

Transport Capacity Adjustments of Shipping Lines: Chartering decision before and during COVID-19 Pandemic

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Introduction and Research Questions

The shipping industry is a crucial part of transport systems and value chains, but managing large fleets of container vessels is challenging due to high investments, operational difficulties and various risks that can impact a company's profitability (Cariou & Wolff, 2013). The COVID-19 pandemic has further highlighted the impact of sanitary policies and health protocols set by countries, causing disruptions in both demand and supply that have affected national and regional economies (EMSA, 2021), as well as international logistics and containerized trade. As a result, shipping lines and logistics operators have had to adjust their strategies by modifying sailing frequencies and levels of maritime connectivity between different regions (UNCTAD, 2020).

The ability of shipping lines to remain resilient during economic and financial disruptions is considered one of their biggest strategic challenges. The COVID-19 pandemic was an unexpected event that had a significant impact on the flow of goods in international supply chains. For example, global ship calls decreased by 8.7% in the first half of 2020 compared to 2019, primarily due to lockdowns and economic and social restrictions (UNCTAD, 2021). Therefore, the commercial success of shipping lines depends on achieving an optimal balance between reliable operational services and financial sustainability. Fleet optimization and asset management have become essential areas for the competitiveness and survival of a shipping line in a highly competitive market environment (Cariou & Wolff, 2013; Chang et al., 2015; D'agostini et al., 2019; Shin et al., 2019). While previous research has investigated the resilience of shipping through the lens of such strategies, this study focuses on the chartering behaviors of liners before and during COVID-19, aiming to extend the research on transport capacity management adjustments during a crisis.

The research aims to investigate whether short-term chartering strategies of shipping lines showed any fundamental changes due to the COVID-19 pandemic. It is important to confirm whether and how

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shipping lines reacted to an unforeseen external shock that may repeat in the future. From a theoretical perspective, the results can provide a deeper understanding of the pandemic with respect to chartering strategies of shipping lines. As crises recur in the shipping context, the results can contribute toward enhancing the resilience of shipping lines during unexpected future events and can help learn from past events. It can also help these market players hedge against pandemic risks and take more data-driven decisions to improve their strategies and use the results as a benchmark against competitors' behaviors.

Materials and Methods

This study aims to analyze the strategic decision-making of the top 11 shipping lines before and during the COVID-19 pandemic. In the first stage, data on chartered tonnage of shipping lines were obtained from Clarkson Shipping Intelligence Network and used to perform a Mann-Whitney U test. The dataset covered the period from January 8, 2018, to October 29, 2021, and included specifications such as the ship's name, year of construction, size in TEU, charterer's name, minimum and maximum charter period, hire in USD/day, and ship-owner's name. The dates of the fixtures were sub-grouped into 2018 and 2019 (before COVID-19) and 2020 and 2021 (during the pandemic) for analysis, and the period of charter was expressed as both minimum and maximum periods. An average period of charter was calculated by taking the average of these values. Table 1 shows the descriptive statistics of the data.

Table 1. Descriptive statistics

Statistics	Size of Chartered Ship (TEU)	Built Year of Chartered ship (Year)	Period of Charter (months)
<i>Minimum</i>	366	1989	0.27
<i>Maximum</i>	14,952	2021	180
<i>Mean</i>	3,263.52	2007.39	10.90
<i>Standard Deviation</i>	2,139.38	4.62	13.20

Source: Author's calculation

Results

In the next stage of the study, the mean differences of the size, age and period of chartered ships were examined through statistical testing. Initially, a two-sample independent t-test was used, but it was found that the distribution of means did not meet the normality assumption. Therefore, non-parametric methods such as the Mann-Whitney U test and Kruskal Wallis H test were used to test the hypothesis. The results, as shown in Table 2, indicate that the three variables examined in this study were significantly different after 2020, compared to the period before that. The null hypothesis was rejected at a 5% level of significance, indicating that the size, age, and period of chartered ships were significantly different after 2020.

Table 2. Hypothesis Testing

Null Hypothesis	Test	Sig.	Decision
<i>The distribution of the size of chartered ships (in TEU) is the same across categories of 'Before After'</i>	Mann-Whitney U test	.000	Reject the null hypothesis
<i>The distribution of the age of chartered ships (in TEU) is the</i>	Mann-Whitney U test	.000	Reject the null hypothesis

*same across categories of
'Before After'*

*The distribution of the period of
chartered ships (in TEU) is the
same across categories of
'Before After'*

Mann-Whitney U test

.000

Reject the null
hypothesis

Source: Author's calculation

The next step in the study involved analyzing individual shipping companies to test for statistical differences in the size, age and charter period of chartered ships before and after 2020. The Mann-Whitney U test was used to compare each company before and after 2020, and Kendall's Tau b test was used to measure the direction of the relationship between the variables. Results in Table 3 showed that some companies, such as Cosco, Hapag Lloyd, HMM, MSC and Wan Hai, chartered ships of approximately the same size before and after 2020, while others, including CMA-CGM, Evergreen, Maersk, ONE, Yang Ming, and Zim, showed significant statistical differences in the size of chartered ships. After 2020, the age of ships chartered by most companies remained unchanged when compared to the period before, except for CMA-CGM, HMM, ONE, and WanHai, which chartered younger ships. The charter period remained unchanged for only Evergreen and HMM, while Cosco, Hapag Lloyd, Maersk, MSC, ONE, Wan Hai, Yang Ming, and ZIM showed statistical significance for the period of charter after 2020.

The direction of the relationship before and after 2020 was measured using Kendall's Tau b test, which showed a negative correlation for chartered ship size after 2020, indicating that shipping lines chartered smaller ships after 2020. For example, CMA-CGM, Evergreen, Maersk, ONE, Yang Ming, and Zim all chartered smaller ships after 2020 than they did before.

The negative correlation in Table 4 indicates that CMA-CGM and HMM chartered younger ships after 2020, while ONE and WanHai chartered older ships. Most shipping lines chartered vessels for longer periods after 2020, except for Yang Ming, which chartered ships for shorter periods (negative correlation).

Table 3. Mann-Whitney U test Results

Line	CMA-CGM	Cosco	Ever green	Hapag Lloyd	HMM	Maersk	MSC	One	Wan Hai	Yang Ming	Zim
Size	0.01	0.146	0.024	0.077	0.086	0.002	0.375	0.011	0.137	0.000	0.008
Age	0.02	0.397	0.719	0.667	0.000	0.066	0.479	0.001	0.005	0.432	0.631
Peri.	0.01	0.000	0.542	0.002	0.096	0.000	0.000	0.000	0.000	0.026	0.000

a. Grouping Variable: before_after

*Highlighted cells show that no significant change occurred after 2020

Table 4. Correlation Matrix

Line	CMA-CGM	Cosco	Ever green	Hapag Lloyd	HMM	Maersk	MSC	One	Wan Hai	Yang Ming	Zim
Size	-.083**	-0.064	-.134*	-0.069	-0.142	-.092**	-0.036	-.181*	-0.076	-.267**	-.140*
Age	-.080**	0.038	0.022	0.017	-.370**	0.056	-0.030	.249**	.149**	-0.060	-0.026
Peri.	.088**	.212**	0.036	.122**	0.140	.212**	.184**	.311**	.274**	-.165*	.386**

The analysis conducted allows for a general summary of the major chartering strategies to be made at the company level. Table 5 presents the differences in strategies for ship size, age and charter period after 2020 compared to before. If a company shows 'no change', it means that there was no significant difference before and after 2020. The shipping lines pursued different strategies after 2020, with some showing considerable change and others showing differences in only one of the variables. For example, Zim and Maersk decided to charter smaller ships for longer periods while maintaining the age of the ship. Wan Hai focused on older ships for longer periods. CMA-CGM showed differences in all three variables and chartered smaller, younger ships for longer periods. Similarly, ONE chartered smaller, older ships for longer periods. Hapag Lloyd only chartered ships for longer periods, Evergreen chartered smaller ships only, and HMM focused on chartering younger ships. Yang Ming chartered smaller tonnage and was the only one to shorten the charter period.

Table 5. Summary of the Shipping Lines' Chartering Strategies

Line	CMA-CGM	COSCO	EVERGREEN	HAPAG LLOYD	HMM	MAERSK	MSC	ONE	WANHAI	YANGMING	ZM
Size	Smaller	No Change	Smaller	No Change	No Change	Smaller	No Change	Smaller	No Change	Smaller	Smaller
Age	Younger	No Change	No Change	No Change	Younger	No Change	No Change	Older	Older	No Change	No Change
Peri.	Larger	Larger	No Change	Larger	No Change	Larger	Larger	Larger	Larger	Shorter	Larger

Policy Implications

This analysis suggests that the chartering strategies in response to the pandemic have changed both for all companies in aggregate as well as for individual shipping lines. Shipping lines have utilized transport capacity management in terms of chartered tonnage as a strategy to adjust tonnage requirements during the pandemic. The results of the study show changes in relation to the size, age, and period of the charter. We highlighted that, overall, smaller ships were chartered for longer periods of time during the pandemic..

The implications of this study support both academics and managers. From the research perspective, the analysis showed that shipping lines adopted different chartering strategies and that each one has pursued a peculiar path in response to the pandemic. The findings point out that decision-making of shipping lines was divergent across the sample but all of them showed resilience to a new market scenario represented by the pandemic. For these reasons, we argue that, whilst the resilience of shipping has been mainly driven by network rescheduling and shared capacity management as shown by past research, capacity management adjustments of liners were also represented by chartering activities and the characteristics of chartered tonnage. From a managerial perspective, the results can be useful to ship managers, operators, owners and charterers to deepen the understanding of chartering activities in response to external shocks.

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