

Benefits and Concerns of Containership Pooling

Part One of Research Project

“Analysis of Containership Pooling and Benefit Sharing Scheme”

Study conducted by
Maritime Economics Research Center
Hamburg Business School
University of Hamburg
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All data used in this report are obtained from the Clarkson's Shipping Intelligence Network database, unless otherwise denoted.

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Executive Summary

This report, as **Part One** of the project “**Analysis of Containership Pooling and Benefit Sharing Scheme**”, aims to explain what is ship pooling and what are the main benefits and concerns. Even though ship pooling has existed for decades as a common way of collaboration among ship owners, it has never been thoroughly discussed in published literatures. A series of interviews with some of the largest containership owning companies were conducted and the results are presented to provide a comprehensive description of ship pooling practice. This study is conducted with the background that the probably worst shipping depression in recorded history has lasted over nine years already, and global liner concentration has reached a peak level and is still increasing. Oversupply and market power imbalances are both among the main issues that non-operator ship owners need to tackle with. Ship pooling on the owners’ side can be necessary and effective to partly solve the problems. In addition to normal operational benefits, ship pooling can also work as a countervailing tool for the ship owners against their powerful buyers—the global liners.

To what extent the benefits and market influences of containership pooling can be realized depends on many factors and very complex market conditions. In order to draw more definite conclusions, an economic model with market data analysis will be conducted in **Part Two** of the project.

Furthermore, to form and maintain a successful pool, an effective and efficient revenue-sharing scheme is essential. How to fairly and efficiently share the revenues and profits among non-homogenous vessels based on their earning capabilities under real and contemporary market conditions is the main challenge

and will be discussed based on Cooperative Game Theory in **Part Three** of the project.

This report is composed of 3 sections:

The Liner shipping market

Section 1 first introduces what is the container shipping market, and clarifies some key terminologies to help with clear discussions through the whole report. In the next, we explain how the market works by generalizing the container shipping market into a three-layer structure, and show how the different players interact in the different sub-markets, such as the freight market and charter market. Finally, the status of global shipping market and current challenges are reviewed.

Depressed freight and charter markets caused by massive overcapacity and sluggish demand have continued for about nine years now since 2008. The length and severity of this recession are both one of the most serious in the recorded history of maritime shipping. During this long turmoil, the whole shipping industry experience serious operational and financial difficulties. Two of main problems are oversupply of vessels and market power imbalances between the liner coalitions and their counterparties, including shippers, port operators and non-operator ship owners¹.

The container shipping market is extremely concentrated. The top 10 liner companies operated more than

¹ Although sluggish demand is a major concern for the market, it is not discussed because it is not the main focus

of this study and is also generally out of control of the shipping companies.

80% of the global container-carrying capacity and the top 50 operated more than 90% as per March



2017. Of the Top 20 liners, about nine of them are part of the three global liner alliances: 2M, Ocean Alliance, and THE alliance, which together own 79% of OOs’ total containership capacity. For the NOOs’ total containership capacity, the Top 10 own about 41% by September 2016. As for the total world containership fleet, the three alliances (nine liners) own 41%, whereas the top 15 NOOs own 20%.

Containership pools

Section 2 discusses what is ship pooling and different ways of pooling, as well as the benefits, concerns, and potential market effects.

In this study, ship pooling is defined as a business practice of ship owners to pool their vessels together and share vessel-charter revenues based on previously agreed revenue-sharing scheme. There are different ways of pooling the vessels, but essentially if the pool is centrally managed by one single manager, the pool is considered as a “tonnage pool”, otherwise a “revenue pool.”

The main benefits of ship pooling are steady revenue and risk mitigation, and the economies of scale effect that includes flexibility,

„How to fairly and efficiently share the revenues and profits among non-homogeneous vessels based on their earning capabilities under real and contemporary market conditions is the main challenge, and the key to a successful pool.“

+ Steady Returns

+ Flexibility

+ Cost Control

+ Market

Opportunities

+ Market Power

cost control, market opportunities, and market power. Per the concerns, original ship owners/manager are reluctant to give up the commercial expertise and control, and there is a risk that the overall earnings of the pool can be dragged below the breakeven point by idle ships, pulling down employed ships into insolvency risk.

In the end, we also briefly discuss some potential market effects of ship pooling. 1) Due to limited samples and performance data, existing studies have not been able to draw a definite conclusion about whether joining a ship pool will improve overall profit for the pool members compared with the market average. (2) A large ship pool can be a very necessary and effective way for the ship owners to gain countervailing power

against the global liner coalitions. The liner coalitions share operating costs among the members and plan networks and capacities jointly, which essentially create higher market power to the liners when negotiating with the other market counterparties from both upper and lower levels. (3) Pooling can lead to rational capacity control for the whole container shipping market if the pool members can gain higher profits by reducing operating capacity. This may even also

benefit the liners, if the overcapacity issue is partially solved by the NOOs. In this way, a ship pool enhances efficiencies of the industry and pass on benefits to their customers.

Summary

The main conclusions are summarized in the last section.

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1. The Liner shipping market

1.1. Players

Industrial jargons can be different from academic understandings and sometimes even confusing among practitioners themselves, even though most of the times the meanings are implicitly agreed upon. Therefore, before we dive into the discussion of ship pooling practices, it is necessary to clarify what we are talking about and who is who. This clarification will help with clear discussions through the whole report, and also be beneficial to reach a wider range of readers who are not familiar with this industry. Nevertheless, we will try to keep jargons as minimum as possible so that it could be most easily understood by the audience.

Liner shipping vs. tramp shipping:

Liner shipping essentially is an ocean shipping service that mainly transports containerized cargoes with containerships with fixed routes, fixed schedules, and fixed prices. Liner shipping, or frequently named container shipping, is very different from bulk shipping which is also often called tramp shipping by practitioners. The characteristics and differences of the two are not relevant for our analysis, but it is important to emphasize that our study focuses on liner shipping. Therefore, unless explicitly noted as bulk ships or bulk ship pools, all the terms with “ships” or “pools” are about containerships implicitly.

Operator Owners (OOs) vs. No-operator Owners (NOOs):

The operators of liner shipping are the liner companies (or liners). The liners usually own or manage a group of vessels, too. Hence, in terms of vessel ownership, the liners are considered as “Operator Owners” (OO), in contrast to the “Non-operator Owners” (NOO)² who are independent owners of vessels and do not operate the vessels.

Charterers vs. Charter owners:

A charterer is a person or company who hires a ship from a ship owner for a period of time (time charter) or who reserves the entire cargo space for a single voyage (voyage charter). A charter owner is a company who owns and offers the charter ships in the open charter market to the charterers. The charter owner can be a NOO or an OO, while the charterer of the containership is usually a liner company.

² Nowadays, a NOO has become subtler than it used to be, especially with the modern financing tools. In the recent decades, many financial entities have essentially become joint-owners of vessels by offering loans and finances to vessel buyers. For example, the German KG fund system has become very popular which essentially offers ship-owning funds to small private investors in Germany who have a little disposable income and are attracted to “low risk returns for a long-time period”. Although the many private investors are the real “owners” which together share the vessels, the KG fund corporation is the virtual operator who makes decisions about buying, selling, operating and

managing vessels with a great level of authority. The normal traditional ship owner, who owns at least a significant share, if not the whole, of a vessel—in comparison to the KG fund buyers who only share a very negligible part of the whole vessel investment, typically outsources its business to different types of managers, although it could also do everything itself. The outsourced businesses may involve a commerce manager, crewing manager, technic manager, and operations and chartering manager, who are paid either with annual fixed amount or based on commissions on vessel fixtures.

1.2. Relationships

Many parties are involved in the liner shipping industry and interact with each other in the market. Although an individual entity often play more than one role, leading to a very complex market. The market structure can be generalized into three levels, as shown in *Figure 1: Container Shipping Market Structure*

Figure 2Figure 1: In the center of the market are the global liners – the carriers (the medium level). The carriers receive all kinds of production inputs and services from their suppliers in the upstream (the upper level), and provide shipping services to their customers — the shippers³ in the downstream (the lower

level). Within each level, the players compete or collaborate with each other. Players from different levels interact with each other by getting products or services with price payments through different sub-markets, e.g. charter market, freight market, etc. Financial payments flow from the bottom to the top.

In the charter market, the two groups of players that operate on opposite sides are the vessels owners (charter owners), who provide vessels, and the carriers (charterers), who acquire vessels for a certain voyage or a certain period of time. As the purpose of this study is to analyze ship pools as an industry practice and potential solution for NOOs, the vessels owned or managed by the OOs will not be considered in this study and it is assumed that the pool provides vessels

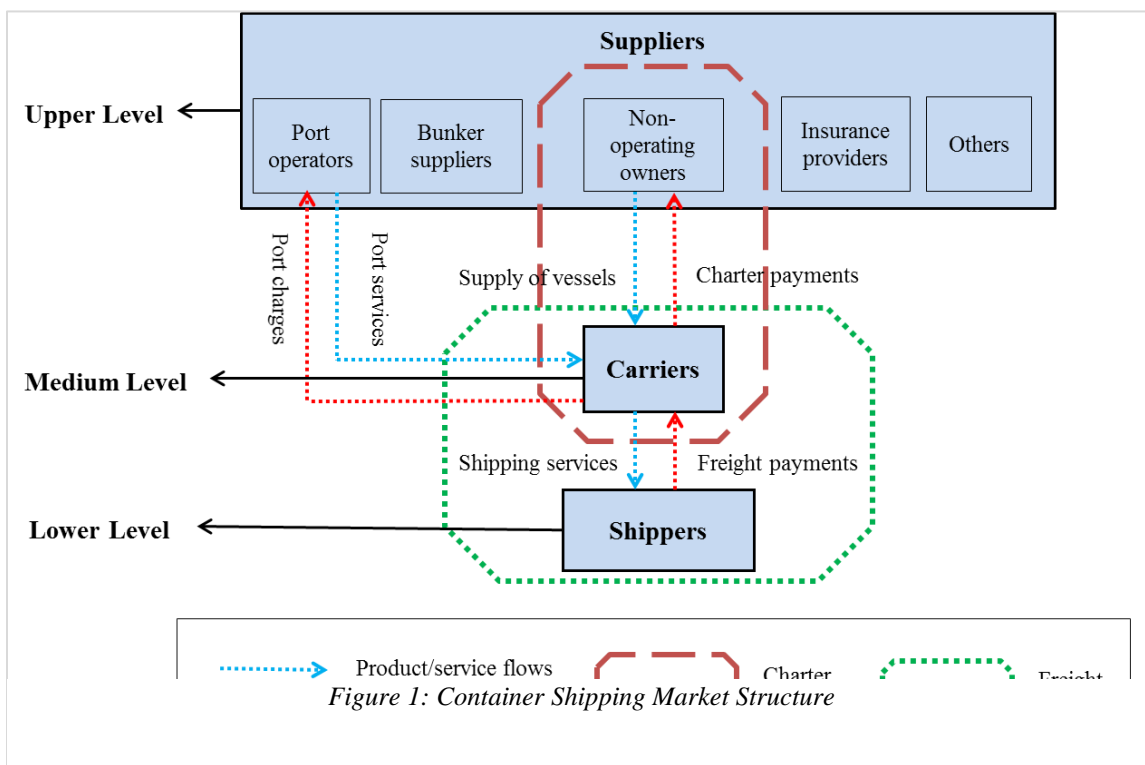


Figure 2Figure 3: Container Shipping Market Structure

³ A shipper could be a cargo owner or buyer who needs transportation services from the carrier, or some third party that solely arranges the transportation of the cargo.

only to OOs in the charter market. Therefore, in this study, the potential pool member can be

- a NOO who manages its ships directly,
- a KG cooperate who manages the ships on behalf of all the equity investors and banks, or
- a typical ship manager who manage all the ships of the real owners. (Noted that a typical ship manager often represents more than one owner, in which case this ship manager is also a small-pool manager.)

1.3. Challenges

1.3.1. Shipping cycle from 2003 until 2017

Depressed freight and charter markets caused by massive overcapacity and sluggish demand have contin-

ued for about eight years now since 2008. New historical lows of freight rates, charter rates, second-hand prices, and youngest demolish age have been reported one after another across all ship sizes and trade lanes. Looking back at this shipping cycle, with the upswing starting roughly in 2003 and reaching the peak time around late 2007 before falling precipitously into recession almost right away, its time span – lasting 14 years already, and its severity are both one of the most serious in the recorded history of shipping. During this long turmoil, the whole shipping industry experience serious operational and financial difficulties. The world containership fleet development in the past decades is depicted in *Figure 2: Containership fleet status*

Figure 3Figure 2. First checking the demolition and delivery volume, global fleet owners have been taken

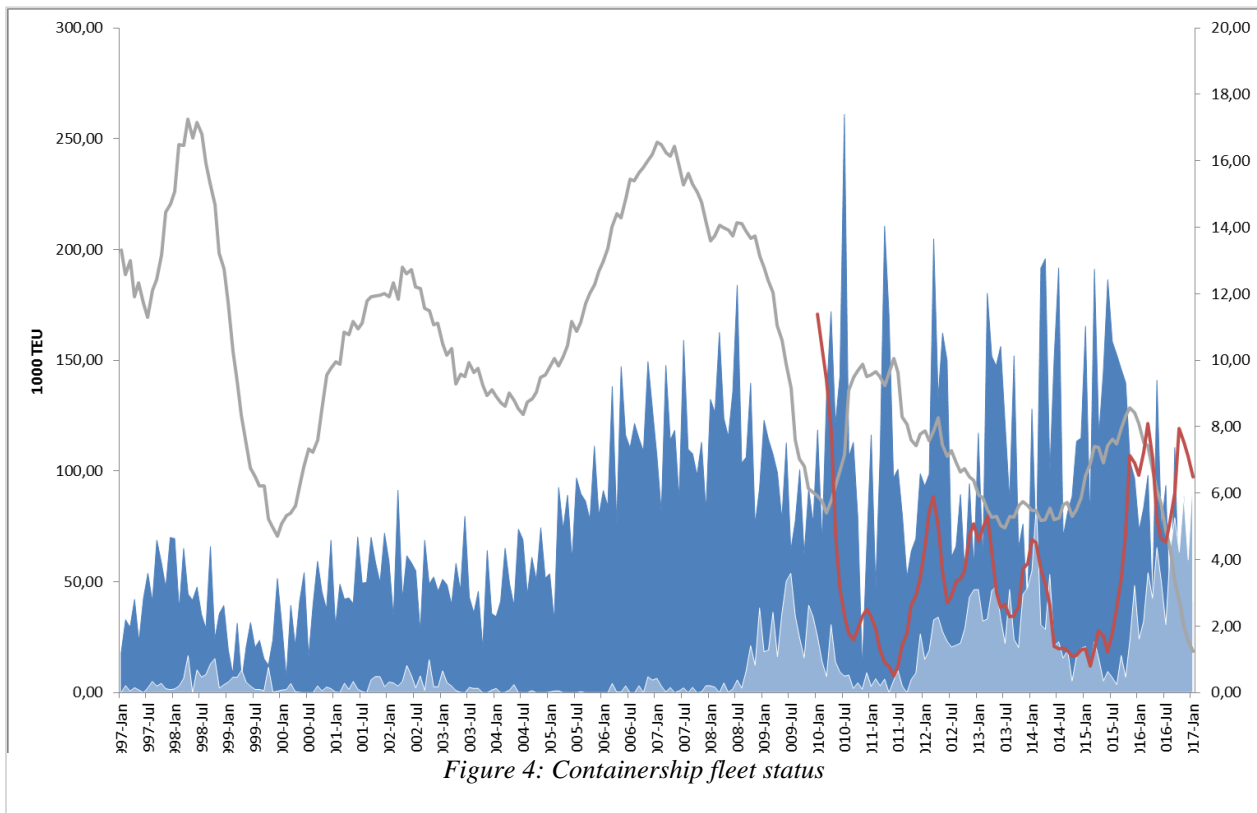


Figure 5Figure 6: Containership fleet status

actions to reduce the surplus supply as shown by the increasing demolition volume since 2008, but the delivery volume is still much higher than demolition due to the large amount of orders placed in the earlier years. The black line shows that the overall containership fleet growth rate has been steadily decreasing since 2007 compared to previous years. The red line shows that the fleet idle rate (data only available from 2010 onwards) greatly increased in late 2015, reaching 8% in early 2016, and on average were about 6% for the whole 2016. As shown by *Figure 3*: Development of new-ordered Containerships since 1996

Figure 4
Figure 3, although market actions have been fluctuating and market sentiment has been unstable since 2009, the overall trend is getting worse.

1.3.2. Market concentration of liner shipping

Demolishing a vessel and exiting the market permanently causes a tremendous financial loss to the owner, and hence, is the last resort of rescue. Therefore, shipping liners seek other solutions first in the efforts of surviving the tough period and waiting for the market to recover, while at the same time strengthening their market status and competing for larger market shares.

With the goal of reducing operating costs, the liner companies order more mega-containerships as illustrated in *Figure 3*, which have caused more overcapacity problems to the whole market in the end (Cullinane et al. 2000; Lun et al. 2009) and continuously increase individual operating scale through mergers and joint-ventures (Cullinane et al. 2000). Since 2014, mergers and acquisitions have forced a complete reshaping of the carrier tie-ups.

As a result, the container shipping market has become extremely concentrated. The top 10 liner companies operated more than 80% of the global container-carrying capacity and the top 50 operated more than 90% as per March 2017. In addition, to further expand market scope and increase vessel utilization, container liners are also forming coalitions with Vessel-Sharing Agreements. Of the top 20 liners, about 9 of them are part of the three global liner alliances: 2M, Ocean Alliance, and THE alliance. According to the announced plans for April 2017, out of the total 10,455,010 TEU fleet capacity owned by OOs, nearly 80% will be controlled by the three alliances (*Figure 4*).

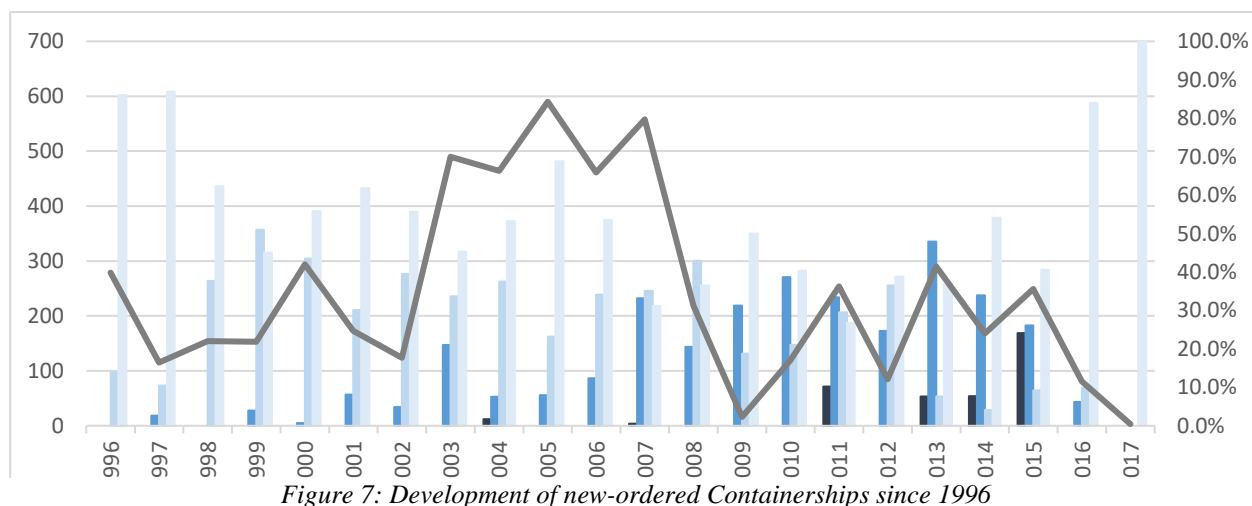


Figure 7: Development of new-ordered Containerships since 1996

Figure 8
Figure 9: Development of new-ordered Containerships since 1996

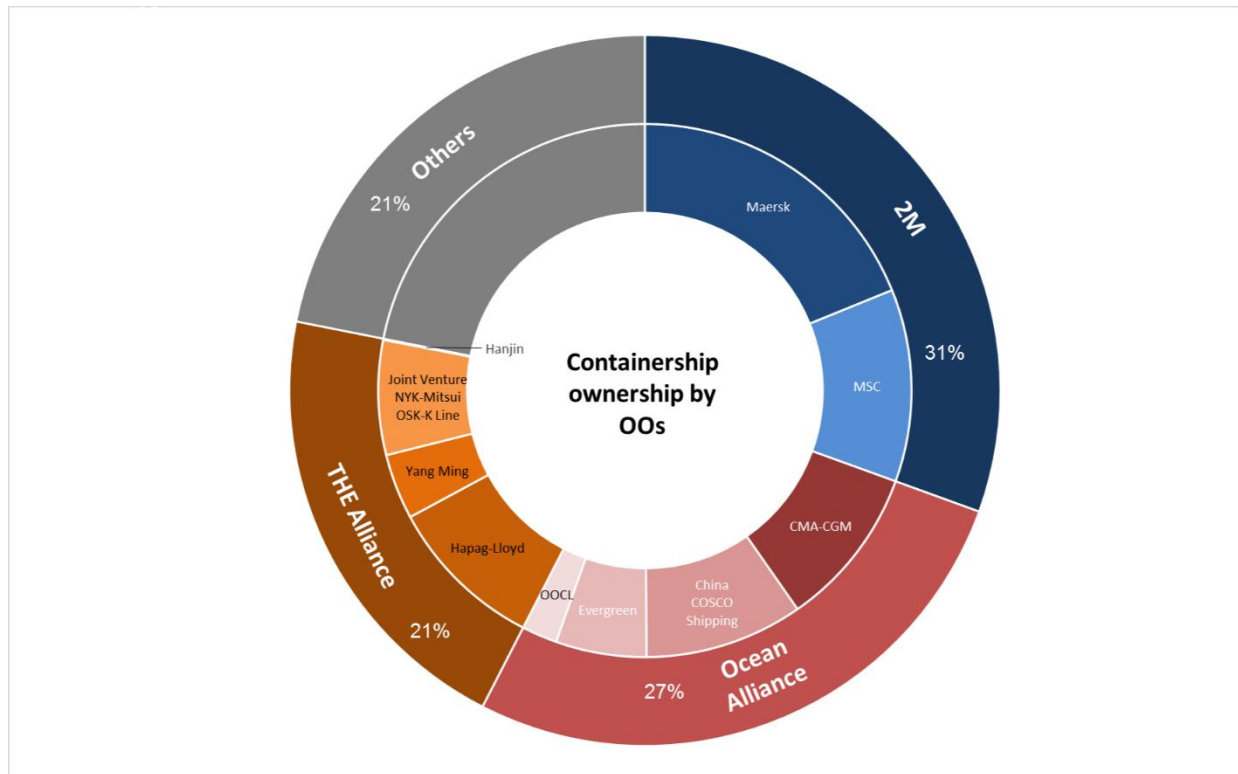


Figure 10: Total containership capacity owned by OOs (in TEU)

1.3.3. Market power imbalance

The high concentration level of the liners has raised lots of concerns from the liners' counterparties. Recent articles from JOC have reported strong objections from the shippers' group, as well as plans and actions by the global port operators about joining forces and forming coalitions in order to better plan for their future spending and infrastructure needs and strengthen their negotiating power with the mammoth Vessel-Sharing Agreements by the super liner coalitions.

In 2015, the ports of Seattle and Tacoma formed the Northwest Seaport Alliance. Then by end of 2016, (1) the South Carolina Ports Authority said it was in “hypothetical and anticipatory” discussions with regulators over a potential alliance with an undisclosed port (Hutchins 2016), (2) three of Hong Kong's container terminals entered a collaborative agreement to bring majority of the berth space at Hong Kong's Kwai

Tsing terminals under unified management and operation for the first time (Mooney 2016), (3) five of the world's largest terminal operators (PSA International, Hutchison Port Holdings, APM Terminals, DP World, Shanghai International Port Group) and the largest port in Europe (the Port of Rotterdam) proposed to seek approval from US maritime regulators to form the first global terminal alliance in what could mirror container lines' own alliances (Hutchins 2016), and (4) US maritime regulators approved an alliance between two container terminals at Miami Port to jointly negotiate, set, and approve terminal rates with container lines (Braden 2016).

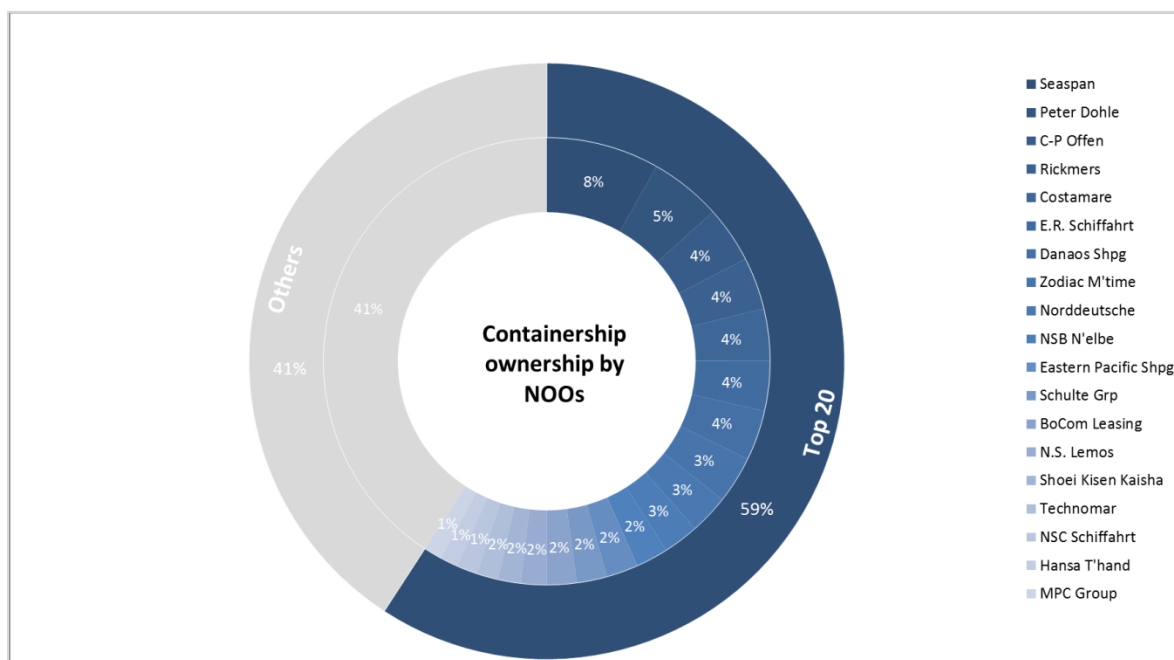


Figure 5: Total containership capacity owned by NOOs (in TEU)

In the freight market, a liner generally serves a large number of much smaller shippers, especially compared to the bulk carrier which is more like a wholesale business and often faces a limited number of large cargo-owners or shippers. In the charter market

Figure 1: Container Shipping Market Structure

Figure 2Figure 1, the liners are also confronted with a large number of ship suppliers, such that almost perfect competition exists. This can be seen by comparing the market concentration levels of the global liners (Figure 4) and NOO (**Error! Reference source not found.**). Out of the total 9,524,160 TEU fleet capacity owned by the world NOOs, the top 10 NOOs own about 41%, and top 15 own about 52%, as per September 2016. If we compare the ownership capacities of the two groups against the total world fleet in Figure , NOO's Top 15 own 20% of the market share,

while the three liner alliances (nine liners now) have 41% of world fleet's market share.

Furthermore, although the real charterer of a vessel charter contract is always an individual liner instead of a liner coalition, the liner coalitions plan service networks and vessel deployments together which directly affect the demand of each coalition member in the charter market. In that sense, the NOOs are playing against liner coalitions in the charter market, instead of individual liners.

2. Containership pools

2.1. What is ship pooling

As a common way of collaboration among ship owners, ship pooling has existed for decades, but nevertheless has rarely been discussed in literature⁴.

⁴ In the only book on ship pooling, Packard (1989) defined shipping pool as: “a collection of similar vessel types under

various ownerships placed under the care of an administration. This administration markets the vessels as a single, cohesive fleet and collects—‘pools’—their earnings which,

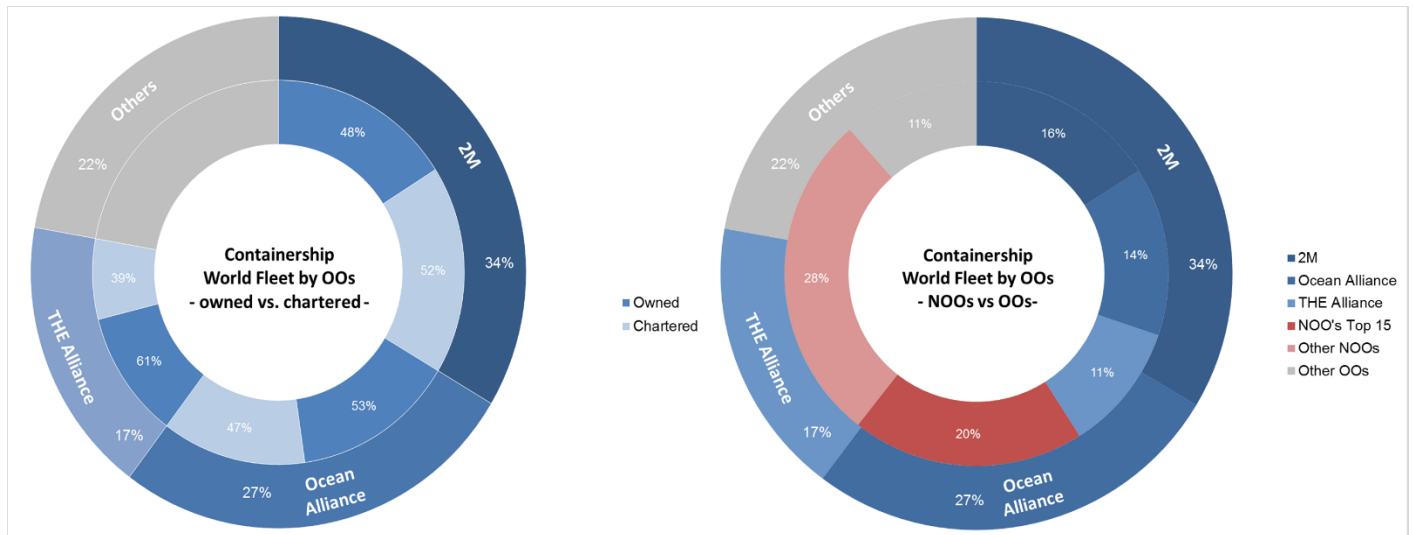


Figure 6: Total world containership capacity shares: NOOs versus OOs (in TEU)

Definitions about ship pooling in the existing literature are not always clear and sometimes only refer to one specific type of ship pools. In the most general way, we define in this report that

ship pooling is a business practice of ship owners to pool their vessels together and share vessel-charter revenues based on previously agreed revenue-sharing scheme.

From this simple definition, the three most essential steps of forming a ship pool could be generated: First, a revenue-sharing scheme is set up and agreed among members; second, ships are pooled together; and third, revenues are shared among the members based on the previously agreed method. Furthermore, two points are implied in our definition: First, the concerned ship pooling practice is only constrained to NOOs, while the liner coalitions with Vessel-Sharing Agreements which can be viewed as vessel pooling practices by the liners are excluded; and second, there are different ways of pooling vessels and sharing revenues which shall be further discussed and compared in this report.

One essential factor is who should manage the ships after pooling. And based on this factor, ship pools can be categorized into two types:

- (1) **Tonnage Pool:** In this type of pool, all the vessels are managed and marketed centrally by a common pool manager, who can be a third-party or one of the pool members, while operating expenses such as crew, maintenance and insurance normally remain the responsibility of the ship owners. Because this

in due course, are distributed to individual owners under a pre-arranged ‘weighing’ system, by which each entered vessel should receive its fair share.”

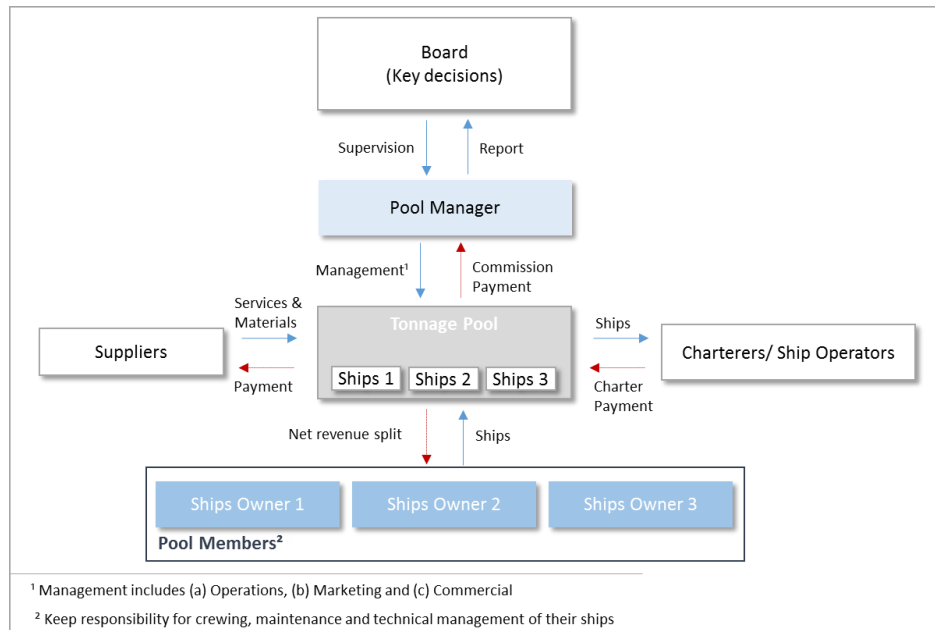


Figure 7: General structure of the Tonnage Pool

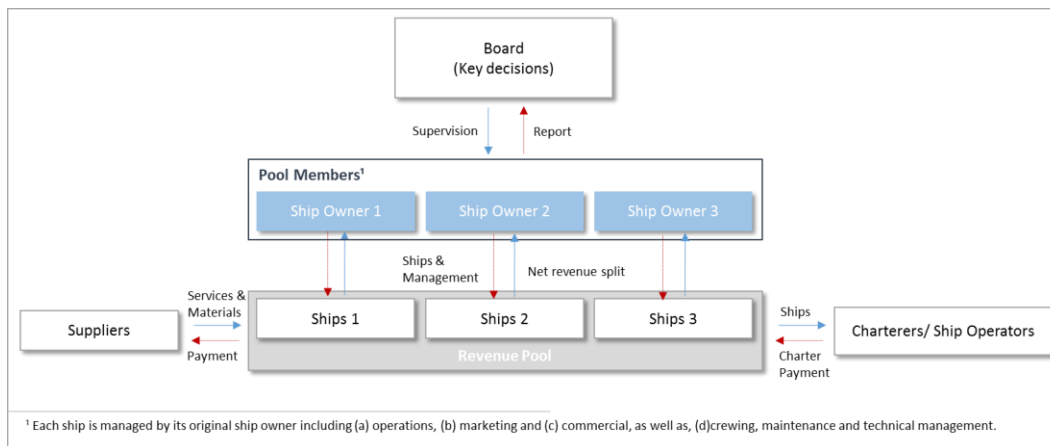


Figure 8: General structure of the Revenue Pool

approach essentially increases the total tonnage volume under the manager’s dispatch and generates economies of scale effect, this type is called the “tonnage pool” (Figure 7).

- (2) **Revenue Pool:** On the other hand, some ship owners or managers do not want to give up their management authorities, or for some other reasons, do not want to have a central managing approach. In this case, they would rather keep the vessels managed independently instead of jointly. This type is

called the “revenue pool” because its main function is to share revenues and smooth out fluctuations without really have a volume effect (Figure 8).

To fully understand the pooling practice and the motivation or concerns of ship owners to join or not to join a pool, we conducted interviews with some of the largest containership charter owners which represent 23% of world charter-owner containership fleet capacity (about 11% of total world containership fleet).

The interview results are consistent with common intuitions and existing literature (Haralambides 1996, Tankers International 2011). We hope this part of discussion will provide for the public, probably the first-time, a comprehensive description of ship pooling practice. Based on the interviews and existing literatures, the benefits and concerns of container ship pooling are summarized in the next section.

2.2. Benefits of ship pooling

The benefits of ship pooling can be generalized into two categories:

(1) Steady Revenue

- A. **Risk mitigation.** This is the most basic and primary benefit of any kind of ship pooling. With the similar idea of mutual funds, by putting assets of discrepant features together, it essentially mitigates variances of returns in terms of volume, time and geography. So, market fluctuations, no matter from seasonal effects, overall economy performance, or simply unexpected market shocks like charterer defaults, can be shared and mitigated among vessels in the pool.
- B. **Liquidity improvement.** Sometimes the pool has a bunker sharing policy, providing a liquidity solution for small ship owners or owners in a difficult time to make ballast voyage in order to get the next employment.
- C. **Finance attractiveness.** Reduction of unemployment periods and better long-term predictability of stable returns are more financially attractive to banks and financial service

providers in terms of obtaining loans by reducing the risk of insolvency.

(2) Economies of Scale

Economies of scale are more sophisticated benefits for ship pooling which only exist for Tonnage Pools because Revenue Pools do not increase the “scale” of operations since the vessels are still separately managed by their original managers. The benefits generated from Economies of Scale are clustered into four groups and explained below:

- A. **Flexibility.** A larger pool of ships can more easily meet various demands of customers, and be more flexible in substituting vessels during the charter period⁵. Furthermore, if there are more vessels with the required features for a new charter contract, the pool manager can defer the decision of naming the specific vessels in the contract, and instead he could wait until the time of contract begins when he has a better knowledge of redelivery⁶ time and location of all vessels⁷.
- B. **Cost control.** Generally, with higher flexibility in managing the vessels, the manager can better control operating costs. For example, it is easier for the pool manager with a larger pool to fix the nearest vessel for a new charter so that ballast voyages are reduced.
- C. **Market opportunities.** A larger ship pool has a higher level of market activities and, thus, creates a brand effect. As a result, the pool gets more superior market intelligence which again leads to more employment opportunities. It might also be possible that

⁵ The need of substituting vessels can come from both ends. For example, a customer may want to upgrade to a bigger ship, or the owner may need to put a vessel dry-docked for maintenance.

⁶ Redelivery means a chartered vessel finishes its current employment and will be redelivered back to its owner/manager.

⁷ A time charter contract normally has a flexible charter period (for example, 3-12 months) and a flexible time window of notice (for example, 20-30 days of notice). Therefore, the vessel owner/manager does not know the exact date or location of vessel redelivery until the charterer notifies the owner/manager.

some employment opportunities are only available for large ship pools. For example, when a liner needs to update its operating network and upsize or downsize the vessel slings, it can choose to charter a group of vessels from one single pool manager.

- D. **Market power.** With a greater operational scale, the pool manager obtains higher market power to negotiate with its suppliers and charterers for favorable contract conditions.

2.3. Concerns of ship pooling

(1) Agency concerns

Normally, ship owners/manager are reluctant to give up the commercial expertise and control, and are concerned about staff reemployment for joining a pool. Furthermore, they give attention to the potential difficulty of exiting the pool once the market has recovered.

In addition to those, it is also a concern that providing more ships for a limited number of employments may lead to even more aggressive price suppression. Risk sharing from a pool may also give false motivations to take on unnecessary or additional risks that otherwise would have not been taken.

(2) Operational concerns

The biggest operational concern about a ship pool is that its overall earnings can be dragged below the breakeven point by idle ships, pulling down employed ships into insolvency risk. Other operational difficulties mainly exist with non-homogenous pools, where the discrepancy of market earnings from different types/sizes of vessels creates obstacles and operating burdens for owners with better market perspectives to join the pool.

For all those concerns above, the essential reason and also the solution, is an effective and efficient

profit sharing scheme. How to fairly and efficiently share the revenues and profits among non-homogenous vessels based on their earning capabilities under real and contemporary market conditions is the main challenge, which is the task for Part Three of our project. Other minor concerns include that pool members must have the capabilities and willingness to cooperate and apply similar standards in technical reliability, operational performance and cargo care.

2.4. Market effects of ship pooling

(1) Profit of NOOs

For an individual NOO, whether joining a ship pool will improve its overall profit depends on many factors. Existing studies based on real market data do not seem to strongly support a positive conclusion. Haralambides (1996) used the statistics from the Western Bulk Carriers pool and found that for most of the period from 1982 to 1993, the average annual earnings of the pool were above the equivalent time-charter earnings. However, no data source was given for the benchmark values. Glen and Martin (2002) analyzed whether tanker pools have influenced market rates using the case of Tanker International pool. With very limited data, they found no significant evidence about effects on VLCC (Very-Large-Crude-Carrier) rates received by pool members, nor significant gains in earnings. Konstantinos (2015) tried to test the hypothesis that participating in a pool agreement has significant effect on the stock prices of a tank shipping company. The time charter equivalent and the categorical variable which illustrates whether the company participates in a pool agreement or not in a specific period of time were used as the explanatory variables to model the stock prices of eight listed tanker shipping companies. The analysis could not detect any significant evidence to support the hypothesis. These studies used statistical analysis to compare the performance of pool members

with the market average. However, with limited pool samples and performance data, the results are not statistically sufficient to draw final conclusions on pooling effects.

(2) Market power balance

As a potential solution for the NOOs to collaborate in a difficult market period, a large ship pool can be a very necessary and effective way for the ship owners to gain countervailing power against the global liner coalitions. As we have discussed in Section 1.3.3, the Vessel-Sharing Agreements among the liners focus on sharing operating costs and planning networks and capacities jointly, which essentially create higher market power to the liners when negotiating with the other market counterparties from both upper and lower levels.

While it is an important and inevitable concern that ship pooling may encounter with regulatory objections, the legal aspect and anti-trust issue are not the focus of this study, especially because each case can be different depending on the total market share of the pool in question and the specific law in different countries and regions.

(3) Overall capacity control

For the whole container shipping market, pooling can lead to rational capacity control if the pool members can reduce operating capacity to improve market conditions and enhance their profits, while the costs of laying up some vessels can be shared among the members. This may even also benefit the liners, if the overcapacity issue is partially solved by the NOOs. In this way, a ship pool enhances efficiencies of the industry and pass on benefits to their customers. But, on the other hand, a pool may also potentially “save” an uneconomical or old vessel that otherwise would be scrapped, which does not help the overall market to recover more quickly.

3. Summary

In addition to dealing with powerful buyers, the ship owners are also facing with long-term financial constraints, low market charter rates and severe overcapacity problems, and in order to cope with all these difficulties, they may find cooperation with others is necessary. Especially with the sharp contrast of concentration levels between the non-operator ship owners and the global liners, a large ship pool can be very necessary and effective for the ship owners to gain countervailing power against the global liner coalitions.

Ship pooling offers a variety of benefits to the members, especially in the current market situation. The main benefits of ship pooling are steady revenue and risk mitigation, and the economies of scale effect that includes flexibility, cost control, market opportunities, and market power. Per the concerns, original ship owners/manager are reluctant to give up the commercial expertise and control, and there is a risk that the overall earnings of the pool can be dragged below the breakeven point by idle ships, pulling down employed ships into insolvency risk.

Although it is expected that joining a ship pool will improve overall profit for the pool members compared with the market average, existing studies have not been able to draw a definite conclusion about it, mainly due to limited samples and data. Another potential market impact from pooling is that it can lead to rational capacity control for the whole container shipping market, if the pool members can enhance profits by reducing operating capacity (*Figure*).

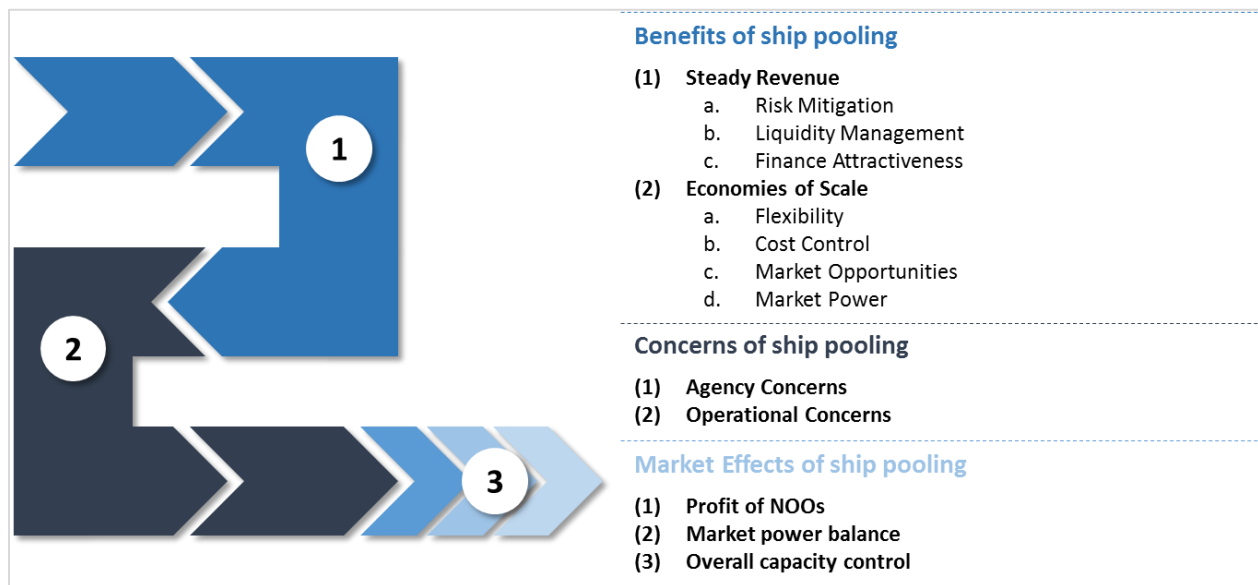


Figure 9: Summary of the performed Analysis on benefits, concerns and potential market effects

To follow up, **Part Two** of the project will focus on analyzing to what extent the benefits and market influences of containership pooling can be realized, which depends on many complex factors. The effects will also vary for different market segments. An economic model will be applied to real market data to estimate the impacts of containership pooling on the shipping market and on the market power balance between the NOOs and the liners.

Furthermore, **Part Three** of the project will discuss about revenue-sharing schemes, which is essential to form and maintain a successful pool. How to fairly and efficiently share the revenues and profits among non-homogenous vessels based on their earning capabilities under real and contemporary market conditions is the main challenge. A desirable scheme should possess characteristics such as stability and fairness, and will be proposed based on Cooperative Game Theory and be tested with empirical numbers in comparison with existing methods.

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