012)

Share in TEU throughput HLH-range between coastal and upstream ports 1975-2009



Source: Notteboom (2010)

Appendix B: Terminal Operating Companies

B1. Determining the HLH range market concentration – Full H* tables

Detailed terminal figures Hamburg for 2004 and 2010

Terminal figures Hamburg									
Terminal Operator	2004 Ilm Capacity	2004 Handled	2004 Utility %	2010 Ilm Capacity	2010 Capacity*	2010 Handled	2010 Utility %	HHI 2010 Capacity	HHI 2010 Handled
Eurogate	1.600.000	2.273.722	142%	3.300.000	4.100.000	2.119.628	52%	0,08	0,07
CT Hamburg	**1.600.000 (B)	2.273.722	142%	3.300.000	(C) 4.100.000	(B) 2.119.628	52%	0,08	0,07
HHLA	5.220.000	4.549.000	87%	10.200.000	10.200.000	(A) 5.548.000	57%	0,47	0,51
CT Burchardkai	2.600.000	(A) 2.558.000	98%	5.200.000	(Δ) 4.800.000	(^*) 2.487.000	52%	0,11	0,10
CT Altenwerder (25.1% Hapag)	1.900.000	(A) 1.266.000	67%	3.000.000	(D) 3.000.000	(^) 2.400.000	80%	0,04	0,09
CT Tollerort	720.000	(A) 725.000	101%	2.000.000	(D) 2.000.000	(^*) 661.000	30%	0,02	0,01
Buss Ports					350.000	120.000	52%	0,00	0,00
Hanse Terminal (multi+RoRo)					(Δ) 350.000	(Δ*) 120.000	52%	0,00	0,00
Total	**6.820.000**	**6.822.722**	**100%**	**13.500.000**	**14.250.000**	**7.787.628**	**56%**	**0,56**	**0,58**
Terminal HHI + Annual Report		*7.003.479*				*7.895.736*		*0,26*	*0,28*

A) Annual Reports of HHLA (2004, 2010)

B) Press releases Eurogate:

- http://www.eurogate.de/live/eg_site_en/eg_news_en/show.php3?id=55&nodeid=46&_language=en
- http://www.eurogate.eu/live/eg_site_en/eg_news_en/show.php3?id=251&nodeid=46&_language=en

C) Handelskammer Hamburg: http://www.hk24.de/linkableblob/367464/.6./data/Port_of_Hamburg_Facts_and_Figures_Stand_Februar_200952064-data.pdf;jsessionid=DD09AF25F1F37851A61D4FD5483F8F74.repl1

D) Port of Hamburg: http://international.hafen-hamburg.de/content/development-and-extension

^) Thesis van der Houwen – Benchmarking APMTR

^*) Combined terminal throughput in Benchmarking APMTR 3.148.000, divided by author

Δ) Dynamar – Container throughput & terminal capacity

Δ*) Estimated based on Dynamar 2009 figures

** Ilmer capacity altered

Detailed terminal figures Bremen for 2004 and 2010

Terminal figures Bremen									
Terminal Operator	2004 Ilm Capacity	2004 Handled	2004 Utility %	2010 Ilm Capacity	2010 Capacity*	2010 Handled	2010 Utility %	HHI 2010 Capacity	HHI 2010 Handled
Eurogate	3.800.000	(B) 3.447.668	91%	6.000.000	6.900.000	(B) 4.871.297	71%	1,00	1,00
NTB (50% APMT)	-	-	-	-	(^) 3.400.000	(^) 3.023.000	89%	0,24	0,39
Eurogate Bremerhaven	-	-	-	-	(^) 2.000.000	(^*) 697.343	35%	0,08	0,02
MSC Gate (50% MSC)	-	-	-	-	(^) 1.500.000	(^*) 1.150.954	77%	0,05	0,06
Total	**3.800.000**	**3.447.668**	**91%**	**6.000.000**	**6.000.000**	**4.871.297**	**71%**	1,00	1,00
Annual Report		*3.469.000*				*4.876.000*		*1,00*	*1,00*

B) Press releases Eurogate:

- http://www.eurogate.de/live/eg_site_en/eg_news_en/show.php3?id=55&nodeid=46&_language=en
- http://www.eurogate.eu/live/eg_site_en/eg_news_en/show.php3?id=251&nodeid=46&_language=en

^) Thesis van der Houwen – Benchmarking APMTR

^*) Altered figures from the Thesis of A. van der Houwen – Benchmarking APMTR

Detailed terminal figures Rotterdam for 2004 and 2010

Terminal figures Rotterdam									
Terminal Operator	2004 Ilm Capacity	2004 Handled	2004 Utility %	2010 Ilm Capacity	2010 Capacity*	2010 Handled	2010 Utility %	HHI 2010 Capacity	HHI 2010 Handled
ECT Terminals Total	6.800.000	(E) 5.033.000	74%	10.000.000	11.400.000	(F) 7.320.000	64%	0,46	0,43
Euromax Terminal (ECT)	-	-	-	2.000.000	(I) 2.300.000	(^) 1.720.000	75%	0,02	0,02
ECT Terminals (ex. Euromax)	6.800.000	-	-	8.000.000	9.100.000	(^) 5.600.000	62%	0,29	0,25
City Terminals	-	-	-	1.000.000	(G) 1.100.000	(^) 1.000.000	91%	0,00	0,01
Delta Terminals	-	-	-	-	(G) 8.000.000	(^) 4.600.000	58%	0,23	0,17
APM Terminals	1.200.000	-	-	1.500.000	(^) 3.519.000	(^) 2.413.000	71%	0,04	0,05
APM Terminal Delta	1.200.000	-	-	1.500.000	3.400.000	(H) 2.410.000	71%	0,04	0,05
C. Steinweg Handelsveem	-	-	-		(J) 2.000.000	(#) 1.412.000	71%	0,01	0,02
Uniport (ø)	-	-	-	-	(Δ) 1.800.000	(#) 550.000	31%	0,01	0,00
RST	-	-	-	-	(Δ) 1.400.000	(#) 862.000	62%	0,01	0,01
Kramer Groep	-	-	-	-	500.000	100.000	20%	0,00	0,00
Rotterdam Container Terminal	-	-	-	-	500.000	(Δ*) 100.000	20%	0,00	0,00
Interforest	-	-	-	-	200.000	50.000	20%	0,00	0,00
Interforest Terminal	-	-	-	-	200.000	(Δ*) 50.000	20%	0,00	0,00
Total	8.000.000	5.033.000	104%	11.500.000	16.919.000	11.145.000	66%	0,52	0,49
Annual Report		*8.282.000*				*11.145.000*		*0.39*	*0.37*

E) Annual Report of HPH Whampoa (2004)

F) "More than 7 million" ECT Fast Forward Munich (May 2011)

G) ECT Focus on Brochure

H) http://www.porttechnology.org/news/apm_terminal_to_use_moerdijk_harbor_to_ease_port_of_rotterdam_traffic_conge

I) http://www.tba.nl/uploads/files/euromax,_a_new_standard_in_container_handling.pdf

J) http://www.shortsea.nl/main/news_down4.php?id=1816&language=1

ø) Hanno Terminal transferred from ownership between 2004 and 2010 from ECT to Uniport

^) Thesis van der Houwen – Benchmarking APMTR

Δ) Dynamar – Container throughput & terminal capacity

Δ*) Dynamar 2009 figures utilized for 2010

#) Calculated difference

Detailed terminal figures Antwerp for 2004 and 2010

Terminal figures Antwerp									
Terminal Operator	2004 Ilm Capacity	2004 Handled	2004 Utility %	2010 Ilm Capacity	2010 Capacity*	2010 Handled	2010 Utility %	HHI 2010 Capacity	HHI 2010 Handled
PSA operated terminals	6.265.000	(Q) +5.000.000	80%	10.015.000	12.500.000	7.000.000	58%	0,68	0,69
MSC Home Terminal (50% MSC)	2.800.000	-	-	-	(K) 5.400.000	(P) 4.500.000	83%	0,13	0,28
Deurganck Terminal	-	-	-	-	(K) 2.600.000	(^) 288.000	11%	0,03	0,00
Noordzee Terminal	1.875.000	-	-	-	(L) 2.000.000	(^) 1.360.000	68%	0,02	0,03
Europa Terminal	1.700.000	-	-	-	(L) 1.700.000	(^) 375.000	22%	0,01	0,00
Churchill Terminal	450.000	-	-	-	(Δ) 450.000	(^) 372.000	83%	0,00	0,00
DP World (P&O terminals)	2.000.000	1.300.000	93%	5.500.000	2.400.000	1.301.000	54%	0,03	0,02
Antwerp Gateway	-	-	-	-	(Δ) 1.800.000	(^) 811.000	45%	0,01	0,01
Delwaide dock	(O) 1.400.000	(O) 1.300.000	-	-	(Δ) 600.000	(^) 490.000	82%	0,00	0,00
ICL	-	-	-	-	200.000	130.000	65%	0,00	0,00
Independant container line	-	-	-	-	(Δ) 200.000	(Δ) 130.000	65%	0,00	0,00
Total	7.665.000	6.300.000	82%	15.515.000	14.750.000	8.431.000	58%	0,71	0,71
Annual Report		*6.064.000*				*8.468.000*		*0.56*	*0.57*

K) PSA International website
L) PSA International presentation – Filip Merckx (2006)
M)Ninneman (2006) http://www.port-net.net/activities/pdf/ninnemann_bpt_container_09052006.pdf
N) Cosco Annual Report – Container Terminals (2005)
O) http://www.prnewswire.co.uk/cgi/news/release?id=121419
P) Minimum efficient scale of terminal (Notteboom 2010)
Q) http://www.internationalpsa.com/psanews/pdf/nr050613_antwerp.pdf
Δ) Dynamar – Container throughput & terminal capacity
^) Thesis A. van der Houwen – Benchmarking APMTR

Detailed terminal figures Zeebrugge for 2004 and 2010

Terminal figures Zeebrugge								
Terminal Operator	2004 Ilm Capacity	2004 Handled	2010 Ilm Capacity	2010 Capacity*	2010 Handled	2010 Utility %	HHI 2010 Capacity	HHI 2010 Handled
APM Terminals* (Flanders)	1.000.000	-	2.000.000	1.000.000	562.000	56%	0,29	0,09
APMT Zeebrugge (25% SIPG)	1.000.000	-	2.000.000	(^) 1.000.000	(^) 562.000	56%	0,29	0,09
PSA	1.000.000	-	1.000.000	1.700.000	966.000	57%	0,21	0,15
PSA ZIP	-	-	-	(^) 600.000	-		0,03	0,00
PSA CHZ (35% CMA CGM)	1.000.000	-	1.000.000	(^) 1.100.000	(^) 966.000	88%	0,09	0,15
RoRo – P&O Ferries	-	-	-	-	(*) 234.000		0,00	0,01
RoRo – DFDS	-	-	-	-	(*) 234.000		0,00	0,01
RoRo – Searo	-	-	-	-	(*) 234.000		0,00	0,01
RoRo – Ico Terminals	-	-	-	-	(*) 234.000		0,00	0,01
Total	2.000.000	1.196.755	3.000.000	2.700.000	2.500.000	64%	0,53	0,24
Annual Report		*1.196.755*			*2.500.000*		0,44	0,09

^) Thesis A. van der Houwen – Benchmarking APMTR
*) Calculated average

Detailed terminal figures Le Havre 2010

Terminal figures Le Havre						
Terminal Operator	2004 Handled	2009 Capacity*	2009 Handled	2009 Utility %	HHI 2009 Capacity	HHI 2009 Handled
CNMP		845.000	443.000	52%	0,03	0,03
Terminal d' Atlantique		(Δ) 650.000	(Δ) 290.000	45%	0,02	0,01
Quai des Ameriques (50/50 GMP, CNMP)		(Δ) 195.000	(Δ) 153.000	78%	0,00	0,00
GMP		1.778.333	1.071.000	60%	0,15	0,17
Quai des Ameriques (50/50 GMP, CNMP)		(Δ) 195.000	(Δ) 153.000	78%	0,00	0,00
North Terminal – Quai de l'Europe		(Δ) 250.000	(Δ) 140.000	56%	0,00	0,00
øTerminal de France (50% CMA CGM)		(Δ*) 1.333.333	(Δ) 778.000	58%	0,08	0,09
Terminaux Normandie – Perrigault		1.450.000	755.000	52%	0,10	0,10
L' Ocean (50% MSC)		(Δ) 1.000.000	(Δ) 680.000	68%	0,05	0,07
Normandie (L'Asie and d'Osaka)		(Δ) 450.000	(Δ) 75.000	17%	0,01	0,00
Perrigault		544.000	346.000	68%	0,01	0,02
øPorte Oceane (50% APMT)		(Δ) 544.000	(Δ) 346.000	68%	0,01	0,02
Total	2.150.000	5.073.333	2.615.000	40%	0,29	0,30
*Annual Report**	2.150.000		2.241.000		0,06	0,06

Δ) Dynamar – Container throughput & terminal capacity

Δ*) Deviation from Dynamar data , author's figures used

ø Located in Port 2000

** Instead of the Annual report , the Rotterdam port statistics data is utilized.*

B2. Determining the HLH range market concentration – Gini coefficient tables

Gini coefficient for Hamburg 2008 - 2011

Gini coefficient Hamburg – 2008 & 2009											
Operator.	X	Y 2008	σX	σY 2008	$\sigma X_{i-1} - \sigma X_i$ (B)	$\sigma Y_{i-1} + \sigma Y_i$ (A) 2008	A*B 2008	Y 2009	σY 2009	$\sigma Y_{i-1} + \sigma Y_i$ (A) 2009	A*B 2009
Eurogate	0,333	0,28	0,33	0,28	0,33	0,28	0,09	0,30	0,30	0,30	0,10
HHLA	0,333	0,71	0,67	0,99	0,33	1,26	0,42	0,69	0,99	1,29	0,43
Buss Ports	0,333	0,01	1,00	1,00	0,33	1,99	0,66	0,01	1,00	1,99	0,66
Total							**1,18**				**1,19**

Gini coefficient Hamburg – 2010 & 2011											
Operator.	X	Y 2010	σX	σY 2010	$\sigma X_{i-1} - \sigma X_i$ (B)	$\sigma Y_{i-1} + \sigma Y_i$ (A) 2010	A*B 2010	Y 2011	σY 2011	$\sigma Y_{i-1} + \sigma Y_i$ (A) 2011	A*B 2009
Eurogate	0.333	0.27	0.33	0.27	0.33	0.27	0.09	0.23	0.23	0.23	0.08
HHLA	0.333	0.71	0.67	0.98	0.33	1.26	0.42	0.87	1.10	1.33	0.44
Buss Ports	0.333	0.02	1.00	1.00	0.33	1.98	0.66	0.02	1.12	2.21	0.74
Total							**1.17**				**1.26**

Gini coefficient for Bremen 2008 - 2011

Gini coefficient Bremen – 2008 & 2009											
Operator.	X	Y 2008	σX	σY 2008	$\sigma X_{i-1} - \sigma X_i$ (B)	$\sigma Y_{i-1} + \sigma Y_i$ (A) 2008	A*B 2008	Y 2009	σY 2009	$\sigma Y_{i-1} + \sigma Y_i$ (A) 2009	A*B 2009
Eurogate	1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Total							**1.00**				**1.00**

Gini coefficient Bremen – 2010 & 2011											
Operator.	X	Y 2010	σX	σY 2010	$\sigma X_{i-1} - \sigma X_i$ (B)	$\sigma Y_{i-1} + \sigma Y_i$ (A) 2010	A*B 2010	Y 2011	σY 2011	$\sigma Y_{i-1} + \sigma Y_i$ (A) 2011	A*B 2009
Eurogate	1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Total							**1.00**				**1.00**

Gini coefficient for Rotterdam 2008 - 2011

Gini coefficient Rotterdam – 2008 & 2009											
Operator.	X	Y 2008	σX	σY 2008	$\sigma X_{i-1} - \sigma X_i$ (B)	$\sigma Y_{i-1} + \sigma Y_i$ (A) 2008	A*B 2008	Y 2009	σY 2009	$\sigma Y_{i-1} + \sigma Y_i$ (A) 2009	A*B 2009
ECT	0.2	0.59	0.20	0.59	0.20	0.59	0.12	0.62	0.62	0.62	0.12
APMT	0.2	0.25	0.40	0.84	0.20	1.43	0.29	0.25	0.86	1.48	0.30
Steinweg	0.2	0.14	0.60	0.98	0.20	1.82	0.36	0.12	0.98	1.85	0.37
Kramer	0.2	0.01	0.80	1.00	0.20	1.98	0.40	0.01	0.99	1.98	0.40
Interforest	0.2	0.00	1.00	1.00	0.20	2.00	0.40	0.01	1.00	1.99	0.40
Total							**1.56**				**1.58**

Gini coefficient Rotterdam – 2010 & 2011											
Operator.	X	Y 2010	σX	σY 2010	$\sigma X_{i-1} - \sigma X_i$ (B)	$\sigma Y_{i-1} + \sigma Y_i$ (A) 2010	A*B 2010	Y 2011	σY 2011	$\sigma Y_{i-1} + \sigma Y_i$ (A) 2011	A*B 2009
ECT	0.2	0.66	0.20	0.66	0.20	0.66	0.13	0.63	0.63	0.63	0.13
APMT	0.2	0.22	0.40	0.87	0.20	1.53	0.31	0.23	0.86	1.49	0.30
Steinweg	0.2	0.13	0.60	1.00	0.20	1.87	0.37	0.13	0.98	1.84	0.37
Kramer	0.2	0.01	0.80	1.01	0.20	2.01	0.40	0.01	0.99	1.98	0.40
Interforest	0.2	0.00	1.00	1.01	0.20	2.02	0.40	0.01	1.00	1.99	0.40
Total							**1.62**				**1.59**

Gini coefficient for Antwerp 2008 - 2011

Gini coefficient Antwerp – 2008 & 2009											
Operator.	X	Y 2008	σX	σY 2008	$\sigma X_{i-1} - \sigma X_i$ (B)	$\sigma Y_{i-1} + \sigma Y_i$ (A) 2008	A*B 2008	Y 2009	σY 2009	$\sigma Y_{i-1} + \sigma Y_i$ (A) 2009	A*B 2009
PSA	0.333	0.84	0.33	0.84	0.33	0.84	0.28	0.82	0.82	0.82	0.27
DP World	0.333	0.14	0.67	0.98	0.33	1.82	0.61	0.16	0.98	1.80	0.60
ICL	0.333	0.02	1.00	1.00	0.33	1.98	0.66	0.02	1.00	1.98	0.66
Total							**1.54**				**1.54**

Gini coefficient Antwerp – 2010 & 2011											
Operator.	X	Y 2010	σX	σY 2010	$\sigma X_{i-1} - \sigma X_i$ (B)	$\sigma Y_{i-1} + \sigma Y_i$ (A) 2010	A*B 2010	Y 2011	σY 2011	$\sigma Y_{i-1} + \sigma Y_i$ (A) 2011	A*B 2009
PSA	0.333	0.83	0.33	0.83	0.33	0.83	0.28	0.82	0.82	0.82	0.27
DP World	0.333	0.15	0.67	0.98	0.33	1.81	0.60	0.16	0.98	1.80	0.60
ICL	0.333	0.02	1.00	1.00	0.33	1.98	0.66	0.02	1.00	1.98	0.66
Total							**1.54**				**1.53**

Gini coefficient for Zeebrugge 2008 - 2011

Gini coefficient Zeebrugge – 2008 & 2009											
Operator.	X	Y 2008	σX	σY 2008	$\sigma X_{i-1} - \sigma X_i$ (B)	$\sigma Y_{i-1} + \sigma Y_i$ (A) 2008	A*B 2008	Y 2009	σY 2009	$\sigma Y_{i-1} + \sigma Y_i$ (A) 2009	A*B 2009
APMT	0.167	0.31	0.17	0.31	0.17	0.31	0.05	0.24	0.24	0.24	0.04
PSA	0.167	0.28	0.33	0.59	0.17	0.90	0.15	0.40	0.64	0.87	0.15
RoRo - P&O	0.167	0.10	0.50	0.69	0.17	1.27	0.21	0.09	0.73	1.36	0.23
RoRo - DFDS	0.167	0.10	0.67	0.79	0.17	1.48	0.25	0.09	0.82	1.55	0.26
RoRo - Sea-Ro	0.167	0.10	0.83	0.90	0.17	1.69	0.28	0.09	0.91	1.73	0.29
RoRo - Ico T.	0.167	0.10	0.50	0.69	0.17	1.27	0.21	0.09	0.73	1.36	0.23
Total							**1.15**				**1.19**

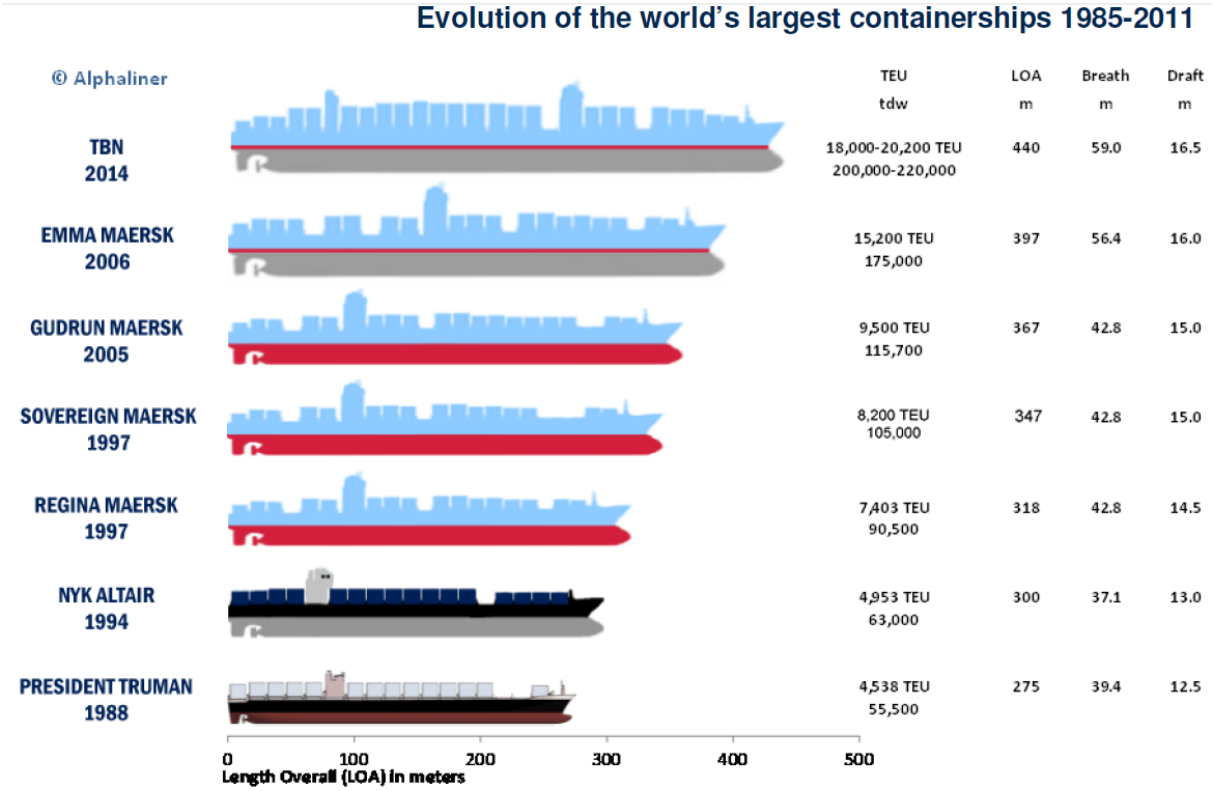
Gini coefficient Zeebrugge – 2010 & 2011											
Operator.	X	Y 2010	σX	σY 2010	$\sigma X_{i-1} - \sigma X_i$ (B)	$\sigma Y_{i-1} + \sigma Y_i$ (A) 2010	A*B 2010	Y 2011	σY 2011	$\sigma Y_{i-1} + \sigma Y_i$ (A) 2011	A*B 2009
APMT	0.167	0.22	0.17	0.22	0.17	0.22	0.04	0.29	0.29	0.29	0.05
PSA	0.167	0.39	0.33	0.61	0.17	0.84	0.14	0.40	0.69	0.99	0.16
RoRo - P&O	0.167	0.10	0.50	0.71	0.17	1.32	0.22	0.08	0.77	1.46	0.24
RoRo - DFDS	0.167	0.10	0.67	0.81	0.17	1.51	0.25	0.08	0.85	1.62	0.27
RoRo - Sea-Ro	0.167	0.10	0.83	0.90	0.17	1.71	0.28	0.08	0.92	1.77	0.30
RoRo - Ico T.	0.167	0.10	0.50	0.71	0.17	1.32	0.22	0.08	0.77	1.46	0.24
Total							**1.15**				**1.27**

Gini coefficient for Le Havre 2009

Gini coefficient Le Havre – 2009							
Operator.	X	Y 2009	σX	σY 2009	$\sigma X_{i-1} - \sigma X_i$ (B)	$\sigma Y_{i-1} + \sigma Y_i$ (A) 2009	A*B 2009
APMT	0.25	0.19	0.25	0.19	0.25	0.19	0.05
PSA	0.25	0.46	0.50	0.65	0.25	0.84	0.21
Perrigault	0.25	0.15	0.75	0.80	0.25	1.45	0.36
T. Normandie	0.25	0.32	1.00	1.12	0.25	1.92	0.48
Total							**1.10**

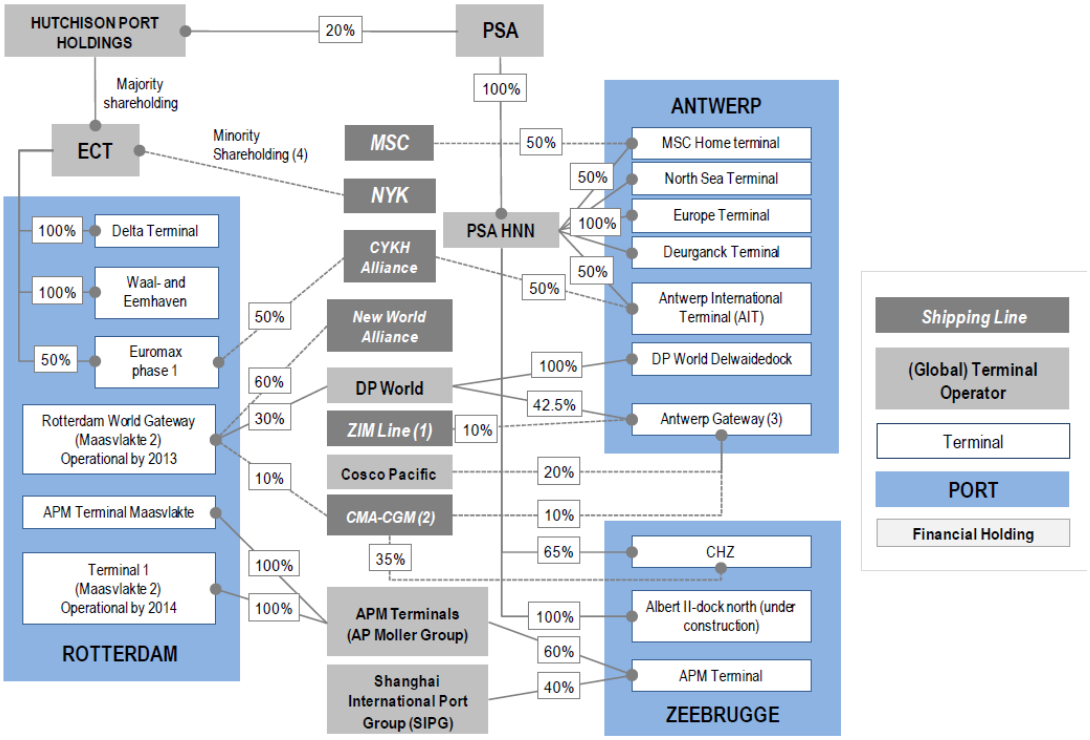
Appendix C: Shipping lines and alliances

The evolution of the world's largest container ships 1985-2011



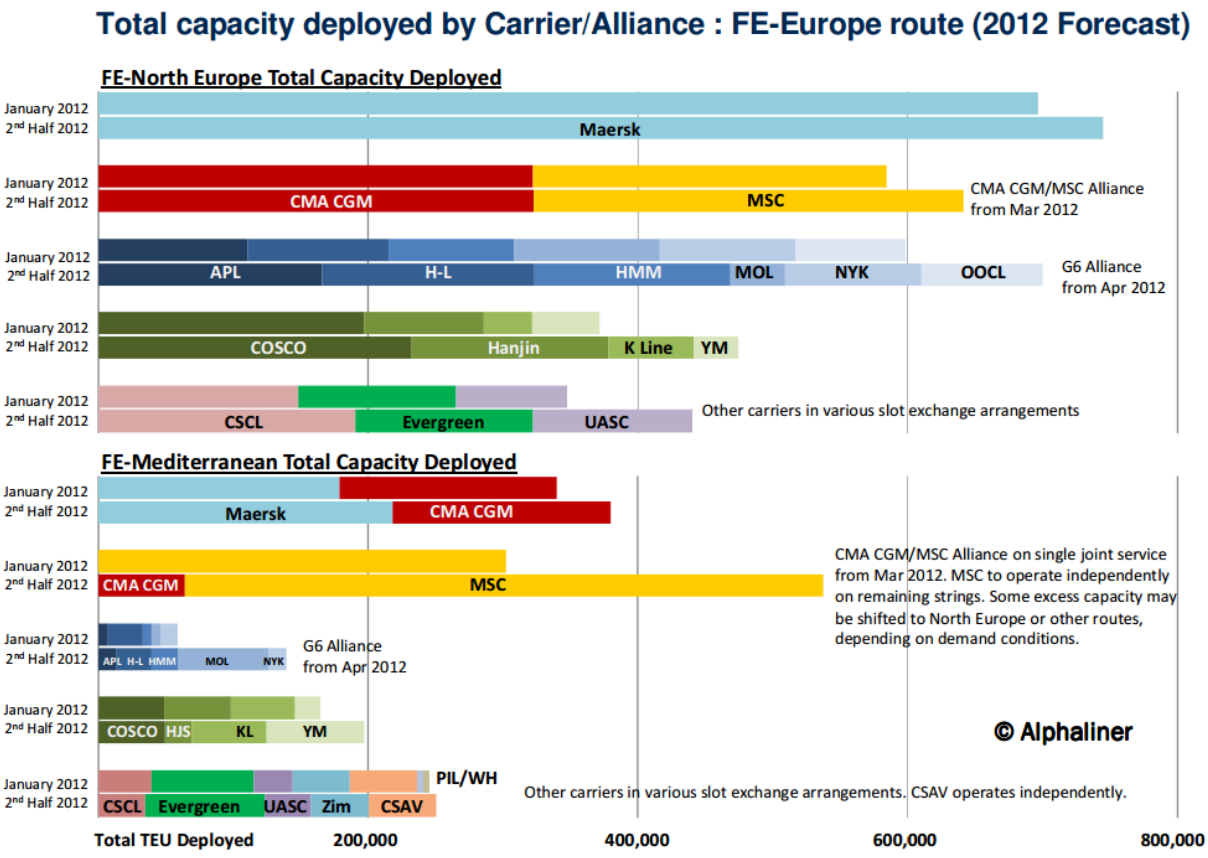
Source Alphaliner

The container terminal shareholder structure in Antwerp, Rotterdam and Zeebrugge



(1) Through subsidiary company ZIM Ports; (2) Through subsidiary company Terminal Link; (3) Duisport is the fifth shareholder with a share of 7.5%; (4) Unconfirmed reports put NYK's ECT interest at 10%.

The total capacity deployed by the Carriers/Alliances on the FE-Europe trade (2012)



Source: Alphaliner newsletter No. 52 – 2011

Alphaliner - Top 100 : Operated fleets as per 10 December 2011

		Total		Owned		Chartered			Orderbook			N=100	N=100
Rnk	Operator	TEU	Ships	TEU	Ships	TEU	Ships	% Chart	TEU	Ships	% existing	HHI	H*
1	APM-Maersk	2,523,620	658	1,178,482	218	1,345,138	440	53.3%	530,106	49	21.0%	0.03	-
2	Mediterranean Shg Co	2,096,382	478	983,373	205	1,113,009	273	53.1%	490,862	43	23.4%	0.02	-
3	CMA CGM Group	1,346,433	401	505,558	93	840,875	308	62.5%	70,070	8	5.2%	0.01	-
4	COSCO Container L.	646,310	147	348,005	95	298,305	52	46.2%	244,168	32	37.8%	0.00	-
5	Hapag-Lloyd	643,667	146	292,590	63	351,077	83	54.5%	132,000	10	20.5%	0.00	-
6	APL	617,424	146	179,167	45	438,257	101	71.0%	290,810	28	47.1%	0.00	-
7	Evergreen Line	614,278	166	330,167	88	284,111	78	46.3%	308,000	35	50.1%	0.00	-
8	CSCL	533,867	149	329,938	77	203,929	72	38.2%	159,822	19	29.9%	0.00	-
9	Hanjin Shipping	468,952	99	220,895	37	248,057	62	52.9%	243,864	30	52.0%	0.00	-
10	MOL	435,469	99	215,352	36	220,117	63	50.5%	109,620	11	25.2%	0.00	-
11	OOCL	405,126	85	281,432	46	123,694	39	30.5%	132,576	12	32.7%	0.00	-
12	Hamburg Süd Group	402,944	115	199,923	46	203,021	69	50.4%	196,788	31	48.8%	0.00	-
13	NYK Line	402,901	101	304,354	57	98,547	44	24.5%	61,908	6	15.4%	0.00	-
14	CSAV Group	383,008	85	52,221	11	330,787	74	86.4%	36,000	4	9.4%	0.00	-
15	Yang Ming Marine Tr.Corp.	355,182	86	206,965	48	148,217	38	41.7%	89,038	14	25.1%	0.00	-
16	K Line	337,002	78	104,332	20	232,670	58	69.0%	45,200	5	13.4%	0.00	-
17	Zim	324,781	93	158,129	34	166,652	59	51.3%	153,216	13	47.2%	0.00	-
18	Hyundai M.M.	296,367	62	100,646	17	195,721	45	66.0%	156,075	15	52.7%	0.00	-
19	PIL (Pacific Int. Line)	275,911	144	171,923	96	103,988	48	37.7%	71,900	21	26.1%	0.00	-
20	UASC	231,533	55	126,696	28	104,837	27	45.3%	104,800	8	45.3%	0.00	-
21	Wan Hai Lines	173,035	77	122,463	57	50,572	20	29.2%	36,415	13	21.0%	0.00	-
22	HDS Lines	87,746	23	3,714	3	84,032	20	95.8%				0.00	-
23	TS Lines	73,774	37	3,156	2	70,618	35	95.7%				0.00	-
24	X-Press Feeders Group	60,569	54			60,569	54	100.0%	4,000	2	6.6%	0.00	-
25	SITC	50,552	54	13,191	15	37,361	39	73.9%	14,039	13	27.8%	0.00	-
26	RCL (Regional Container L.)	49,694	37	40,885	32	8,809	5	17.7%	2,086	2	4.2%	0.00	-
27	CCNI	49,211	22			49,211	22	100.0%				0.00	-
28	KMTC	46,301	36	20,883	19	25,418	17	54.9%	6,643	3	14.3%	0.00	-
29	MISC Berhad	45,314	20	24,295	13	21,019	7	46.4%				0.00	-
30	Hainan P O Shipping Co	43,490	18	13,194	5	30,296	13	69.7%				0.00	-
31	Grimaldi (Napoli)	43,190	36	41,901	33	1,289	3	3.0%	1,062	3	2.5%	0.00	-
32	Grand China Logistics	39,881	26	17,361	11	22,520	15	56.5%				0.00	-
33	NileDutch	39,759	22	2,137	3	37,622	19	94.6%	14,000	4	35.2%	0.00	-
34	Horizon Lines	38,948	17	19,818	9	19,130	8	49.1%				0.00	-
35	Matson	38,493	18	30,396	15	8,097	3	21.0%				0.00	-
36	Seaboard Marine	35,176	39	5,677	8	29,499	31	83.9%				0.00	-
37	UniFeeder	34,098	34			34,098	34	100.0%				0.00	-
38	Sinotrans	33,041	33	11,828	14	21,213	19	64.2%	7,886	6	23.9%	0.00	-
39	Simatech	32,627	18	7,025	6	25,602	12	78.5%				0.00	-
40	STX Pan Ocean (Container)	31,733	19	12,370	8	19,363	11	61.0%	12,260	4	38.6%	0.00	-
41	Arkas Line / EMES	31,615	27	17,959	13	13,656	14	43.2%	5,600	2	17.7%	0.00	-
42	Emirates Shipping Line	31,552	12			31,552	12	100.0%				0.00	-
43	Samudera	31,128	39	11,517	20	19,611	19	63.0%				0.00	-
44	S.C. India	30,907	10	14,407	5	16,500	5	53.4%	23,000	4	74.4%	0.00	-
45	Schöller Group	29,630	19	7,522	4	22,108	15	74.6%	14,203	7	47.9%	0.00	-
46	Linea Messina	23,720	16	17,734	13	5,986	3	25.2%	11,680	4	49.2%	0.00	-
47	Meratus	23,413	47	22,754	42	659	5	2.8%				0.00	-
48	Sinokor	23,055	26	9,048	13	14,007	13	60.8%				0.00	-
49	Swire Shipping	22,476	22	13,696	13	8,780	9	39.1%	16,656	8	74.1%	0.00	-
50	OEL / Shreyas	21,522	17	6,782	7	14,740	10	68.5%				0.00	-
51	Crowley Liner Services	20,523	22	8,304	9	12,219	13	59.5%				0.00	-
52	Heung-A Shipping	20,339	23	6,571	11	13,768	12	67.7%				0.00	-
53	MACS	20,320	14	6,828	4	13,492	10	66.4%	16,000	8	78.7%	0.00	-
54	Turkon Line	19,022	14	19,022	14							0.00	-
55	Salam Pasific	18,670	34	18,670	34							0.00	-
56	Tanto Intim Line	18,532	35	18,532	35							0.00	-
57	FESCO	17,867	18	12,659	15	5,208	3	29.1%	3,108	1	17.4%	0.00	-
58	Log-In Logistica	15,985	8	11,472	6	4,513	2	28.2%	8,424	3	52.7%	0.00	-
59	Nam Sung	14,868	20	14,174	19	694	1	4.7%				0.00	-
60	United Feeder Services	14,722	15			14,722	15	100.0%				0.00	-
61	Westwood	14,699	7			14,699	7	100.0%				0.00	-
62	Dole Ocean Liner	13,682	27	8,890	10	4,792	17	35.0%				0.00	-
63	Mariana Express Lines	13,295	11			13,295	11	100.0%				0.00	-
64	Great White Fleet	13,071	25			13,071	25	100.0%				0.00	-
65	Borchard Lines	11,494	14	1,606	2	9,888	12	86.0%				0.00	-
66	DAL	11,198	7	4,500	1	6,698	6	59.8%				0.00	-
67	Temas Line	10,379	23	10,379	23							0.00	-
68	Marfret	10,174	8	8,442	7	1,732	1	17.0%				0.00	-
69	Delphis NV / Team Lines	9,499	10			9,499	10	100.0%				0.00	-
70	Containerships OY	9,428	11	966	1	8,462	10	89.8%				0.00	-

71	Independent Container Line	9,250	4			9,250	4	100.0%				0.00	-
72	Quanzhou An Sheng Shg Co	9,044	5	9,044	5							0.00	-
73	SeaFreight	8,804	8			8,804	8	100.0%				0.00	-
74	HubLine Bhd	8,626	15	8,083	14	543	1	6.3%				0.00	-
75	Caribbean Feeder Services	8,518	12	6,640	10	1,878	2	22.0%				0.00	-
76	Shanghai Jin Jiang	8,506	10	7,082	8	1,424	2	16.7%				0.00	-
77	NSCSA	8,100	4	8,100	4				2,184	6	27.0%	0.00	-
78	Melfi C.L.	7,200	6			7,200	6	100.0%				0.00	-
79	King Ocean	7,181	7			7,181	7	100.0%				0.00	-
80	Eimskip	7,126	11	4,550	7	2,576	4	36.1%	1,750	2	24.6%	0.00	-
81	Samskip	7,025	11			7,025	11	100.0%				0.00	-
82	OPDR	6,708	10	4,490	7	2,218	3	33.1%				0.00	-
83	Vinalines	6,665	11	6,405	10	260	1	3.9%	3,600	2	54.0%	0.00	-
84	Tarros	6,656	6			6,656	6	100.0%				0.00	-
85	Valfajre Eight Shg Co	6,297	9	6,297	9							0.00	-
86	Tropical Shg	6,219	13	3,946	11	2,273	2	36.5%				0.00	-
87	Irish Continental Group	6,188	10			6,188	10	100.0%				0.00	-
88	Boluda Lines	6,171	7	4,099	5	2,072	2	33.6%				0.00	-
89	Kambara Kisen	6,136	8	907	1	5,229	7	85.2%	2,040	2	33.2%	0.00	-
90	Universal Africa Line	5,945	11			5,945	11	100.0%	574	2	9.7%	0.00	-
91	Maestra Navegacao	5,674	4	5,674	4							0.00	-
92	Marguisa	5,637	5			5,637	5	100.0%				0.00	-
93	Shanghai Hai Hua (Hasco)	5,523	7	4,894	6	629	1	11.4%				0.00	-
94	Caraka Tirta Perkasa	5,518	8	5,288	7	230	1	4.2%				0.00	-
95	Chun Kyung (CK Line)	5,308	12	2,182	7	3,126	5	58.9%	2,120	2	39.9%	0.00	-
96	Peel Ports (BG Freight)	5,213	9			5,213	9	100.0%				0.00	-
97	Goto Shipping	5,109	4			5,109	4	100.0%				0.00	-
98	Qatar National Line	4,977	7	4,977	7							0.00	-
99	MTT Shipping	4,942	8			4,942	8	100.0%				0.00	-
100	Gemadept	4,839	7	3,651	5	1,188	2	24.6%				0.00	-
#	Top 100	15,153,679	4,863	7,049,185	2,061	8,104,494	2,802	-	3,836,153	497	-	0.07	0.06

Source: Alphaliner (alphaliner.com, 2011c)

Alphaliner top 100 liner shipping companies as per 10 December 2011 – adjusted for alliances

The left is based on the calculated alliance commitment, the right displays full alliance commitment.

		Total				
Rnk	Operator	TEU	Ships	Alliance	HHI	H*
1	APM-Maersk	2.523.620	658	-	0,03	-
2	**G6 alliance**	1.777.159	369	G6	0,01	-
3	**MSC/CMA CGM**	1.721.408	440	MSC/CMA	0,01	-
4	**CKYH alliance + E**	1.680.415	415	CKYH+E	0,01	-
5	Mediterranean Shg Co	1.048.191	239	MSC/CMA	0,00	-
6	CMA CGM Group	673.217	201	MSC/CMA	0,00	-
7	CSCL	533.867	149	-	0,00	-
8	Hamburg Süd Group	402.944	115	-	0,00	-
9	CSAV Group	383.008	85	-	0,00	-
10	Zim	324.781	93	-	0,00	-
11	Evergreen Line	307.139	83	CKYH + E	0,00	-
12	Hapag-Lloyd	296.087	53	G6	0,00	-
13	PIL (Pacific Int. Line)	275.911	144	-	0,00	-
14	UASC	231.533	55	-	0,00	-
15	MOL	221.218	40	G6	0,00	-
16	APL	195.106	32	G6	0,00	-
17	COSCO Container L.	173.857	32	CKYH + E	0,00	-
18	Wan Hai Lines	173.035	77	-	0,00	-
19	NYK Line	150.282	28	G6	0,00	-
20	OOCL	115.461	16	G6	0,00	-
21	HDS Lines	87.746	23	-	0,00	-
22	Hanjin Shipping	87.694	14	CKYH + E	0,00	-
23	Yang Ming Marine Transport Corp.	87.020	17	CKYH + E	0,00	-
24	K Line	85.599	16	CKYH + E	0,00	-
25	TS Lines	73.774	37	-	0,00	-
26	X-Press Feeders Group	60.569	54	-	0,00	-
27	SITC	50.552	54	-	0,00	-

	Full alliance commitment	Total			
Rnk	Operator	TEU	Ships	HHI	H*
1	**MSC/CMA CGM**	3.442.815	879	0,05	-
2	**G6 alliance**	2.800.954	493	0,03	-
3	APM-Maersk	2.523.620	658	0,03	-
4	**CKYH alliance + E**	2.421.724	576	0,03	-
5	CSCL	533.867	149	0,00	-
6	Hamburg Süd Group	402.944	115	0,00	-
7	CSAV Group	383.008	85	0,00	-
8	Zim	324.781	93	0,00	-
9	PIL (Pacific Int. Line)	275.911	144	0,00	-
10	UASC	231.533	55	0,00	-
11	Wan Hai Lines	173.035	77	0,00	-
12	HDS Lines	87.746	23	0,00	-
13	TS Lines	73.774	37	0,00	-
14	X-Press Feeders Group	60.569	54	0,00	-
15	SITC	50.552	54	0,00	-
16	RCL (Regional Container L.)	49.694	37	0,00	-
17	CCNI	49.211	22	0,00	-
18	KMTC	46.301	36	0,00	-
19	MISC Berhad	45.314	20	0,00	-
20	Hainan P O Shipping Co	43.490	18	0,00	-
21	Grimaldi (Napoli)	43.190	36	0,00	-
22	Grand China Logistics	39.881	26	0,00	-
23	NileDutch	39.759	22	0,00	-
24	Horizon Lines	38.948	17	0,00	-
25	Matson	38.493	18	0,00	-
26	Seaboard Marine	35.176	39	0,00	-
27	UniFeeder	34.098	34	0,00	-

28	RCL (Regional Container L.)	49.694	37	-	0,00	-	28	Sinotrans	33.041	33	0,00	-
29	CCNI	49.211	22	-	0,00	-	29	Simatech	32.627	18	0,00	-
30	KMTC	46.301	36	-	0,00	-	30	STX Pan Ocean (Container)	31.733	19	0,00	-
31	Hyundai M.M.	45.641	9	G6	0,00	-	31	Arkas Line / EMES	31.615	27	0,00	-
32	MISC Berhad	45.314	20	-	0,00	-	32	Emirates Shipping Line	31.552	12	0,00	-
33	Hainan P O Shipping Co	43.490	18	-	0,00	-	33	Samudera	31.128	39	0,00	-
34	Grimaldi (Napoli)	43.190	36	-	0,00	-	34	S.C. India	30.907	10	0,00	-
35	Grand China Logistics	39.881	26	-	0,00	-	35	Schöller Group	29.630	19	0,00	-
36	NileDutch	39.759	22	-	0,00	-	36	Linea Messina	23.720	16	0,00	-
37	Horizon Lines	38.948	17	-	0,00	-	37	Meratus	23.413	47	0,00	-
38	Matson	38.493	18	-	0,00	-	38	Sinokor	23.055	26	0,00	-
39	Seaboard Marine	35.176	39	-	0,00	-	39	Swire Shipping	22.476	22	0,00	-
40	UniFeeder	34.098	34	-	0,00	-	40	OEL / Shreyas	21.522	17	0,00	-
41	Sinotrans	33.041	33	-	0,00	-	41	Crowley Liner Services	20.523	22	0,00	-
42	Simatech	32.627	18	-	0,00	-	42	Heung-A Shipping	20.339	23	0,00	-
43	STX Pan Ocean (Container)	31.733	19	-	0,00	-	43	MACS	20.320	14	0,00	-
44	Arkas Line / EMES	31.615	27	-	0,00	-	44	Turkon Line	19.022	14	0,00	-
45	Emirates Shipping Line	31.552	12	-	0,00	-	45	Salam Pasific	18.670	34	0,00	-
46	Samudera	31.128	39	-	0,00	-	46	Tanto Intim Line	18.532	35	0,00	-
47	S.C. India	30.907	10	-	0,00	-	47	FESCO	17.867	18	0,00	-
48	Schöller Group	29.630	19	-	0,00	-	48	Log-In Logistica	15.985	8	0,00	-
49	Linea Messina	23.720	16	-	0,00	-	49	Nam Sung	14.868	20	0,00	-
50	Meratus	23.413	47	-	0,00	-	50	United Feeder Services	14.722	15	0,00	-
51	Sinokor	23.055	26	-	0,00	-	51	Westwood	14.699	7	0,00	-
52	Swire Shipping	22.476	22	-	0,00	-	52	Dole Ocean Liner	13.682	27	0,00	-
53	OEL / Shreyas	21.522	17	-	0,00	-	53	Mariana Express Lines	13.295	11	0,00	-
54	Crowley Liner Services	20.523	22	-	0,00	-	54	Great White Fleet	13.071	25	0,00	-
55	Heung-A Shipping	20.339	23	-	0,00	-	55	Borchard Lines	11.494	14	0,00	-
56	MACS	20.320	14	-	0,00	-	56	DAL	11.198	7	0,00	-
57	Turkon Line	19.022	14	-	0,00	-	57	Temas Line	10.379	23	0,00	-
58	Salam Pasific	18.670	34	-	0,00	-	58	Marfret	10.174	8	0,00	-
59	Tanto Intim Line	18.532	35	-	0,00	-	59	Delphis NV / Team Lines	9.499	10	0,00	-
60	FESCO	17.867	18	-	0,00	-	60	Containerships OY	9.428	11	0,00	-
61	Log-In Logistica	15.985	8	-	0,00	-	61	Independent Container Line	9.250	4	0,00	-
62	Nam Sung	14.868	20	-	0,00	-	62	Quanzhou An Sheng Shg Co	9.044	5	0,00	-
63	United Feeder Services	14.722	15	-	0,00	-	63	SeaFreight	8.804	8	0,00	-
64	Westwood	14.699	7	-	0,00	-	64	HubLine Bhd	8.626	15	0,00	-
65	Dole Ocean Liner	13.682	27	-	0,00	-	65	Caribbean Feeder Services	8.518	12	0,00	-
66	Mariana Express Lines	13.295	11	-	0,00	-	66	Shanghai Jin Jiang	8.506	10	0,00	-
67	Great White Fleet	13.071	25	-	0,00	-	67	NSCSA	8.100	4	0,00	-
68	Borchard Lines	11.494	14	-	0,00	-	68	Melfi C.L.	7.200	6	0,00	-
69	DAL	11.198	7	-	0,00	-	69	King Ocean	7.181	7	0,00	-
70	Temas Line	10.379	23	-	0,00	-	70	Eimskip	7.126	11	0,00	-
71	Marfret	10.174	8	-	0,00	-	71	Samskip	7.025	11	0,00	-
72	Delphis NV / Team Lines	9.499	10	-	0,00	-	72	OPDR	6.708	10	0,00	-
73	Containerships OY	9.428	11	-	0,00	-	73	Vinalines	6.665	11	0,00	-
74	Independent Container Line	9.250	4	-	0,00	-	74	Tarros	6.656	6	0,00	-
75	Quanzhou An Sheng Shg Co	9.044	5	-	0,00	-	75	Valfajre Eight Shg Co	6.297	9	0,00	-
76	SeaFreight	8.804	8	-	0,00	-	76	Tropical Shg	6.219	13	0,00	-
77	HubLine Bhd	8.626	15	-	0,00	-	77	Irish Continental Group	6.188	10	0,00	-
78	Caribbean Feeder Services	8.518	12	-	0,00	-	78	Boluda Lines	6.171	7	0,00	-
79	Shanghai Jin Jiang	8.506	10	-	0,00	-	79	Kambara Kisen	6.136	8	0,00	-
80	NSCSA	8.100	4	-	0,00	-	80	Universal Africa Line	5.945	11	0,00	-
81	Melfi C.L.	7.200	6	-	0,00	-	81	Maestra Navegacao	5.674	4	0,00	-
82	King Ocean	7.181	7	-	0,00	-	82	Marguisa	5.637	5	0,00	-
83	Eimskip	7.126	11	-	0,00	-	83	Shanghai Hai Hua (Hasco)	5.523	7	0,00	-
84	Samskip	7.025	11	-	0,00	-	84	Caraka Tirta Perkasa	5.518	8	0,00	-
85	OPDR	6.708	10	-	0,00	-	85	Chun Kyung (CK Line)	5.308	12	0,00	-
86	Vinalines	6.665	11	-	0,00	-	86	Peel Ports (BG Freight)	5.213	9	0,00	-
87	Tarros	6.656	6	-	0,00	-	87	Goto Shipping	5.109	4	0,00	-

88	Valfajre Eight Shg Co	6.297	9	-	0,00	-	88	Qatar National Line	4.977	7	0,00	-		
89	Tropical Shg	6.219	13	-	0,00	-	89	MTT Shipping	4.942	8	0,00	-		
90	Irish Continental Group	6.188	10	-	0,00	-	90	Gemadept	4.839	7	0,00	-		
91	Boluda Lines	6.171	7	-	0,00	-					0,00	-		
92	Kambara Kisen	6.136	8	-	0,00	-					0,00	-		
93	Universal Africa Line	5.945	11	-	0,00	-					0,00	-		
94	Maestra Navegacao	5.674	4	-	0,00	-					0,00	-		
95	Marguisa	5.637	5	-	0,00	-					0,00	-		
96	Shanghai Hai Hua (Hasco)	5.523	7	-	0,00	-					0,00	-		
97	Caraka Tirta Perkasa	5.518	8	-	0,00	-					0,00	-		
98	Chun Kyung (CK Line)	5.308	12	-	0,00	-					0,00	-		
99	Peel Ports (BG Freight)	5.213	9	-	0,00	-					0,00	-		
100	Goto Shipping	5.109	4	-	0,00	-					0,00	-		
101	Qatar National Line	4.977	7	-	0,00	-					0,00	-		
102	MTT Shipping	4.942	8	-	0,00	-					0,00	-		
103	Gemadept	4.839	7	-	0,00	-					0,00	-		
#	Top 100	15,153,679	4,863	-	0,03	-			15.153.679	4.717	0,14	0,13		