COVID–19 impact on the shipping industry: An event study approach

Dimitris Gavalas [a,c,*], Theodoros Syriopoulos [b,c], Michael Tsatsaronis [a]

[a] *Department of Shipping, Trade and Transport, School of Business, University of the Aegean, Chios, Greece*
[b] *Department of Ports Management and Shipping, School of Economics and Political Sciences, National and Kapodistrian University of Athens, Psachna Evias, Greece*
[c] *Audencia Business School, Nantes, France*

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ABSTRACT

The COVID-19 pandemic, apart from leading to human cases and deaths, is also distracting the shipping stock market and the Baltic Indices. While event studies, as well as macroeconomic research has been conducted in the literature, we have not witnessed any effort yet to investigate how external shocks - and in particular the COVID-19 outbreak - may impinge on the shipping markets. Therefore, our research tries to fill in this gap by studying how a sanitary incident might influence shipping freight rates and stock values. We have used a market-model event study approach to investigate how fast and comprehensively shipping markets react upon certain latest evidence. To quantify the pandemic's economic impact, we estimated the abnormal returns; in a phase before and after the event, they may work as a measure of the unexpected effect of the event on a shipping firm's performance. The data that we have used in stock analysis come from a major shipping index, while for our freight study, time-series come from all main Baltic indices. Our results show that according to the key date set as the event window, different results appear of how pandemic-proof the dry market, the tanker market, and the shipping stock market have proven to be.

1. Introduction

The most important factor determining economic developments worldwide in 2020 is the coronavirus pandemic, which within a few months it affected all countries, with the focus shifting from Asia first to Europe, then to North America, and finally to the rest of the world. It is noteworthy that, while in January the International Monetary Fund (IMF) forecasted growth of the world economy by 3.3% for 2020 and world trade by 2.9%, five months later, in June, the corresponding forecasts revised to −4.9% and −8% respectively. At the same time, in the June estimates for 2020, the IMF predicted a decrease in GDP by 8% in the USA, by 10.2% in the Eurozone, and by 3% in emerging and developing economies. Of the major economies, the only one for which the forecast remains positive is China, with 1%, compared to 6% forecast in January (IMF, 2020a).

On the other hand, the expansionary policies of banks and governments globally have contributed significantly to reducing this impact, to the extent that financial markets do not share this pessimism. Most stock indices have recovered much of their losses since Feb. 2020, while NASDAQ, which includes many companies that benefited from quarantine and telecommuting, was at its highest. Generally, the international economy at present functions in an unprecedented macroeconomic, fiscal, monetary, and financial setting, through contradictory conditions and trends (Phan and Narayan, 2020).

From one side, economies confront - at least in the short term - very high levels of recession and unemployment rates, the administrations of all major countries and the European Commission have already proclaimed and implemented colossal monetary and fiscal sustenance packages for economies, oil prices fluctuate historically at very low levels, while gold and other valuable metals are at very high levels (sign of downturn, but also amplified vagueness and risk), (European Commission, 2021); instead, interest rates move towards zero, negative liquidity moves in exceptionally high levels, and high share indices seem to anticipate a swift recovery (Altavilla et al., 2019). In contrast to the markets, the forecasts of international organizations seem to "degrade" the impact of the drastic interventions of Central Banks and governments to strengthen the financial system of countries, businesses, and households (IMF, 2020b). To the "big picture" of the world economy, it is necessary to add the ongoing disputes over global trade, Brexit, and the threats of developments in concern to economies like Turkey and Argentina.

Moreover, the irregular progress of the pandemic, i.e. the point that

it is passes through several stages in each country, proves how challenging it is to reorganize the world economy and international trade, including the shipping industry. Especially since, at the time we run this study, the pandemic continues to be on the rise at the US, nonetheless in other countries of the world, as well.

The COVID-19[1] pandemic showed a remarkable effect on the shipping markets in 2020. According to Clarksons Shipping Intelligence Network (2020a) estimations, global seaborne trade would contract by 4.4% across 2020, a comparable decrease to that seen after the international financial crisis (2009: 4.1%). The tanker market experienced an excellent cash position, after seeing the floating storage fleet to climb on 11% of the fleet, in April; in the container market, the idle tonnage had fallen from 11% to 4% and liner companies published promising fundamentals for Q3/2020; the fall of the bunker prices assisted bulkers to experience a few weeks of advanced rates, after a feeble 1H/2020.

The orderbook continued to shorten, while deliveries from Chinese shipyards stabilized after preliminary COVID-19 disturbance, although this snapshot remained vulnerable, especially in cruise newbuildings. Newbuild ordering constrained (23ml. dwt in the first 8 months), as the pandemic, alongside fuel and technology alternatives, affected investment decisions. Clarksons Shipping Intelligence Network (2020a) estimated a 2.6% fleet growth in 2020 and 1.7% for 2021. It is worth mentioning that only 0.5% of fleet capacity is currently undergoing a scrubber retrofit (down from 2.0% in Q1/2020) and the implementation of some of the scheduled alterations seem exposed.

The COVID-19 pandemic, apart from leading to human cases and deaths, has affected the shipping stock market and the Baltic Indices. Michail and Melas (2020) suggested that such events straightly affect the dry bulk and the dirty tanker sectors; additionally, second round impacts, mostly due to the decrease in oil prices and, after has been discovered, third round impacts because of the stock market, likewise occur.

Shedding light upon the shipping market, in spite of past literature having concentrated on macro-variables disturbing the industry (Drobetz et al., 2010; Papapostolou et al., 2014; Gavalas, 2016), there is a research gap in exploring how the industry reflects specific events (especially the COVID-19 pandemic), by incorporating an event study approach. Therefore, our research tries to fill in this gap by studying how a sanitary incident might influence shipping freight rates and stock values. Our key contributions are as follows: (i) we unfold the literature upon the effect of foremost public health events on stock markets (including shipping); (ii) we propose a market-model based abnormal return event study approach; and (iii) our results show that according to the key date used as the event window, different outcomes occur regarding the dry and tanker shipping markets, as well as the shipping stocks.

We structure the rest of this study, like so: in Section 2, the existing literature upon the under-investigation matter is exposed. We carry on with Section 3, presenting our methodological issues. In Section 4, our model is employed, using an event study approach, where the results are revealed. We conclude and discuss in Section 5.

2. Theoretical background

2.1. The impact of emergencies on stock markets

Investor sentiment relies on confidence about forthcoming cash flows, and investment risks that are not reasonable by the underlying fundamentals. Emergencies tend to affect the sentiment, which consequently affects the trading behavior, which eventually affects asset returns, and stock prices. In 2008, Nikkinen et al. (2008) employed intelligence within a wide range of equity markets to examine the short-term impact of the September 11th attacks on earnings and unpredictability of the markets. They argued that the event had disturbed share markets' performance among countries; moreover, the extent of this disturbance is extremely substantial for developed, European, and to a less significant extent, countries in Asia. The attacks influenced reasonably the economies and Latin America, but the impact on the Middle East and North Africa resulted negligible. Al-Rjoub and Azzam (2012) used data covering the period from January 1st, 1992 to July 2nd, 2009 studying 7 past incidents of stock exchange crashes along with their outcome. Such incidents were: the Mexico's Tequila crises of 1994, the Asian/Russian crises in 1997–1998, September 11th strike in the USA in 2001, the war in Iraq in 2004, ASE bubble burst on November 11th, 2005, financial crisis in November 2005, and the global financial crisis generated during 2008–2009. By running a GARCH-M model they showed that the above episodes negatively affect stock returns.

Righi and Ceretta (2011) used a copula based GARCH model to approximate conditional variances and covariances of the multivariate correlation amongst English, German, and French markets. After incorporating daily prices of FTSE100, DAX and CAC they found that the instability of markets suggests signs of the European financial crisis. Furthermore, they stated that those markets performed equivalent estimated break point, which matched the beginning of the Greek debt crisis. During the same year, Schwert (2011) published a study where US monthly returns, daily and intraday returns had been used, to demonstrate how stock volatility had shifted over time. The paper stated that the global financial crisis had been linked with instability being witnessed previously in stock exchanges, mostly in financial sector stocks.

Rengasamy (2012) intended to examine the influence of Sovereign Debt-related directives announcements and improvements in the Euro Zone in concern with the returns and volatility models of the BRICS stock markets. The study used a dataset of specific high capitalized stock markets of the BRICS nations. The results revealed that there was not any stock exchange of the BRICS group to have experience non-positive earnings. The index representing the mean earnings had declined throughout the sovereign debt crisis aftermath era. Bai et al. (2019) examined whether integrating extraordinary disasters facilitates in describing the "value premium puzzle". They inputted catastrophes into a general equilibrium manufacturing economy with heterogeneous corporations. Their results contained three crucial components, containing uncommon, but critical deteriorations in "aggregate productivity growth, asymmetric adjustment costs, and recursive utility". Lanfear et al. (2019), instead of employing catastrophes related to macro-economic variables, used the event of a particular category of severe weather event, the North Atlantic hurricanes. They proceeded with an event study methodology to investigate the influence of the entire USA landfall North Atlantic typhoons from 1990 to 2017 on stock returns.

Furthermore, Kaplanski and Levy (2010) examined the influence of air travel disasters on stock prices and consider that volatile share values are above others exposed to this cause. They studied about the role of information inflow, the psychological influence it has upon decision-making processes, and how markets turn out to be more effective over time. Ragin and Halek (2016) examined a series of catastrophes in the insurance sector since 1970 and discovered that insurance agents (instead of insurers) succeeded irregular share earnings on the time of the event, leading to investors expecting markets to consolidate and broker commissions to improve.

2.2. The effect of foremost public sanitary incidents on stock markets

According to our research, there have not been so far many studies investigating the damaging effect of crucial sanitary cases on stock exchanges. Previous findings mainly concentrate on SARS and influenza.

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[1] COVID-19 is a contagious virus triggered by a newly exposed coronavirus, so-called SARS-CoV-2. According to the World Health Organization (WHO), the majority of people infected by the COVID-19 virus suffer weak to slight breathing sickness and recuperate, deprived of needing special medication (WHO, 2020a).

Goh and Law (2002) argued that the Asian economic disaster in 1997 and the Hong Kong influenza epidemic one year after, affected tourism negatively. They employed SARIMA models which - according to their results - performed better than the rest of time-series approaches, though the non-seasonal ARIMA model's robustness outperformed all deemed prediction simulations.

In 2013, McTier et al. (2013) examined in which extent influenza had affected the US stock market; after gathering data from 25 countries, they argued that an upsurge in the frequency of flu would match a decline in trading and return instability, but greater bid-ask spreads. Chen et al. (2007) studied the Hong Kong SARS outbreak, pinpointing that hotel industry performance in Taiwan stock exchange had been severely impacted, prompting fear among shareholders and verified excessive instability of the hotel industry toward epidemics. Chen et al. (2018) examined whether the SARS epidemic had an impact on the enduring correlation among stock markets in Asia; their findings showed that the epidemic had weakened the stock market integration. Sobieralski (2020) investigated the consequences of ambiguity extreme events on aviation employment, provoked by travel restrictions during COVID-19 pandemic. The anticipated job loss had been considered about 7% of the airline workforce, reaching a possible threshold of 13%.

Moreover, Ali et al. (2020) studied the pandemic's effect on financial markets' volatility by using fundamentals for a plethora of countries. Additionally, they contained corporate bonds index (S&P 500), US treasury bonds core index (ICE core), among others. Their findings argued an ongoing progressively fear and rapidly diminishing condition in the markets, as COVID-19 shifted from an epidemic to a pandemic. In a similar spirit, Liu et al. (2020) examined the correlation amongst the COVID-19 pandemic, oil market and stock market in the USA, by employing a time-varying parameter vector autoregression model. Their findings suggested a negative interaction among crude oil and stock returns. Finally, He et al. (2020) employed an event study methodology to analytically examine the market efficiency and reaction movements to the pandemic, of companies established in China. Their findings suggested that electricity/heating, environment, mining, and transportation had been negatively compressed, while education, information technology, manufacturing, and healthcare had demonstrated a pandemic-proof reaction.

2.3. Shedding light on shipping markets

In 2020 we witnessed major disturbance to seaborne trade levels since the initiation of the pandemic, but considerable trends had also remained noticeable, in regard to supply. Despite fundamental fleet expansion, developments in floating storage, scrubber retrofitting, and idle tonnage resulted in remarkable changes in active fleet size in the key segments. Regarding the Baltic indices, during Q3/2020, the Baltic Capesize Index (BCI) had shifted to uncharted waters (Clarksons Shipping Intelligence Network, 2020b). Freights concerning Capesize ships reached USD 2,500 per day, while the average OPEX at that time was USD 7,000 per day. The seasonal decline at the beginning of the year was reinforced by the pandemic as well as by the China-USA tariffs and trade wars. A limitation of our study is that the Baltic freight indices merely matter for freight rates of ships without scrubbers' installation.[2] Specifically, these are vessels operating with Low Sulphur Fuel Oil (LSFO), with a greater cost compared to Heavy Fuel Oil (HFO). During Q3/2020, just 0.5% of fleet capacity had been undergoing a scrubber retrofit, down from 2.0% in early 2020. This situation might lead to a possible re-basement of the indices.

As far as the commodities are concerned, whilst we witnessed a few slight impacts on supply chains, from the other hand world production, and demand had not been remarkably affected, whereby in some cases,

countries expanded their imports attempting to reinforce reserves. A milestone for the resilience of seaborne grain trade would be the record soybean crop over the summer that occurred in Brazil, magnified by improvements in US-China trade. Regarding iron ore trade, steel industries all over the world had been severely impacted, enhancing seaborne iron ore supply, while Chinese iron ore imports hit a record in October 2020 (Clarksons Shipping Intelligence Network, 2020b).

Recently, there has been a series of published studies regarding the shipping markets' impact from external factors, including COVID-19. Notteboom and Haralambides (2020) evaluated crucial topics in port governance study, like – among others - the development of dynamic approaches to port management governance approaches, targeted methods to distinct port governance concerns, and consequences of a cumulative regional and international entanglement of ports. Moreover, in Kilian et al. (2020), a database of crucial economic factors for the Very Large Crude Carriers (VLCC) market had been used, to build on a structural vector autoregressive framework, resulting in quantifying the determinants of these indicators. Additionally, Regli and Adland (2019) examined charterers' capacity to utilize floating storage hedging prospects, by applying time-series and fixtures data on charter rates. Furthermore, the recent study of Gavalas et al. (2021) focuses on the Bay of Bengal Basin countries shipbuilding industry, via proposing a cohesive model of shipbuilding performance that classifies the impact grades of a proposed Balanced Scorecard approach. After seeking the triggering levels and the relative weights importance of the suggested criteria, the authors classify the underlying shipyards' dynamics.

3. Data set and methodology

The reason behind applying an event study approach is to investigate how fast and comprehensively markets react upon certain latest evidence. It seems a standard methodological approach to specify the informational event that has triggered the evidence spreading into the market. Abnormal (or unexpected) return (AR) in a phase before and after the event works as a measure of the unexpected effect of the event on the firm's performance. More specific, AR is described as the attained return minus the expected or normal return. The initial assignment in an event study is the assessment of expected returns. According to the previous literature, three basic models have been used to calculate abnormal returns: the average adjusted return rate model, the market index adjusted return rate model, and the market model, whereby the last one is the most used and has very good prognostic ability (Lauenstein and Simic, 2017). According to Zoogah (2014), the market model reflects fluctuations in the market and stock earnings as a correction to risk when estimating stock earnings during incidents that never existed. In our study, we have used the market-model based AR, following Herwany et al. (2021), Elad and Bongbee (2016), and Panayides and Gong (2002), where the assessed value of beta and the realization of market returns obtained within the window period, as well as the anticipated degree of stock earnings can be calculated as follows:

$$AR_{jt} = R_{jt} - \widehat{\alpha}_j - \widehat{\beta}_j R_{Mt} \tag{1}$$

where R_{jt} show the realized earning to security j at time t, $\widehat{\alpha}_j$ and $\widehat{\beta}_j$ denote the security particular market model factors assessed throughout the estimation window (regression coefficients), and R_{Mt} demonstrates the realized market return at time t. Furthermore, the sample average AR at time t (AR_t) for N sample firms is calculated as:

$$\overline{AR_t} = \frac{1}{N} \sum_{j=1}^{N} AR_{jt} \tag{2}$$

The cumulative average AR from event time p up to event time q, namely the Cumulative Abnormal Return $CAR(p,q)$, is defined as:

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[2] As mandated by the International Maritime Organization (IMO), with a January 1st, 2020 deadline.

$$CAR(p,q) = \sum_{t=p}^{q} \overline{AR_t}$$

$$CAR_{i(t1,t2)} = \sum_{t=t1}^{t2} AR_{i,t} \qquad (3)$$

, where $AR_{i,t}$ demonstrates the average abnormal return rate of stock i on the trading day t, obtained by deducting the anticipated earnings from the actual return. $CAR_{i(t1,t2)}$ denotes the aggregate abnormal earnings degree of stock i appearing in the event window period (t_1, t_2). The normal process is to investigate the CAR for a given event window, with the null hypothesis being that the CAR is zero, meaning that there has been no market response to the incident (Andrew Coutts et al., 1995). The abnormal return determined is equivalent to the earnings to an operating type purchasing sample underwritings during the opening of the initial phase and lasts until the maturity of the final phase. CAR abnormal yields resemble to security owner capital adjustments "in the perimeter" of the incident. Moreover, once employed after the event phases, trials applying such methods offer evidence regarding market performance, because consecutive nonzero abnormal yields subsequent to an incident remain not consistent with effectiveness, suggesting a cost-effective operating type (Kothari and Warner, 2007).

In case an event does not impinge on the stock prices at time t, the average $\overline{AR_t}$ should be concerned as statistically zero. If we assume the independence of the time-series, the test statistics for and $\overline{AR_t}$ and CAR (p,q) respectively, are:

$$t(\overline{AR_t}) = \overline{AR_t}/\widehat{S}(\overline{AR})$$

$$t(CAR) = CAR(p,q)\Big/\left[\widehat{S}(\overline{AR}) * \sqrt{q-p+1}\right]$$

where

$$\widehat{S}(\overline{AR}) = \sqrt{\frac{\sum_{t=-T}^{-l}(\overline{AR_t} - \overline{\overline{AR}})}{T - l + 1 - 2}}$$

$$\overline{\overline{AR}} = \frac{1}{T - l + 1} \sum_{t=-T}^{-l} \overline{AR_t}$$

where T and l is the beginning and the end (in event time) of the evaluation window, respectively. This time-series regular abnormality assessment prevents the possible predicament of cross-sectional connection of security yields, a concern which might remain remarkably significant once the sample companies stem from an identical industry. If the sample companies stand properly spread beyond sectors and time, thereafter supposing cross-sectional independence, the standardized AR test can be employed, by scaling and standardizing the abnormal returns through the security-specific standard deviation, before the aggregation (Eq. (1)). Nevertheless, in case of overlapping in calendar time in the incident window of the sample firms cannot be avoided, this might declare the cross-sectional independence assumption inaccurate, and thus imply a downward bias to the estimated standard deviation and an upward bias to the t-statistics (Gong, 2009).

In our case, regarding the timeline, since December 2019 numerous incidents of pneumonia had been verified in Wuhan city, Hubei Province, China and were spread all over social media. In a Chinese online broadcasting channel (Xinhuanet, 2020) it was stated that a new-type coronavirus, initially named by WHO as the 2019-new coronavirus (2019-nCoV), had caused this outbreak (January 1st, 2020). On January 23rd, 2020, the WHO considered the threat of such event to be then extremely high-ranked in China, high-ranked at the provincial level and high worldwide (WHO, 2020b). Moreover, on January 30th, 2020 public health emergency of international concern was officially declared by the WHO and on March 11th, 2020 the WHO made the evaluation that COVID-19 could be described as a pandemic (WHO, 2020c).

According to Krivin et al. (2003), the main advantage of using an informal methodology instead of applying a fixed-length window is that the second methodology makes use of information about the price movement and/or trading quantity of a share. Moreover, a more coherent methodology is to form a rule to define incident window duration, wherein the response to an event is deemed to endure if certain criteria are met. Like the ad hoc method, a rule uses evidence about the security being examined to define incident window duration, rather than just choosing a random amount of days. A rule, nonetheless, likewise employs a coherent set of criteria to clarify once the share value response to an incident is terminated.

Based upon the above timeline and literature review (Siriopoulos et al., 2021; He et al., 2020, inter alia), we considered January 23rd, 2020 the event day of the COVID-19 outbreak. In case the estimation window is extremely narrow, our findings might be biased; in case the estimation window is extremely prolonged, the prediction composition might alter. To prevent this, by enhancing the accuracy of our forecasting, we chose 160 trading days prior to the event date, as being the forecasting duration. As far as the event window period is concerned, we ended up to a five trading-day period, around the event occurrence date. The time interval has been established from June 1st, 2019, to March 11th, 2020. To estimate the returns, we calculated the log-quotient between the current and the immediately preceding value $(t_2 - t_1)$; then we calculated the abnormal return (expected return minus actual return) applying the results for both 5 days and 15 days CAR. We also applied the t-test to monitor the abnormal earnings degree throughout the window period.

Event study is a research methodology that is based on the Efficient Market Hypothesis (EMH). According to EMH, the share prices of a firm reflect all the information about it, so every single event related to the firm is depicted on its stock returns (Schwert, 2011). Abnormal return in a phase before and after the event runs in the same way as a measure of the unexpected effect of the incident on the company's performance. It is calculated by deducting the expected (as normal earnings) from the real earnings of the stocks.

The data that we have used in stock analysis come from a major shipping index, the Dow Jones Global Shipping Index (DJGSI), which is intended to gauge the capacity of firms in the shipping business, worldwide. DJGSI comprises each firm participating in the shipping business worldwide which mainly transfer goods and materials; firms exclusively engaged in transporting travelers stay out. A firm must additionally keep a least amount float-adjusted market capitalization of $150 million and a three-month average everyday trading amount of $2 million. DJGSI is reviewed on an annual basis, every June, while price and total earnings indices are estimated in USD (Shachmurove and Vulanovic, 2015). In particular, the available aggregated index incorporates all equity securities observed by S&P Dow Jones Indices in the Oil & Gas Storage & Transportation and Marine GICS sub-industries listed on developed shipping stock exchanges. Moreover, the data we have incorporated for our freight study come from all main Baltic indices, and that is Baltic Exchange Dry Index (BDI), Baltic Exchange Dirty Oil Tanker Index (BDTI), Baltic Exchange Clean Oil Tanker Index (BCTI), and Baltic Exchange Liquid Petroleum Gas Index (BLPG).

4. Empirical results

The first weeks of 2020 had been dominated by the dramatic impact of the COVID-19 pandemic, with effects filtering through to the shipping markets, although impacts varied by sector, as we shall discuss. Following previous researchers (i.e. He et al., 2020; Michail and Melas, 2020) we investigate by what means a worldwide exogenous incident would influence the business through calculating the correlation amongst a pandemic incident, the stock prices, and the freight market of the dry bulk, tanker, and LPG shipping sub-segments. Initially, after allocating the shipping market, we examined the market value of the stocks prior to and once the occurrence of the pandemic. The regression

findings (Table 1) indicate that when COVID-19 commenced, the price of DJGSI, as well as the Baltic indices did not substantially deteriorate. Nevertheless, while the pandemic exaggerated, since the 15th banking day following the incident, the values considerably plunged and persisted on this trend for a very large duration.

Table 2 reveals the pandemic's effect on the value of the Baltic indices, plus the shipping stocks. One might confirm that when the pandemic outburst, BDI, BLPG and DJGSI reacted negatively to the WHO announcement on January 30th, 2020, but it seems that there was a rapid recovery. In the contrary, the clean and dirty tanker market had not been affected by this external shock.

Based on the prediction window before the event being analyzed, the approach computes what the normal earnings of the impacted company (ies) might be on the day of the incident and some days before and once the incident occurs. This period defines the window of such event. Subsequently, the procedure removes these expected earnings from the real earnings to obtain the abnormal earnings credited to the incident. Event studies, however, can vary in terms of their specification of expected returns. In our study, we employed two different short-horizon windows. The first one is a 5-days window, with day zero being the key date (January 30th, 2020 and March 11th, 2020) and calculating the abnormal and aggregate abnormal earnings for the following five days. The second window is a 15-days window, beginning five days prior to the incident and counting 10 days later than the day of the incident. According to Chen et al. (2018), rather short-horizon than long-horizon event studies are more trustworthy. This method analyzes the actual returns of the baseline reference, which is the average of the index's return last month and tracks the relationship between the index price and the baseline. Such method trails abnormal returns on an event's particular date. Hence, it exposes the distinction amongst the share returns on that day and links them to the normal or average earnings. The result is the actual impact of this on the index. The CARs are revealed in Table 3 and Table 4, while they are illustrated in Group A and Group B graphs:

It is worth noting that there is a different reaction between the two key dates. With the exception of the tanker market that showed a pandemic-proof reaction, BDI, and DJGSI reacted negatively to the WHO announcement on January 30th, 2020, but it is clear that there was a rapid recovery after 4–5 days, suggesting that the "news" had been overestimated. Indeed, during early February 2020, clean/dirty product carriers performed a shift in momentum, with a healthy flow of cargoes; especially the medium range oil tanker of approximately 30–55,000 dwt (MR) market showed tightening of prompt tonnage, forcing rates to rise. As concerns the bulk carrier market is concerned, the market remained under severe pressure with activity limited and spot rates dropping until the first week of February where the picture began to reverse (Clarksons Shipping Intelligence Network, 2020b).

Table 1
Regression findings of COVID-19 effects.

Event window	CAR	t value
(−30, 0)	−0.0025***	−8.2115
(−25, 0)	−0.0022***	−8.5976
(−20, 0)	−0.0017***	−6.4955
(−15, 0)	0.0019***	−5.9486
(−10, 0)	0.0013***	−3.4449
(−5, 0)	−0.0012**	−2.2496
(0, 0)	−0.0022	−1.0016
(0, +5)	−0.0024***	−3.3649
(0, +10)	−0.0019***	−4.1224
(0, +15)	−0.0023***	−6.2213
(0, +20)	−0.0024***	−7.8863
(0, +25)	−0.0023***	−8.1156
(0, +30)	−0.0023***	−6.6470

Source: authors' calculations.
Note: The event window is being demonstrated via the ordinate. ***, **, and * are significant at 1%, 5%, and 10% confidence levels, respectively.

Table 2
Regression findings of COVID-19 effects in dry and tanker shipping markets.

Event window	Baltic Dry Index	Baltic Dirty Tanker Index	Baltic Clean Tanker Index	Baltic LPG Index
(−30, 0)	−0.0062*** (−2.43)	0.0032*** (2.09)	0.0023*** (2.51)	0.0034*** (2.11)
(−20, 0)	−0.0011 (−0.46)	0.0007 (0.41)	0.0019 (0.47)	−0.0015 (−0.43)
(−10, 0)	−0.0145*** (−4.84)	−0.0135*** (−4.33)	−0.0122*** (−4.19)	−0.0137*** (−4.38)
(0, 0)	−0.0316** (−2.40)	0.0311** (2.13)	0.0296** (2.13)	0.0314** (2.28)
(0, +10)	0.0045 (1.28)	0.0042 (1.19)	0.0031 (1.61)	0.0049 (1.22)
(0, +20)	0.0012 (0.55)	0.0011 (0.47)	0.0018 (0.39)	0.0009 (0.43)
(0, +30)	0.0024 (1.09)	0.0015 (1.05)	0.0031 (0.95)	0.0021 (1.15)

Source: authors' calculations.
Note: The coordinate signifies the shipping market, and the ordinate signifies the event window. ***, **, and * are significant at 1%, 5%, and 10% confidence levels, respectively.

Table 3
The cumulative abnormal returns - Key Date: January 30th, 2020

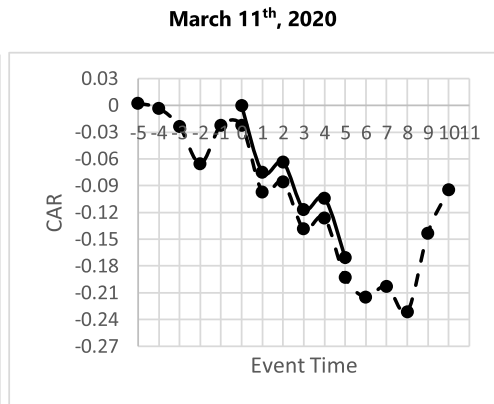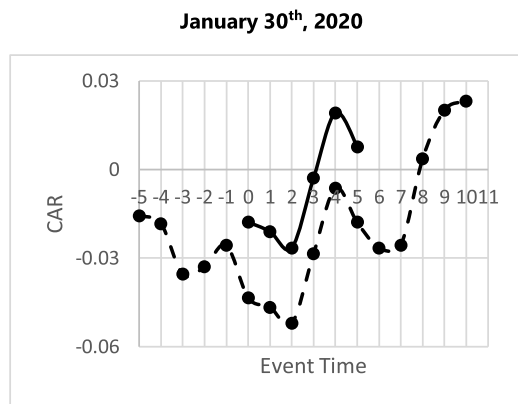| Event Time	Baltic Dry Index	Baltic Dirty Tanker Index	Baltic Clean Tanker Index	Baltic LPG Index	Dow Jones Global Shipping Index
5-days CAR					
0	−2.02%	−9.42%	1.71%	−2.14%	−1.78%
1	−0.99%	−13.24%	2.45%	−3.09%	−2.10%
2	−2.13%	−15.03%	2.19%	−6.36%	−2.65%
3	−1.70%	−18.81%	3.89%	−7.97%	−0.29%
4	−3.64%	−17.52%	6.26%	−9.49%	1.93%
5	−0.15%	−15.87%	9.77%	−11.11%	0.77%
15-days CAR					
−5	−4.58%	−0.46%	−1.63%	−1.57%	−1.56%
−4	−4.67%	−0.06%	−0.85%	−3.23%	−1.83%
−3	−3.40%	−1.40%	0.08%	−4.54%	−3.55%
−2	−1.43%	−4.74%	0.68%	−5.94%	−3.29%
−1	−0.80%	−7.23%	2.23%	−7.70%	−2.56%
0	−2.81%	−16.65%	3.94%	−9.84%	−4.34%
1	−1.78%	−20.47%	4.68%	−10.79%	−4.66%
2	−2.93%	−22.26%	4.42%	−14.06%	−5.21%
3	−2.49%	−26.04%	6.12%	−15.67%	−2.85%
4	−4.44%	−24.76%	8.49%	−17.19%	−0.63%
5	−0.95%	−23.10%	12.01%	−18.81%	−1.79%
6	−1.46%	−20.31%	15.33%	−19.76%	−2.66%
7	0.83%	−16.80%	15.91%	−21.57%	−2.56%
8	5.78%	−11.99%	18.59%	−23.30%	0.37%
9	9.76%	−9.26%	22.54%	−25.42%	2.02%
10	13.02%	−6.41%	27.67%	−29.27%	2.33%

During the second key date of March 11th, 2020, the evidence for the same indices has been different. Evidence of negative abnormal returns for BDI and DJGSI shows that dry bulk and shipping stock markets perceived the announcement of COVID-19 pandemic as "bad" news, predicting the collapse of global trade due to country restrictions. Indeed, during second half of March 2020, bulk spot rates continued to slide; characteristically, the rate on the Dampier-Qingdao route fall to $4.10/tonne, while cargoes on the Tubarao-Qingdao route were fixed below $10/tonne.

During March, when COVID-19 declaration as a pandemic took place, tanker market showed a completely different image as opposed to dry bulk market. Lockdowns around the world reduced oil consumption at such low levels and, in addition to Saudi Arabia's decision to increase oil production, caused a "contagion" in the oil market. During March, oil prices also reached historical lows. The BDTI and the BLPG reacted negatively during the first key date, but with a very slow recovery.

Table 4
The cumulative abnormal returns - Key Date: March 11th, 2020

Event Time	Baltic Dry Index	Baltic Dirty Tanker Index	Baltic Clean Tanker Index	Baltic LPG Index	Dow Jones Global Shipping Index
5-days CAR					
0	−1.24%	21.78%	4.19%	−2.41%	−0.02%
1	−2.80%	31.95%	4.91%	1.52%	−7.50%
2	−4.99%	51.79%	6.97%	7.13%	−6.38%
3	−8.14%	57.24%	8.47%	9.18%	−11.65%
4	−11.80%	56.86%	9.45%	12.43%	−10.39%
5	−10.94%	47.14%	8.77%	13.50%	−17.07%
15-days CAR					
−5	0.46%	−0.25%	3.00%	−1.62%	0.25%
−4	4.96%	−1.00%	3.97%	−1.52%	−0.32%
−3	6.05%	−4.85%	3.46%	−1.05%	−2.38%
−2	4.01%	−3.28%	7.22%	−2.21%	−6.54%
−1	3.91%	5.09%	9.99%	−3.35%	−2.21%
0	2.67%	26.87%	14.17%	−5.76%	−2.23%
1	1.11%	37.04%	14.90%	−1.83%	−9.70%
2	−1.09%	56.88%	16.96%	3.78%	−8.59%
3	−4.24%	62.32%	18.46%	5.83%	−13.85%
4	−7.89%	61.94%	19.44%	9.09%	−12.59%
5	−7.03%	52.23%	18.75%	10.16%	−19.28%
6	−8.75%	41.51%	18.31%	11.22%	−21.47%
7	−11.42%	34.95%	16.80%	11.68%	−20.25%
8	−14.58%	28.79%	15.76%	13.48%	−23.14%
9	−18.75%	23.12%	14.61%	14.67%	−14.30%
10	−24.18%	25.43%	15.45%	13.77%	−9.44%

unprecedented levels in late April, with clean MR and LR2 spot earnings climbing to $167,708/day and $74,081/day respectively, on April 24th (Clarksons Shipping Intelligence Network, 2020c).

5. Concluding remarks

In this research, the authors attempted to describe by what means the maritime markets may respond to an external incident, by utilizing a market-model event study approach. By employing data from the continuing COVID-19 outbreak, the authors investigated the response of the dry bulk, the clean and the dirty tanker, as well as the shipping stock markets. Our key results are the following. First, excluding the tanker market that showed a pandemic-proof reaction, the dry and the stock markets reacted negatively to the WHO announcement on January 30th, 2020, but there was a rapid recovery after 4–5 days, suggesting that the "news" had been overestimated. Second, during the second key date of March 11th, 2020, the evidence for the same indices had been completely different. Evidence of negative abnormal returns for the dry and the stock markets showed that they perceived the announcement of COVID-19 pandemic as an external terrible shock, predicting the collapse of global trade due to country restrictions.

Third, the results on the tanker market are mixed. The dirty and the Liquified Petroleum Gas sub-markets reacted negatively during the first key date, but with a very slow recovery. Instead, the clean tanker market showed a positive abnormal return during the WHO's first announcement on January 30th, 2020. Specifically, in January the average clean

January 30th, 2020   **March 11th, 2020**

Graph Group A. Abnormal returns of the impact of COVID-19 shock on shipping stocks
Source: authors' calculations
Note: January 30th, 2020 and March 11th, 2020 has been set as the event days. 5-days and 15-days CAR are demonstrated via the solid and the dashed line, respectively.

According to market reports (Clarksons Shipping Intelligence Network, 2020c), against the backdrop of the pandemic and after Opec deal collapsing in early March,[3] a sharp fall in oil prices, expectations for higher Saudi Arabian oil output and a surge in floating storage enquiry drove another market spike, with VLCC earnings reaching $279,000/day in mid-March. As far as the LPG carrier sector is concerned, across Q1/2020, Very Large Gas Carrier spot earnings averaged $50,642/day, up by 267% y-o-y, and above the full year 2019 average of $46,009/day; support was provided by continued firm growth in seaborne LPG trade, particularly expanding US exports to Asia.

BCTI showed a positive abnormal return during the WHO's first announcement on January 30th, 2020 that continued in the following weeks. Specifically, average clean MR spot earnings rose by 60% m-o-m to $23,297/day, whilst earnings in the larger long range oil tanker (LR) segments trebled, to over $40,000/day in the LR2 sector (approx. 80–120,000 dwt.) and almost $30,000/day in the LR1 segment (approx. 50–80,000 dwt.). Meanwhile, clean products earnings spiked to

MR spot earnings rose by 60% m-o-m to $23,297/day, whilst earnings in the larger LR segments trebled, to over $40,000/day in the LR2 sector and almost $30,000/day in the LR1 segment. The improvements came despite reports of refinery run cuts and escalating assessments of the pandemic effect on global oil demand (Clarksons Shipping Intelligence Network, 2020a). The above findings have been also verified by the regression analysis, indicating a robust link amongst freight prices, shipping stocks, along with the pandemic timeline.

COVID-19 should be considered a standard unpredictable event, while its initiation, evolution and yet its desirable termination, along with the magnitude of its influence, are still undergoing. We believe that our research should be of assistance to shipping stakeholders, as it merely reveals the way shipping markets responded on a sanitary external shock. This means that shipowners and charterers shall have the time to get prepared via hedging techniques, to minimize their losses, strengthen their cash management, avoiding abrupt ups and downs that could put the shipping firms' sustainability at immediate risk. As during the time of our research, the COVID-19 outbreak is ongoing, further research is needed to entirely apprehend the consequences of such an extraordinary incident to its full magnitude.

Due to the endogenous volatility of shipping markets (Gavalas and

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[3] Oil rates fell around 10% on March 6th, 2020, following a plan of key oil companies to reduce production collapsed (BBC, 2020).
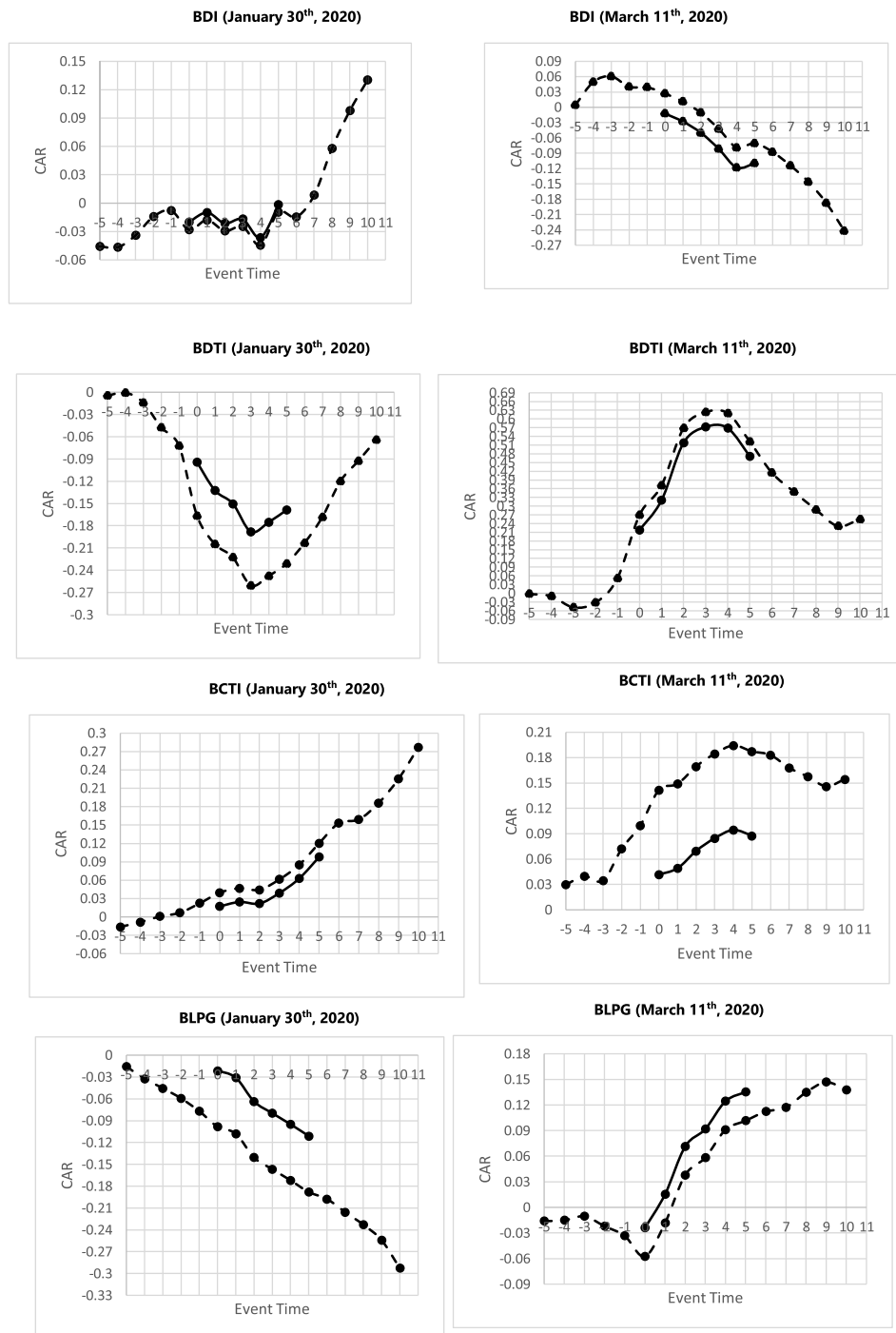
Graph Group B. Abnormal returns of the impact of COVID-19 shock on Baltic indices
Source: authors' calculations
Note: March 11th has been set as the event day. 5-days and 15-days CAR are demonstrated via the solid and the dashed line, respectively.

Syriopoulos, 2016) and the macroeconomic uncertainty the pandemic generated, future research could broaden our present perception of such exogenous shocks, by focusing on the vulnerability of the shipping derivatives i.e. forward freight agreements or debt-for-equity swaps (Bousini, 2020), whose values are adjustments based on other variables, such as the indices used in this study. In particular, debt-for-equity swaps could be used to decrease the leverage ratio and under certain circumstances have impact upon the eligibility of a shipping company to apply for government-backed loan guarantees. Since a conventional debt-for-equity swap will dilute the holdings of the current shareholders, its closing demands an "accord" between the company's shareholders.

Any legal framework adjustment to accommodate swap transactions for financially distressed shipping firms might preserve debtholders' rights and all together improve the companies' balance sheet with share capital.

For policy makers, with COVID-19 considered to have a considerable and long-lasting impact on most shipping companies' transactions figures, the tasks of compensating any-type financiers along with overheads, while holding cash flow in hand shall augment. We would suggest state involvement that improves cash flow either i) indirectly, by a possible period of moratorium on particular tax expenditures being planned with a viewpoint to provide the shipowner and the creditors

adequate time to take into account business plans regarding restructuring, refinancing and other plausible escape routes, or ii) directly, by acknowledging that fresh financing during a pre-determined period should be given priority over unsecured creditors. We believe that measures like the above might enhance the means and the window of opportunity for the shipping industry to deal with disentanglements, in regard to both debt and equity recapitalization.

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