Study on the rise of container liner transportation industry against the trend under the epidemic situation: Research on liner monopoly mechanism

1st Chujun Chen, 2nd Ling Sun, 3rd Yijie Meng, 4th Wei Liu

1 College of Transport and Communications, Shanghai Maritime University, Shanghai, China
2 School of Management, Fudan University, Shanghai, China
3 College of Transport and Communications, Shanghai Maritime University, Shanghai, China
4 College of Transport and Communications, Shanghai Maritime University, Shanghai, China

e-mail: a13052117825@163.com, e-mail: c mengyj47@163.com, e-mail: dweiliu@shmtu.edu.cn

* Corresponding author: b sunl@shmtu.edu.cn

Abstract—In the context of COVID-19, this paper will focus on the rebound of the container market in the context of the epidemic, explore its reasons and experience, and provide theoretical foundations and suggestions for other industries that have been hit hard by the epidemic.

1. INTRODUCTION

Under the impact of COVID-19, the global economy is deeply mired in the epidemic, and the economic recovery is far away [1]. As shown in Figure 1, The GDP growth rate of the world's top ten economies in the first half of 2020 has declined to varying degrees from the average in previous years, and they are all in a state of negative growth.
Shipping industry as a derivative industry that meets freight demand [2]. Its prosperity and depression are largely determined by the global macroeconomic environment and the overall market demand [3]. After 2008 economic crisis, shipping companies suffered large-scale losses. In recent years, the international economic and trade situation has undergone tremendous changes. The drastically reduced shipping revenue and continued high-cost pressure have forced shipping companies to reduce operating costs internally [4]. In this context, the ocean shipping market has become extremely complex [5]. The international shipping market continues to be sluggish [6]. The impact of the economic downturn this year has made the shipping market worse [7].

Generally speaking, the better the world economy, the more prosperous the shipping market [8]. However, under the impact of COVID-19, when the shipping industry was in a downturn, container freight rates showed an overall upward trend. This is very different from usual perception. The current container trunk line freight rate is used as an indicator to reflect the rise and fall of the container market, because the higher the freight rate of the container trunk line, the more prosperous the market [8]. The Dow Jones Industrial Price Index is used as an indicator to reflect the state of the world's macroeconomics, because the Dow Jones Index is the most representative global financial and economic index and does not involve any measurement of uncertainty [9]. The liner alliance's response to the epidemic will be implemented mainly from March. Therefore, this article selects the Dow Jones Industrial Index and container trunk freight rates from March to September this year for analysis. Then calculate the covariance of the two, the covariance is a negative value, which is -354610.5. It explains that the container market and the world macroeconomic environment under the background of the epidemic have opposite trends. With the changes in the global shipping market, existing research can no longer provide constructive advice and guidance for the current shipping market. How does the container market achieve industry recovery under the background of the epidemic, and how to apply the successful experience of the container market to other industries is the key content of the article.

2. ANALYSIS OF THE IMPACT OF THE COVID-19 EPIDEMIC ON THE SHIPPING MARKET

The outbreak of COVID-19 has affected various shipping markets to varying degrees. This article takes the monthly freight index of the Clarkson's shipping network from January 2015 to September 2020 as the representative of the bulk cargo market, the dangerous goods market, and the container market for a longitudinal comparative analysis. Explore the seasonal changes of each market segment itself, and on this basis, analyze the impact of the epidemic on each shipping market. Making a horizontal comparison of each market segment from the perspective of freight demand Bulk market and finding the fundamental reason why container freight market has risen against the trend in the epidemic unexpectedly.

2.1 Bulk market

The outbreak of the COVID-19 in early 2020 has had a very significant impact on the global bulk cargo market. Due to seasonal factors, the performance of the dry bulk shipping market in the fourth quarter will be weaker than the performance of the first three quarters. So, from September 2019, the BDI index began to fall from its peak. However, what is different from the first quarter of previous years is that at the beginning of this year, the BDI index did not show a trend of recovery, but fell to the bottom in April this year. This is because the outbreak of COVID-19 this year has delayed the start of many factories and construction sites or even suspended production, and the demand for dry bulk, mainly iron ore, and coal, has been severely affected. The supply-demand relationship in the global dry bulk trade market is impacted, which indirectly affects the BDI index. Similarly, the rebound in market demand plays a very important role in the recovery of the dry bulk market. China is a large importer of dry bulk. According to Clarkson’s statistics, China's dry bulk transportation volume accounts for about 35% of the global total. Its imports and exports have a significant impact on the global dry bulk shipping market. Therefore, as the COVID-19 is gradually controlled in China, domestic production is gradually returning to the right track, and domestic demand for major bulk cargoes such as steel and coal has
increased, which has driven the global import of dry bulk cargoes, mainly iron ore. The global market situation has improved significantly, and the BDI index has also risen.

2.2 Dangerous Goods Market
Affected by the epidemic, tourism, industrial and economic activities have almost come to a standstill. The market's demand for gasoline, diesel and aviation fuel has continued to decline. Refineries have been forced to reduce or suspend production, and both the tanker market and the liquefied gas market have been affected.

Since 2015, the overall oil price index has been showing a relatively stable trend. Affected by heating oil, oil demand in summer is low, and demand in winter is gradually picking up. As shown in Figure 2, the BCTI and BDTI indexes mainly showed a downward trend in the first three quarters of each year, and the freight rate increased in the fourth quarter. The difference between this year and previous years is that since February, the freight rate in the tanker market has risen rapidly, and after reaching its peak in April, it has rapidly fallen to the bottom. This is because oil prices plummeted at the beginning of the year due to the decline in market demand. Under this background, companies purchased low-priced oil and used floating oil storage facilities such as offshore oil storage vessels for storage. In a short period of time, the demand for oil transportation in the oil transportation market increased, resulting in short-term freight rates rising sharply. Since May, due to the new outbreak of epidemic, the customs policies of various countries have been tightened, and the number of orders from related companies has been greatly reduced. The oil trade market has once again fallen into a downturn.

2.3 Container liner market
Although the global outbreak of COVID-19 has had a certain impact on the global container shipping market, according to relevant data, the freight rates of various routes in the container market fluctuate little during the epidemic and have seen rapid increases since June. Because of the large number of shipping routes in the container market, this article selects representative China-US shipping routes and China-Europe shipping routes for specific analysis.

According to the China Export Container Freight Index, the freight rates of China-US routes have shown a relatively stable trend of changes since 2016. The first and third quarters of each year are peak seasons for traditional container transportation, its freight index starts to rise in January and July every year and falls back to the original freight rate month by month. As shown in Figure 3, the overall freight rates of China-US routes have been on the rise this year, with a slight decrease only in March and May.
Although the epidemic in early February caused a simultaneous decline in trade volume and transportation demand, as the route is still in the traditional peak season for transportation, its freight rate is still on upward trend. Since June, the effective control of China’s epidemic situation and the urgent demand of the United States for resumption of work and production have led to the gradual recovery of the Sino-US trade market. At the beginning of the third quarter, as the market entered the traditional peak season for China-US routes and each liner company flexibly invested in capacity to increase freight rates to obtain profits based on market demand, the freight rates of China-US routes continued to rise and showed a sharp upward trend.

It can be known from the analysis that the strict control of shipping capacity by the three major liner alliances is the main reason for the rise in container freight rates during the epidemic. According to Alpha liner statistics, in 2019, the capacity of three major container liner alliances accounted for 81% of the Far East-North America routes, and in the Far East-Europe route accounted for 100%. Therefore, although transportation demand has fallen due to the impact of the epidemic, the major alliances have kept the container market in a state of short supply through shrinking capacity, which caused the freight index of the two routes to increase and continue to rise during the epidemic.

2.4 Horizontal comparative analysis of various shipping market segments

According to Clarkson’s statistics, due to the impact of epidemic, transportation demand in all shipping markets this year has declined year-on-year. In this context, the freight rate changes in the container transportation market and other cargo transportation markets have shown different results. When the freight index of dry bulk, general cargo, oil, and other shipping markets has suffered a huge drop due to the impact of the epidemic, the freight rate in container market only dropped slightly at the beginning of the epidemic, and its overall trend continued to improve. The freight rates in the China-Europe and China-US routes have even exceeded the same period last year.

Through the analysis of the changes in the freight index of each shipping market, we can know that the freight index of shipping industry fluctuates mainly due to changes in market supply and demand. The difference between the container market and other markets is that its capacity mainly concentrated in three major alliances, so liner companies can flexibly control capacity through market demand to adjust the supply and demand relationship in the transportation market, so the container transportation market is less affected by demand. When the entire shipping industry is affected by the epidemic, the semi-monopoly of the container market is the real reason why its freight index has continued to improve.

3. MATERIALS AND METHODS

The monopoly of the industry is mainly manifested by a certain operator's rapid expansion of production, enhancement of its own business strength, acquisition of market dominance and other scarce resources, thereby greatly reducing the possibility of effective competition, forming an exclusive situation, and then forming a monopoly. It can be manifested as two or more enterprises or enterprise associations, which jointly control the production or sales of a certain industry through express or implied agreements to restrict competition or joint actions.

3.1 Concentration ratio

It can be considered that in monopolistic market, the higher degree of monopoly of an industry, the easier it is for monopolistic enterprises in the industry to obtain more resources. Concentration ratio (CR) is the most basic and widely used indicator to measure market concentration. It is usually measured by the sum of market shares of previous large-scale companies in the market. The calculation formula is:

\[
CR_n = \frac{\sum_{i=1}^{n} X_i}{\sum_{i=1}^{N} X_i} = \frac{\sum_{i=1}^{n} S_i}{\sum_{i=1}^{N} S_i}
\]
Here, \( n \) represents the number of selected container liner companies, usually \( n=4 \) or \( n=8 \). \( CR_n \) represents the total market share of the top \( n \) companies. \( X_i \) represents the turnover of i-ranked company. \( S_i \) represents market share of the i-ranked company.

Container liners have dual characteristics of competition and monopoly. This article uses absolute market concentration ratio to analyze. The structure of oligopoly market competition is shown in Table 1.

| Types                                   | CR/%        | Number of enterprises |
|-----------------------------------------|-------------|-----------------------|
| Extremely oligopolistic                 | >75         | 1-40                  |
| Highly concentrated oligopolistic       | (65, 75]    | >85                   |
| Middle (upper) centralized oligopoly    | (50, 65]    | (75,85]               |
| Middle (lower) centralized oligopoly    | (35, 50]    | (45,75]               |
| Low concentration and oligopoly         | (30, 35]    | (40,45]               |
| Competitive                             | \( \leq 30 \) | \( \leq 40 \)         |

The number of enterprises is large and not centralized

### 3.2 Equations

The calculation results show that the container liner industry is a typical monopoly industry. The competition between the two container shipping companies in the liner shipping market is based on the competition of the joint market strategy. The shipment price setting in the shipping industry is quite complicated and is highly seasonally driven. There is a disconnect between current shipment demand, available shipping capacity, and shipment pricing[10]. In this paper, the price model is as follows:

\[
P = k_1 e^{aP}
\]

(2)

Here, \( P \) is pricing, \( a, k_1 \) is parameter.

Traditional economic theory believes that the relationship between supply and demand in the market will affect the pricing of commodities. When there are fewer companies with a larger market share, pricing collusion becomes easier. Economies of scale are positively related to size and vertical and horizontal integration of FMI providers.

In summary, we believe that under fixed market demand, commodity prices are inversely proportional to the productivity of \( n \) companies in the industry. The formula is as follows:

\[
d = k_2 P(x_1 + \ldots + x_n)
\]

(3)

Here, \( d \) is commodity demand, \( k_2 \) is parameter, \( P \) is pricing, \( x_1 \ldots x_n \) are turnover of each enterprise of the container liner company.

Solve equations (1), (2), (3), obtain result:

\[
P = k_3 e^{\frac{x_1 + x_2 + \ldots + x_n}{d} k_4 P}
\]

(4)

From equation (4), it can be found in the container liner industry, under the circumstance of certain market demand, liner freight is only related to the total market share of the top 4 liner companies occupying the market share on each route. The greater the combined market share of the top 4 companies, the higher the monopoly price of container liner freight on the route.
4. CONCLUSION
The container liner shipping industry belongs to the service industry. Currently, the global liner shipping industry has formed three major alliances: 2M, OCEAN Alliance, THE Alliance. There are currently four main monopoly strategies for liner monopoly alliances: joint operation, price increase plan, capacity storage, suppression strategy.

4.1 Suggestions
1) Joint operations have been increasing in recent years with the depth and breadth of cooperation among its members. From the perspective of organizational model, it has expanded from traditional space leasing, space interchange, mutual lease to joint ship dispatch, network reorganization, and inland transportation cooperation. Liner companies determine market freight rates by signing freight agreements, stabilization agreements, etc., and use penalties to make price reductions a non-dominant strategy to prevent market freight rates from falling. Therefore, the optimal strategy for liner companies is to maintain a negotiated freight rate.

2) The price increase plan is proposed by the liner company with a large market share, and other liner companies respond to jointly raise prices to increase revenue. It is currently one of the most commonly used price increase methods for liner companies.

3) Judging from the actual situation of this epidemic, the sudden drop in container liner transportation demand did not cause the freight rate to drop to an incredible level. The reason is that the major container liner companies have sealed up shipping capacity and increased the equilibrium freight rate by reducing the maximum volume. In addition to direct storage, low-speed navigation is essentially a way to control the amount of capacity.

4.2 Summary
This article starts from the general background of the global economic downturn under the epidemic. By calculating the industry concentration of the top 4 and top 8 container liner industry sales, judging that the container liner shipping industry is a medium (upper) concentrated oligopolistic market. By establishing a p-CR model to solve the discovery, it can be found that the liner market freight rate is exponentially related to the market share of the top 4 (8) companies in the industry.

Through the analysis of the monopoly mechanism and main monopoly strategies of the liner alliance, it is believed that joint operations, price increase plans, capacity storage, and suppression strategies are the main monopoly strategies of liner alliance. This article believes that the monopoly strategy of container liner market can also be applied to other similar markets, that is, there is a certain degree of monopoly, but due to few companies, it also has a competitive service market such as air transportation market, communication market. Future research can further demonstrate the feasibility of applying the monopoly strategy of container liner alliance in other similar industries to obtain higher profits and stronger anti-risk capabilities.

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