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PAPER

# Containership Charter Rates: Analysis of Unprecedented Growth After Covid-19 Pandemic Outbreak

**Grigoriy Zaidman[*] • Giorgio Dominese[**] • Sergey Yakubovskiy[***] • Tetiana Rodionova[****]**

**Abstract** The covid-19 pandemic outbreak disrupted the entire world economy with no exception. The shipping industry was hit hard short-term, after which the dry shipping sector demonstrated a surprisingly rapid return to the pre-covid level and subsequently exceeded the same. The containership segment experienced the most unprecedented surge. The current paper examines the containership market by analyzing charter rate as a main variable of interest for all shipping industry stakeholders and investigates the nature of the 10-time increase of rates on the charter market, concentrating on the containerships of certain capacity (2750 TEU). To conduct this analysis, the vector autoregression model, namely the Granger test, is constructed. The impact of various independent macroeconomic variables, namely vessel prices, industrial production of several countries, several goods prices, the market capitalization of the leading container shipping companies, container throughput of the leading global ports, on containership charter rate is assessed. It was proven that the swift increase of containership charter rate could not have a basic demand-related justification, as the volume of containerized trade was more or less stable within the period of consideration (2020-2021) and neither Singapore nor Hong Kong nor Los Angeles port container throughput indicators appeared to have an effect on containership charter rate. It was ascertained that geographical factor determined the way macroeconomic indicators influenced charter rate – the more dependent region or country on seaborne trade and maritime transportation of goods, the more significant the relation with charter rate. Europe appears to be the least dependent.

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US industrial production affects the charter rate, although it is not affected in return. In turn, Asian indicators (Asian port throughputs and industrial development of Asian countries) are affected by charter rate, while Chinese industrial production is the solo Asian indicator influencing charter rate. The remaining factors impacting charter rate are Maersk market capitalization and steel price.

**Keywords:** shipping, charter rate, containership, chartering market, vessel price.

**JEL Classification:** C80, F14, L99, O14, R41, R49.

## 1. Introduction

The shipping industry plays a vital role in the global supply chain and occupies a considerable segment of the world economy. This role was especially noticeable during the outbreak of coronavirus pandemic when the demand on maritime transportation as a main global supplier of goods, including the essential ones, was obviously impacted by the disruption, although experienced lesser shock in comparison to other spheres, but the drop was still considerable short-term as covid-19 was generating uncertainty over strategic decisions.

The article provides an overview of the current shipping trends by looking at four closely related shipping markets, each trading in a different commodity, with the changes and impacts caused by the Covid-19 pandemic. The classification of the shipping markets is as per M. Stopford (2009): the freight market trades in sea transport; the sale and purchase market trades secondhand ships; the newbuilding market trades new ships; and the demolition market deals in ships for scrapping. After the overview, the containership segment of the freight/charter market is being examined, as soon as this shipping sector experienced the unprecedented surge upon the first Covid-19 limitations were lifted.

Trend wise and sector wise, the main shipping markets have reacted to unprecedented pandemic similarly, however, subsequent progress has varied across cargoes and the speed of development is different. Seaborne trade volumes of dry bulk rapidly firmed, container shipping trade has seen a remarkably quick bounce-back from covid-driven initial slowdown. Apart from bulk commodities and containers, LNG was demonstrating stable positive dynamics. Interestingly, real economic growth did not accompany the surge in activity on shipping markets.

Containerized trade is a crucial segment of the shipping industry. Containerships carry various types of commodities in containers which are miscellaneous consumer products, home, and building products, furniture, industrial machines and parts, textile, clothing, miscellaneous industrial products, autos and auto parts, consumer electronics, iron/steel, toys, sports equipment, wood pulp, lumber, peas, beans, lentils, wastepaper, hay/alfalfa, fresh and frozen meat, soya beans, malt, newsprint, scrap metal, etc. The range of these commodities only underpins how important the containerized trade is for both households and manufacturing.

The widely used measure of the volume of containerized trade, as well as the capacity of the containership, is TEU – twenty-equivalent unit. This measurement comes from the volume of a 20-foot-long intermodal container, which is a metal box of a standard size with a main benefit being its uniformity, i.e., it can be simply transferred between various types of transportation, such as ships, trains and trucks. However, the usage of this measure has both advantages and drawbacks. As M. Stopford (2009) notes, by 2005, the tonnage of containerized cargo had reached 1 billion tons and the average tonnage per container lift in 2005 was only 2.7 tons per TEU, which reveals the underlying weakness of the container lift statistics as a measure of transport capacity. Container lifts include all container movements through ports, including double lifts when a container is transshipped from a deep-sea service to a feeder ship and containers returned empty on unbalanced trades. A 20 ft container can carry up to 24 tons, and 10 tons would be a more normal average.

Moreover, although containers are physically homogenous, their contents are not. The weight of the containers varies, depending on the contents. In 2005 Vancouver's average outbound container carried 11.9 tons of cargo, whilst the average inbound container carried 7 tons, reflecting the different characteristics of the inbound and outbound trades. The contents also vary in value. Electronic goods such as TV sets are worth over USD 30000 per ton, motorcycles USD 22000 per ton, basic clothing such as jeans USD 16000 per ton, and designer clothing perhaps USD 60000 per ton. At the other end of the scale, many of the export commodities are worth less than USD 1000 per ton, for example scrap metal USD 300 per ton and steel products USD 600 per ton. These differences are important because they affect transport pricing.

Summarizing the discussion about the most precise approach towards estimation of containerized trade, there is no ideal measurement unit for it – all have some shortcomings not allowing the researchers to assess the value of the traded commodities to its fullest. As soon as there is no relation between the mass and the price of commodities, meaning both indicators can be misleading one way or the other, the current paper sticks to the TEU as a measurement of trade volumes since the industry commonly accepts it. Another distinguishing feature of the container shipping segment is that the major market players not always own the vessel tonnage they operate. By 2005 about 50% of the containership capacity operated by the 20 largest containership companies was being time-chartered from independent owners. There are so-called non-operating owners (NOO) who provide vessels to companies providing regular transportation services under long-time charter.

Between 1975 and 2007, the containerized cargo grew much faster than other parts of the shipping business, as per M. Stopford (2009). In 2019, 811.2 million TEUs were processed in container ports globally. Nearly 65 per cent of world port-container cargo handling was in the Asian region – the share of China surpassed 50 per cent. Europe ranked second in terms of container port-handling volumes, behind Asia, whose share was more than four times greater. Other regions in descending order are North America (7.7 per cent), Latin America and the Caribbean (6.5 per cent), Africa (4 per cent) and Oceania (1.6 per cent). As far as Asia is the main region for containerized trade, the current paper takes into consideration the port container throughput indicator for Singapore and Hong Kong which were the second and the eighth in the list of the leading global container ports in TEU in 2019. Los Angeles, ranked 16 on the same list, is also considered as the busiest container port of North America (UNCTAD, 2020).

## 2. Literature review

The current study dwells exactly on the vessels of 2750 TEU capacity as the most suitable size representative to investigate the entire container shipping market. UNCTAD (2020) researchers echo this approach: when examining the consequences of pandemic-induced disruption, the specialists forecast that potential trade regionalization (especially in container shipping) would lead to increased fragmentation of trade flows which in turn would make the use of larger vessels more challenging.

The pandemic revealed the vulnerability of the larger vessels from the economic efficiency standpoint, which could have never arisen itself under the normal circumstances in the world economy unless hit by the extreme external event. Owing to diminishing trade volumes as factory output in manufacturing regions slowed down and consumers reduced discretionary spending on non-essential items in Europe and North America, carriers cut capacity by introducing such solutions as blank sailing, idling capacity and re-routing via the Cape of Good Hope to pare down costs while taking advantage of lower fuel prices.

Blank sailing and service cancellations announced by the carriers without the usual notice periods affect service reliability and the ability of shippers to plan their supply chains. Deploying larger vessels means that any missed port calls caused by blank sailing has a greater impact on available capacity. In June 2020, many ports reported that blank sailing had resulted in mega-sized vessels calling less often but when they did, the large volumes created peaks and operational challenges. These operational hurdles affected ports (ship-to-shore operations and yard activity), as well as landside distribution.

Since container vessels move on a scheduled rotation, the cancellation of a sailing from the first port in the rotation cascades down to all the other ports served by that carrier in that rotation. Shippers also contributed to the disruption by cancelling bookings without prior notice to carriers, thereby making any planning to optimize vessel capacity difficult. At the port level, less traffic sometimes can result in the cancellation of working shifts without proper notice to carriers conducting inland transportation. The operational challenges become more painful by growing detention and demurrage charges for exceeding free storage time and the late return of equipment to marine terminals (UNCTAD, 2020).

Importantly, liner companies are less flexible than other dry sector players. In addition to the usual trade cycles which affect all shipping businesses, there are two reasons why capacity management can be an issue. Seasonality occurs on many liner routes, meaning cargo volume varies depending on the period of the year. Cargo disbalances take place when there is more trade in one direction than the other, forcing vessels to proceed partly loaded on the leg with the smaller trade flow. Both problems are also intrinsic to the dry bulk market, but market forces quickly resolve them; for instance, ship owning companies negotiate rates and switch from trade to trade. Liner companies lack this flexibility. With so many customers, it is not practical to negotiate a rate for every cargo. This combination of fixed prices and inflexible capacity leaves liner companies with a pricing problem that has dominated the industry since it started (M. Stopford, 2009).

Maritime transportation has been widely explored in the existing literature. The most prominent studies are authored by N. Michail, K. Melas, D. Batzilis, T. Pelagidis, I. Karaounalis, G. Panagiotopoulos, B. Ko, S. Arslanalp, M. Marini, P. Tumbarello, D. Cerdeiro, A. Komaromi.

An attempt to find the relationship between the number of containers transported and real GDP growth was taken by N. Michail et al. (2021). The significant positive effect was revealed – a 1% increase in transported TEUs led to an approximate 1.7% increase in GDP. It can be explained via the fact that TEUs have a positive effect on trade flows between countries and trade flows have long been shown to have a strong positive impact on real GDP growth. A worthy note is that the scholars included exchange rate into the model, so that it accounted for any potential movements in GDP that have already been incorporated by the markets and were thus unrelated to the growth in trade.

Two more articles by N. Michail and K. Melas are worth to be referred to. Both articles supplement each other, forming a single comprehensive attempt to quantify the connection between economic growth and seaborne trade on the macroeconomic level, and the consequent impact on freight rates of various market sectors. Firstly, N. Michail (2020) in order to assess how the world economic growth affects the global demand for seaborne trade, split the world economy into three groups of countries by income (high, middle and low) and the shipping trade market into three main sectors (dry cargo, crude oil and petroleum products). The results of the research display that developments in the world economic growth impact all three cargo categories, although to a different extent: processed petroleum products, related to clean tanker transport, register the most robust effect from an increase in world GDP in comparison to crude oil and dry cargo. The price of oil appeared to have a small negative effect on the amount of goods transported, supporting the view of demand inelasticity with regards to price. The positive reaction of seaborne trade demand on GDP shock has to be mainly attributed to the high- and middle-income countries. As to low-income countries, which are known as net exporters of oil and petroleum products, economic growth appeared to negatively affect seaborne trade, as higher income is likely to be associated with more domestic consumption and less exports.

Secondly, N. Michail and K. Melas (2020) investigated the relationship between seaborne trade and several freight indices and found out a strong impact the quantity of seaborne commodity trade had on the BDI and the BDTI, but not on the BCTI, most likely due to the fact that clean tankers can simultaneously operate both in the clean and dirty sectors. Additionally, it was observed that a shock in the price of Brent oil had the expected positive response from the Baltic Dry Index, while its relationship with the Baltic Clean Tanker Index and the Baltic Dirty Tanker Index was negative because tanker vessels can operate as floating storage units when oil prices decline. N. Michail and K. Melas confirmed that the world GDP determined the freight rates through the quantity of seaborne trade, while the former determined the freight rates directly.

While B. Ko (2010, 2011, 2013) analyzed the general dry bulk freight market with one of the important conclusions being that market players considered the backwardation shock in low uncertainty as more important than in high uncertainty; T. Pelagidis, I. Karaounalis, G. Panagiotopoulos (2019, 2021) investigated precisely capesize sector as a key barometer of commodities shipping trade, namely the connection between the trading of forwarding freight agreements (FFAs) and the volatility of capesize freight market of 4 time charter average (4TC).

IMF researchers D. Cerdeiro and A. Komaromi (2020) constructed a measure called ‘lockdown exposure’ in order to examine the spillover effects of pandemic supply-side disruptions and found out that as opposed to overall activity in the domestic economy, the supply and transportation of goods was indeed influenced by government lockdowns. Supply disruptions due to lockdowns reduced global seaborne imports in February-March 2020 by 10%, with China’s lockdowns contributing about 4%. However, these spillover effects were short-lived – present during the first 2-3 months of the pandemic. After then, demand effects likely dominated the evolution of global trade.

A few other studies by IMF specialists aimed to connect AIS data with trade activity and convert these massive data into practical use for economics. S. Arslanalp, M. Marini and P. Tumbarello (2019) took Malta as a benchmark and used AIS-based port calls data to develop two indicators – ‘cargo number’ and ‘cargo load’ – to trace maritime and trade activity. ‘Cargo number’ stood for the number of ships visiting ports, and ‘cargo load’ stood for changes in vessels’ draughts, representing the fact that either loading or discharging operations happened at port. Thereafter researchers tested produced data by comparing with official reports and the results (0.75 and 0.65 correlation coefficients, respectively) could act as proof of sustainability of the employed method to predict trade volumes by means of AIS data and to nowcast them (assess in real-time). The latter appears to be a topical problem raised by the industry. Nowcasting trade flows is key for all market participants as far as official trade data is always published with delays. This matter was further addressed by D. Cerdeiro, A. Komaromi, Y. Liu, M. Saeed (2020) in "World Seaborne Trade in Real Time: A Proof of Concept for Building AIS-based Nowcasts from Scratch." Having introduced the GTI (Global Trade Intelligence) index counted purely on AIS-based data and having compared it with official global and country divided trade data, the scholars came to the conclusion that based on the high final correlations, such a methodology achieved a good fit with official statistics. As soon as this paper relies solely on AIS messages and publicly available information, its self-dependence underlies the speed of trade estimates being produced with a 5-10-day lag in comparison to 11-15 weeks it takes officials to publish the same data.

## 3. Hypothesis, methodology and data

As a hypothesis of the study, we assume that the following indicators affect charter rates: containership 2750 TEU 10-year-old secondhand price; containership 2750 TEU newbuilding price; US industrial production; European industrial production; OECD industrial production; S. Korean industrial production; Chinese industrial production; Taiwanese industrial production; crude oil Brent price; grain USG price; steel ship plate price; market capitalization of the world-leading containership companies; the world-leading ports container throughput.

The vector autoregression (VAR) framework is chosen to test this hypothesis since it provides a systemic way to capture the rich dynamics in multiple time series. This method has been successfully tested in the following previous studies – Dominese et al. (2020, 2021), Lomachynska et al. (2020).

Specifically, to provide evidence on the dynamic interactions between containership charter rates and other macroeconomic indicators, the following VAR systems are estimated to test Granger non-causality:

$$\begin{aligned} CCCR_t &= \alpha_1 + \sum_{i=1}^{p} \beta_{1i} OMI_{t-i} + \sum_{i=1}^{p} \gamma_{1i} CCCR_{t-i} + \varepsilon_{1t} \\ OMI_t &= \alpha_2 + \sum_{i=1}^{p} \beta_{2i} CCCR_{t-i} + \sum_{i=1}^{p} \gamma_{2i} OMI_{t-i} + \varepsilon_{2t} \end{aligned} \tag{1}$$

where CCCR, OMI and $\varepsilon$ denote respectively: components of containership charter rates –containership 2750 TEU 10-year-old secondhand price; containership 2750 TEU newbuilding price; US industrial production; European industrial production; OECD Industrial production; S. Korean industrial production; Chinese industrial production; Taiwanese industrial production; crude oil Brent price; grain USG price; steel ship plate price; capitalization of the world-leading containership companies (Maersk, Hapag-Lloyd, OOCL); Singapore, Honk Kong, Los Angeles ports container throughput; and the error term. α is a constant term, $\beta$ and $\gamma$ denote the coefficients to be estimated, $p$ is the lag order selected. The null hypothesis of Granger non-causality from CCFR to OMI and from OMI to CCFR are $\beta_{1i}=0$ and $\gamma_{2i}= 0$, respectively. The rejection of the null hypothesis of the Granger non-causality from OMI to CCFR implies that the past macroeconomics indicators can help predict the containership charter rates and vice versa.

The model is estimated as follows. First, an unrestricted VAR is estimated. Then Granger causality testing is performed. The optimal number of lag length was chosen by looking at AIC and SIC criteria. The stability of VAR was checked: all AR roots are inside the unit circle and the Autocorrelation LM test states that no serial correlation in the residuals was detected.

Monthly data is used, taken from the: Clarksons Research (2020, 2021), Hong Kong Maritime and Port Board (2021), Largest Companies by Market Cap (2021), Maritime and Port Authority of Singapore (2021), The Port of Los Angeles (2021).

## 4. Results and discussion

Over the first 5 months of the pandemic, the freight rates have dropped by 73% for the dry bulk segment, by 36% for the dirty tankers segment and by 30% for the clean tanker segment (N. Michail, K. Melas, D. Batzilis, 2020) confirming the initial shock on the dry segment was more significant which is mainly because using tankers as storage capacity is a common practice for the periods of oil market distress. In 2020 during the first two months of the Covid pandemic, floating storage volumes increased by 37%.

However, the dry bulk and containership rates have experienced a quick recovery. By April 2021, capesize spot earnings reached a height 96% above the average level seen since 2009, with the whole dry sector demonstrating the similar trend. Overall, bulker earnings have increased to their highest levels for over a decade. In the tanker segment, 2021 average rates levels are still significantly (3-10 times depending on the vessel type) below average 2020 (Clarksons Research, 2021).

On the sale and purchase market, by April 2021, the price of a 10yo capesize has increased by 40% (USD 7.75m) to USD 27.25m and a price of a 10yo supramax has increased by 35% (USD 3.75m) to USD 14.5m since October 20. At the same time tanker markets have not managed to recover from the stress yet. Once the storage-driven market spike subsided, tanker pricing fell. Compared to March 20, the price of 10yo VLCC was down 12% (USD 6m) at USD 46m (Clarksons Research, 2021). Tanker sector (crude oil and oil products trade) has behaved in a different to dry sector way, facing tough times and experiencing negative or low growth regime delaying a return to pre-covid level – global oil demand is still below same.

On the newbuilding market, by April 2021, the new units order book has grown and represented 12% of the existing fleet, up from about 9% at the beginning of 2021. The containership sector accounted for 39% of all investment in newbuildings made so far in 2021. Boxship newbuilding prices have increased by more than 20% since the pandemic outbreak. The first quarter of 2021 saw the highest level of containership contracting since the first quarter of 2007 (A. Corbett, I. Ang, 2021). Regarding the demolition market, the scrap pricing has firmed – around 12% increase in 2021 (Clarksons Research, 2021).

By and large, the sale and purchase shipping market saw the lowest number of sales (254, totaling 17m dwt) for 8 years in Q2 of 2020. With more positive sentiments in the world economy later in 2020, S&P market picked up firmly – Q3 (429 vessels, 23m DWT) and Q4 (572 vessels, 49m DWT). The recovery of the activity was so strong that sales in Q4 reached a new high and drove the annual total in 2020 to a record of 102m DWT, up 29% from 2019. Activity has shown no sign of slowing so far in 2021, with 590 ships (40m DWT) sold in Q1. At the current run, over 7% of fleet DWT would change hands in 2021, the highest level since 2007 (Clarksons Research, 2021).

The entire dry sector was similarly impacted by the pandemic, although the pace of recovery was different. Since autumn 2020, the containership sector has seen spectacular sharp changes of secondhand asset prices. For example, the price of a 10yo 6,600 TEU unit has increased by 138% (USD 29m) to USD 50m over the same period, whilst the price of a 10yo 4,500 TEU unit has risen by 268% (USD 25.5m) to USD 35m (Clarksons Research, 2021). The stable and fast-paced growth of secondhand asset prices in the containership segment reached the turning point in July 2021 when the price of the 10yo containership of 2750 TEU capacity surpassed the price of newbuild containership of the same capacity – USD 38m vs. USD 36.5m! Moreover, the gap between these prices continued to enlarge, having reached a USD 7m difference in August (Clarksons Research, 2021).

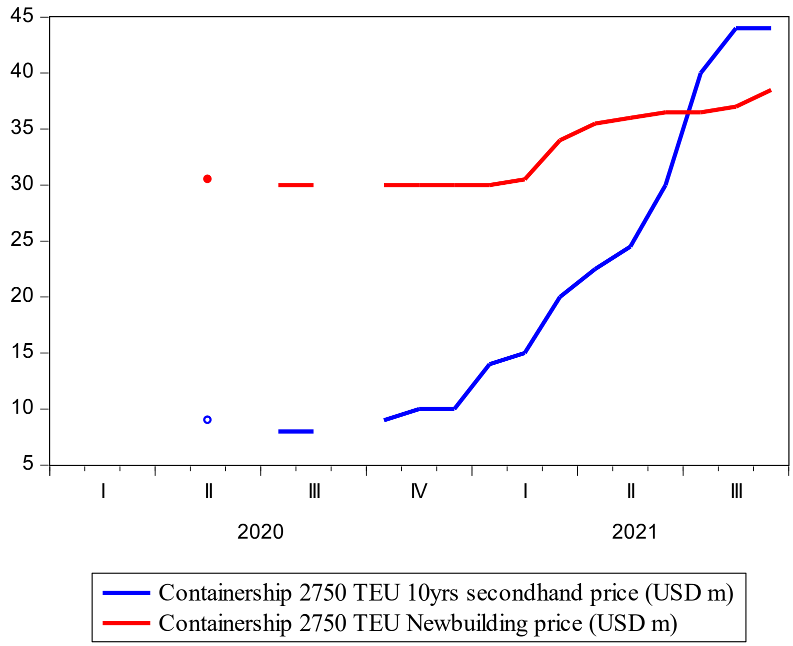


**Figure 1.** Monthly dynamics of the prices for secondhand (10-year-old) and newbuilding containerships of 2750 TEU capacity in 2020-2021 (in USD million).

*Source: compiled by the authors based on (Clarksons Research, 2021).*

The rationale behind this paradox is quite straightforward. The fleet supply cannot increase overnight with the delivery of each new unit taking years, and the majority of orders in 2021 so far has been for 2023 and beyond. The absence of opportunities to quickly get the newbuilding from the shipyard leaves secondhand purchase as the only option for the shipowners willing to absorb new capacity. The determinants of the vessel prices are scrutinized later in this paper.

The results of the Granger test that evaluate the hypothesis of the relationship between containership charter rates components and macroeconomic indicators are shown in table 1 and 2.

**Table 1.** Impact of macroeconomic indicators on containership charter rates components

| Indi-cators | Lagged variables | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **US IP** | **CH IP** | **SK IP** | **TW IP** | **SP** | **BP** | **M MC** | **SP CT** | **HK CT** | **LA CT** |
| CC rate | 5.52 (0.02)[b] L=1 ↑ | 742 (0.00)[a] L=3 ↑ | 2.82 (0.09)[c] L = 1 ↑ | NS | 9.97 (0.00)[a] L=3 ↑ | NS | 24.69 (0.00)[a] L=2 ↑ | 8.38 (0.08)[c] L=4 ↑ | NS | 8.63 (0.07)[c] L=4 ↑ |
| CS SP | NS | NS | 5.86 (0.05)[c] L = 2 ↑ | NS | 77.29 (0.00)[a] L=2 ↑ | 11.8 (0.00)[a] L=3 ↑ | 19.07 (0.00)[a] L=2 ↑ | NS | NS | NS |
| CS NP | NS | 44.58 (0.00)[a] L=2 ↓ | NS | 10.6 (0.00)[a] L=2 ↑ | NS | 73.9 (0.00)[a] L=3 ↑ | NS | 47.1 (0.00)[a] L=2 ↑ | 32.5 (0.00)[a] L=2 ↑ | NS |

**Table 2. Impact of containership charter rates components on macroeconomic indicators**

| Indicators | Lagged variables | | |
|---|---|---|---|
| | **CC rate** | **CS SP** | **CS NP** |
| US IP | NS | NS | 93.98 (0.00)[a] L=2 ↑ |
| CH IP | 57.17 (0.00)[a] L=3 ↑ | NS | NS |

| | | | |
|---|---|---|---|
| SK IP | 5.13 (0.02)[b] L=1 ↑ | 8.93 (0.02)[b] L=2 ↑ | 88.88 (0.00)[a] L=3 ↑ |
| TW IP | 11.27 (0.04)[b] L=5 ↑ | 15.5 (0.00)[a] L=2 ↑ | NS |
| SP | NS | 5.41 (0.07)[c] L=2 ↑ | 13.67 (0.00)[a] L=2 ↑ |
| BP | NS | NS | NS |
| M MC | NS | NS | 6.53 (0.02)[b] L=1 ↑ |
| SP CT | 30.4 (0.00)[a] L=4 ↑ | NS | NS |
| HK CT | 17.57 (0.00)[a] L=5 ↑ | NS | NS |
| LA CT | NS | NS | NS |

Note: CC rate – 2750 TEU containership charter rate; CS SP - containership 2750 TEU 10-year-old secondhand price; CS NP - containership 2750 TEU new building price; US IP - US Industrial production (% change year-on-year); CH IP - Chinese Industrial production (% change year-on-year); SK IP - S. Korean Industrial production (% change year-on-year); TW IP - Taiwanese Industrial production (% change year-on-year); SP - Steel (ship plate) Japan price ($/t); BP - Crude oil Brent price ($/bbl); M MC - MAERSK market capitalization ($ B); SP CT - Singapore container throughput (in TEU); HK CT - Hong Kong container throughput (in TEU); LA CT – Los Angeles container throughput (in TEU); a, b, c represent the 1, 5, and 10 % significance levels, respectively. In parentheses, p values are given; ↑ - direct causality; ↓ - reverse causality.

*Source: authors` calculations, data from Clarksons Research (2020, 2021), Hong Kong Maritime and Port Board (2021), Largest Companies by Market Cap (2021), Maritime and Port Authority of Singapore (2021), The Port of Los Angeles (2021)..*

The shipping industry operates several ship employment types, which are known as chartering agreements. The vessel can be chartered (e.g., employed, hired, rented) under time charter for a certain time period, under voyage charter for a specific voyage from point A to point B, under trip charter, which is a mix of the first two types, as well as under some other rarely used chartering agreements like bareboat charter. While the containership market is in the focus of the current paper and containerships are most commonly chartered under time charter agreements, we examine 2750 TEU capacity containership, chartered for 6-12 months, daily rate as an outcome variable.

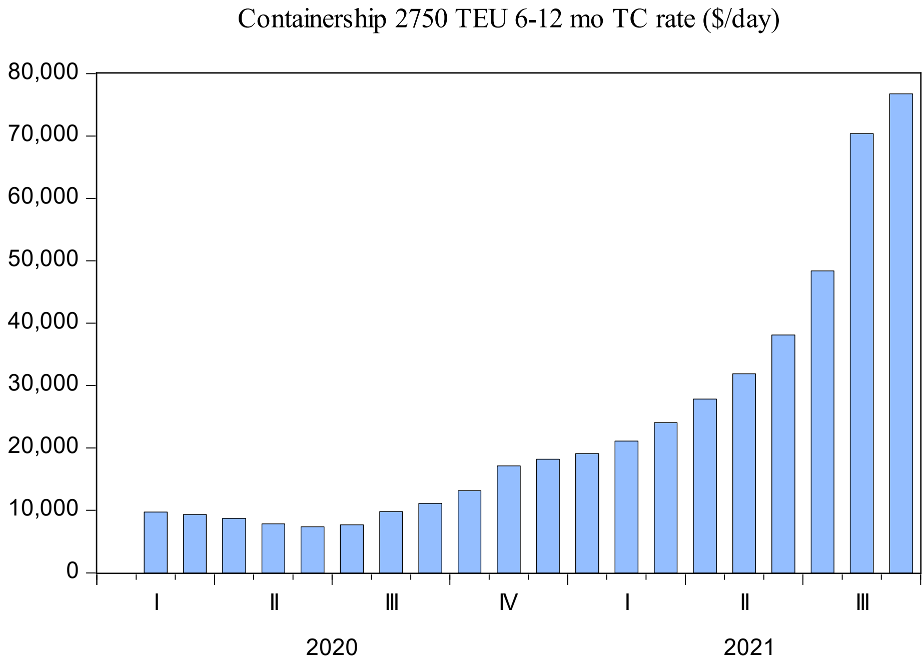


**Figure 2.** Monthly dynamics of the 2750 TEU containership daily charter rate (for 6-12 months) in 2020-2021 (in USD).

*Source: compiled by the authors based on (Clarksons Research, 2021).*

It is evident from Figure 2 that the containership charter rate growth is very swift and reaching all-time highs; at the same time, the similar growth of containerized shipping trade volumes isn't observed within the same period, see Figure 3. The shipping is a demand-derived system, although the unprecedented growth of containership charter rates can't be explained simply by demand growth – this is not the case. Thus, several shipping, financial and industrial indicators were put through analysis against containership charter rate growth.

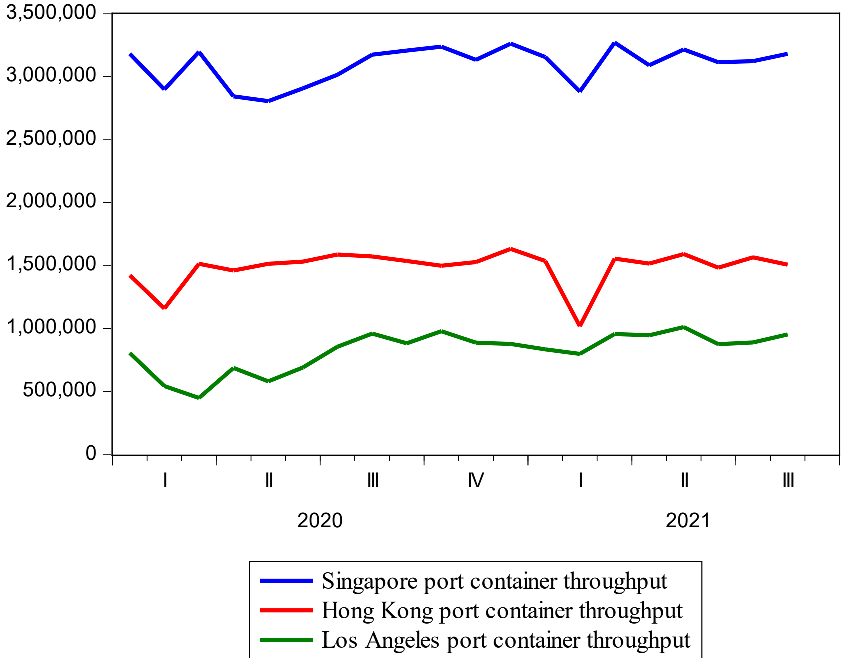


**Figure 3.** Monthly dynamics of container throughput of Singapore, Hong Kong and Los Angeles ports in 2020-2021 (in TEU).

*Source: compiled by the authors based on (Hong Kong Maritime and Port Board (2021), Maritime and Port Authority of Singapore (2021), The Port of Los Angeles (2021)).*

The results suggest that 2750 TEU containership charter rate is determined by both newbuilding and 10-year-old secondhand prices of vessels of said capacity; US and Chinese industrial production growth; steel ship plate price; Maersk market capitalization. Interestingly, some of these indicators are in turn affected by containership charter rate: secondhand vessel price and Chinese industrial production. The following macroeconomic indicators appeared to have no or insignificant influence on the containership charter rate: European, OECD, South Korean and Taiwanese industrial production; crude oil Brent and grain price; market capitalization of Hapag-Lloyd and OOCL; Singapore, Hong Kong and Los Angeles container throughput.

Expectedly, the charter rate is affected by secondhand and newbuilding vessel prices. Since the dynamics of vessel prices should be quite similar to the one of charter rate: the positive growth regime is an evidence of the positive market sentiment and increasing demand, when both rates and vessel prices increase, the latter – due to supply 'hunger' and the tough competition between shipping companies to gain more contracts for transportation. As described above, the only way for a shipping company to obtain the new tonnage to increase its own supply is to complete a deal on sale and purchase market, as soon as newbuilding market is not that elastic and cannot satisfy the growing demand in the short-term. This is a probable reason for the mutual effects observed between charter rate and secondhand vessel price, while the connection with newbuilding price is one-way.

A mutual connection is observed between the charter rate and Chinese industrial production. The role of Asia in the world containerized trade cannot be overestimated with the majority of trade happening in the region, China being the unattainable leader (4 out of 5 and 7 out of 10 world-leading container ports are Chinese). The industrial growth of China as the leading economy obviously increases the need for export-import operations, e.g., transportation of goods. The decline in industrial production makes the need for sea transport lower and with the same global ships supply level causes the decline of charter rates. Taiwanese and South Korean industrial production albeit has no influence on charter rate, is being in turn influenced by it.

On the contrary, US industrial production directly impacts charter rate dynamics while there is no reverse effect. The explanation lies in the difference between the US and Asian economic models, the first being more powerful and resistant and the latter being still permanently growing at a high pace, thus more dependent on maritime transportation – external supply of goods, materials, and products (imports) on the one hand and exports of ready-for-consumption products on the other hand. Industrial parts, auto parts, electronics, clothes, etc., are massively produced in Asia and are precisely the goods transported overseas in containers.

As a short but important note, European and OECD industrial production do not demonstrate influence on containership charter rate. This is predominantly based on the nature of the EU economy, which responds to the external shocks more slowly, being relatively self-contained in its trade and which have remained outside the busiest trade routes of the current world economy for a long period. With the EU GDP exceeding US GDP, Europe is represented by only three ports in the global leading container ports list. Furthermore, three of them do not occupy the top positions of this list – Rotterdam ($10^{th}$), Antwerp ($13^{th}$), Hamburg ($17^{th}$).

As to throughput of ports included into the VAR model, it is ascertained that the considered charter rate is affected neither by Singaporean (the second leading world container port) nor Hong Kong ($8^{th}$) nor Los Angeles ($16^{th}$) port handling indicators. At the same time, the charter rate has an effect on Singaporean and Hong Kong throughputs, with no similar connection with number of containers handled in Los Angeles port. Putting this observation into the macroeconomic framework, similarly to analysis of the industrial production indicators, we appear in front of the different behavior of US and Asian economic models when interacting with seaborne trade. Likewise, in US industrial production, Los Angeles container port throughput is not affected by charter rate, while Asian ports, Singapore and Hong Kong, are. So, the identity of reaction of Asian industrial production (excluding China) and Asian port throughput is worth mentioning.

Grain price expectedly appeared to have no effect and not being affected by containership charter rates since this cargo is mainly transported by dry bulk vessels. In turn, steel price affects containership charter rates with no reverse reaction. Steel can be transported by container vessels, so the demand for steel leads to a rate surge. No connection was observed between oil price and charter rate. As already mentioned, container vessels are mainly subject to time charter agreements. One of the conditions of this agreement is the fixed distribution of born costs. The charterer pays the commercial costs (not ship owner), where bunker costs are a considerable part of them. This can serve to possibly explain the non-existing relation between oil price (affecting bunker price, for sure) and the charter rate payable by charterer to ship owner. However, this needs to be further investigated. One of the fields for next research is the examination of the relation between oil price and freight rates of those vessels chartered under voyage charter agreement which presupposes different distribution of costs, commercial part of which (including bunkering) is being born by ship owner. The assumption is that oil price influence on voyage charter rates can be observed.

As to market capitalization of the leading containership market players, Hapag-Lloyd and Orient Overseas Container Line do not demonstrate any connection with charter rate, although market capitalization of Maersk does demonstrate the influence on charter rate. As an irrefutable leader and 'trend-setter' of the containership market, Maersk plays a more significant role in comparison to other companies operating container vessels, even the ones from the top-10 list according to market capitalization and the capacity of managed fleet. Driving the market to a certain extent, Maersk affects charter rates.

Looking one more time at the earlier addressed issue of vessel asset prices dynamics both newbuilding and secondhand by employing the Granger test, we can ascertain that different factors determine secondhand and newbuilding prices. While the price of secondhand containership is affected by charter rate, newbuilding vessel price, steel price, oil price, and Maersk market capitalization; newbuilding price is influenced by Chinese and Taiwanese industrial production, oil price, Singaporean and Honk Kong port throughput. The list of determinants confirms the different and isolated dynamics secondhand and newbuilding prices follow. The determinants do not coincide, hence the fact that the secondhand vessel price exceeds newbuilding is more than justified from the maritime economics perspective and is no more than a 'fallacy' – by default, the secondhand asset is expected to be cheaper than the new one, although under certain circumstances the shipping market rules modify the logical expectations. Charter rate affects secondhand vessel price, although has no impact on newbuilding price. Charter rate is everchanging and unclear middle-term when newbuilding vessel can be constructed and delivered. Interestingly, newbuilding vessel price is negatively affected by Chinese industrial production. China retains the position of the leading shipbuilding region and, at the same, the leading steel producer. The possible explanation of such a relation can lie in the following. It is well known that Chinese shipyards perform shipbuilding activities for a cheaper price than Korean and Japanese. As soon as industrial production is growing, which can be associated with an increase of steel production, this means the increase of steel availability which can be used for shipbuilding. Otherwise, if the steel availability is going down, increasing its price, the newbuilding orders can migrate to alternative places.

## 5. Conclusion

The main shipping markets have reacted to the Covid-19 pandemic similarly; however, the containership market experienced the most remarkable recovery from the slowdown. The demand for containership tonnage increased quickly and significantly. Moreover, in the middle of 2021, it led to the situation when the price of the 10-year-old containership of 2750 TEU capacity surpassed the price of new containership of the same capacity. The rationale behind this paradox is quite straightforward. The fleet supply cannot increase overnight, with the delivery of each new unit taking years, and the majority of orders in 2021 so far has been for 2023 and beyond. The absence of opportunities to quickly get the newbuilding from the shipyard leaves secondhand purchase as the only option for the shipowners willing to absorb new capacity. By employing the vector autoregression model, it was also ascertained that the list of factors determining newbuilding and secondhand vessel price differed. This confirms the isolated paths secondhand and newbuilding prices follow, enabling this paradox, driven by shipping market forces, to occur.

The analysis results show that the charter rate of a containership of 2750 TEU capacity is determined by both newbuilding and 10-year-old secondhand prices of vessels of said capacity; US and Chinese industrial production growth; steel ship plate price; Maersk market capitalization. Notably, neither Singapore, Hong Kong, or Los Angeles port container throughput indicators affect containership charter rate, which confirms the current unprecedented charter market growth does not have a demand-related nature.

If a geographical principle regroups the full list of considered determinants, the finding is the following. The identical relation between several Asian indicators (Asian port throughputs and industrial development of Asian countries) is observed; the behavior of American indicators is to a certain extent quite similar as well. Asian ports (Singapore and Hong Kong) are affected by charter rates similarly to how South Korean, Chinese and Taiwanese industrial production level are. At the same time, only Chinese industrial indicator influences the charter rate.

The explanation lies in the difference between US and Asian economic models: US one is more powerful and resistant to external factors; thus, neither US industrial production nor Los Angeles port throughput are affected by charter rate; and Asian ones are still permanently growing at a high pace, thus more dependent on maritime transportation and more deeply involved into global supply chains, shipping being a workhorse of it. Europe is involved even less than the USA, so European industrial production demonstrates a mutually insignificant relation to containership charter rate. The more dependent region or country on seaborne trade and maritime transportation of goods, the more significant the relation with charter rate. Among the market capitalization of the leading container shipping companies, only Maersk is statistically significant when analyzing the charter rate.

Given the unprecedented nature of shipping rates growth, not only containership but also all dry shipping market segments, apart from demand-side analysis, the bigger picture needs to be assessed and a multi-factor model needs to be created for broader understanding and evaluation the reasons standing behind the changes.

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