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Containership new-building orders and freight rate shocks: A “wait and see” perspective

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ABSTRACT

This paper studies the behaviour of shipping investors following an unexpected shock in the freight rates, while accounting for costs (fuel), and the macro environment (stock prices and trade). The estimates firstly confirm the existence of a long-term relationship between the macroeconomic environment and freight rates, as well as between that and newbuilding orders. Most importantly, we find that when the source of the shock is less clear but still causes an increase in freight rates, shipping investors respond with a delay, which could last almost a year. The thinking behind this “inaction period” is rational, given that the only way to observe whether a shock is permanent or transitory is to wait it out. The above findings have important policy implications not only for shipping investors but also for countries that rely heavily on their ship-building industries.

Introduction

The shipping industry acts as a catalyst for the global supply chain operations since it accounts for the vast majority of goods' transportation (UNCTAD, 2019). Nevertheless, since shipping services are a derived demand system (Stopford, 2013), the volatility found in the markets is one of the highest among the investment sector (Yang et al., 2021). This is especially true when macro events take place.

During the coronavirus pandemic (Michail and Melas, 2020a; Notteboom & Haralambides, 2020; Michail and Melas, 2021 inter alia) freight rates adjusted very quickly to the new demand and supply information. This leaves investors in the industry either exposed to shrinking balance sheets, due to the reduction of the value of their assets (vessels) or due to lower earnings power, or with a lump sum of unexpected earnings (Mohanty et al., 2021).

The extreme volatility exhibited in the freight rates of the maritime markets does not only affect shipping companies' income. Decisions to acquire a vessel are mainly driven by the expected earnings that she will have in the freight markets (Ådland & Koekebakker, 2007; Beenstock, 1985; Mayr, 2015; Xu & Yip, 2012) and thus are primarily demand-driven (Fan & Luo, 2013). Nevertheless, this inter-play between the freight markets and the newbuilding and second-hand markets, affect profoundly the balance sheets of the companies. Naturally, a positive shock would create an influx in the cash flow of the company and appreciation of its assets but, on the contrary, a negative shock would affect both the liquidity and also it would depreciate the market value of its vessels.[1] The latter is an important pitfall given that the industry works primarily with asset-backed loans. Thus, when the market of the vessels drops hugely, the creditworthiness of the company is at stake.

Thus, the question is why one would be willing to invest if this exogenous volatility would harm ones investment. Theodossiou et al. (2020) are the first to explore the reason that some players

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[1] According to Duval et al. (2007) an economic shock may be loosely defined as an exogenous event that disrupts an economic entity's output. Hence, it comprises at least two dimensions: the extent to which shocks are dampened and the speed with which the economic entity revert to normal.

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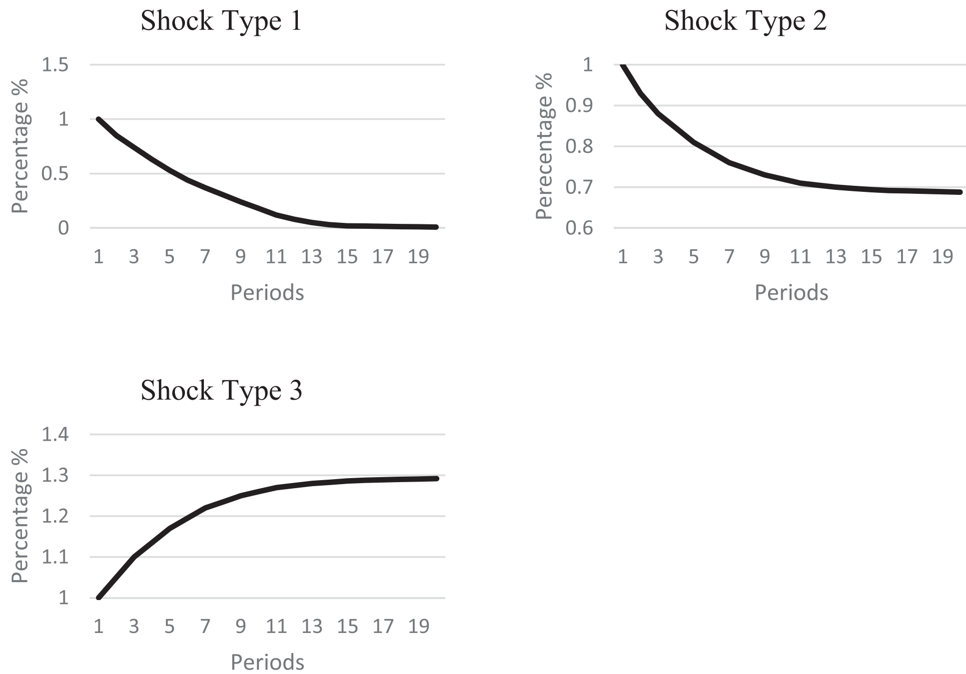

Fig. 1. Types of Shocks.

would prefer to invest in a risky industry like shipping. They show that despite the fact that the average return of shipping investments is low, the high volatility and the positive skewness of the earnings act as catalysts for such investment decisions.

The latter relationship raises some questions on how fast shipping investors can digest the new information that they get from the markets and then proceed accordingly. Naturally, the decision to scrap or to make idle a vessel is something that is not time-consuming per se, thus shipping investors can downgrade their fleets capacity easily. On the contrary, when there is a positive shock in the market, two scenarios come into play. On the one hand, shipowners may choose to buy a second-hand vessel or to acquire new-building vessels, in which case, they will be faced with some waiting time since new vessels take approximately two and a half years to be built.

However, in all the above scenarios, the main concern of the market players is whether the shocks are permanent or their impact will be short-lived. If the shock is permanent, the players are better off if they act on the new state of the economy and decide to acquire vessels or make them idle. On the other hand, if the shock is not permanent shipping investors may decide not to act on the new state of the play since there is not going to be a long-term impact.

Fig. 1 shows the different types of shocks that may take place in an industry. In particular, shock type 1 refers to a transitory shock that declines in value as time goes by, eventually reaching zero. An example of this type of shock is a shock that has a one-off impact on the industry, e.g. a seasonal increase in the price of the commodity carried via the vessel, which in turn increases freight rates (Melas & Michail, 2021).

On the other hand, shock type 2 refers to a permanent shock which will have a permanent impact on the industry, albeit to a lower than a one-to-one extent. For example, a permanent increase in the price of oil by 5 % would not imply a 5 % increase in freight rates given that other factors would also affect this (e.g. fuel efficiency, economies of scale, etc.). Finally, shock type 3 refers to a permanent shock that has a higher than unity impact on freight rates. For example, a 1 % permanent increase in demand for shipping services would imply a more than 1 % increase in overall trade (Michail et al., 2021).

Naturally, the biggest question is whether a shock is permanent or transitory in nature. While a permanent shock may have a less than unity impact (shock type 2), there is less to lose in such a situation. On the other hand, if a shock is transitory but erroneously interpreted as permanent then the shipping investor could end up with more vessels than the current demand can support and thus be hurt financially. As such, the only way that the shipping investor can potentially profit is via correctly interpreting the nature of the shock.

In practice, there is no easy way for this other than via observing the impact it has on freight rates. While the common understanding in the academic literature is that shipping investors react rather quickly to demand shocks (that would be from 3 to 6 months in the dry bulk sector according to Xu et al. 2011) and start purchasing vessels, such a way of operation would be incorrect from a risk management point of view. As such, the pragmatic question this paper seeks to answer is for how long shipping investors will remain idle and simply observe the impact before they make an educated guess on the nature of shock and thus adjust their buying behaviour. While there is research on other industries that exhibit similar time lags between events and investment decisions (Arezki et al., 2017), the research in the maritime industry is limited (Adland & Jia, 2015).

To fill the gap in the shipping industry, this paper studies the behaviour of shipping investors following a shock in the freight rates. To do so, we employ a dataset of monthly observations from 2003 to 2019 for newbuilding orders, the CCFI China Europe Freight Index, and control variables related to fuel price (vessel variable costs), stock markets and trade (macro environment). The estimates from this paper firstly confirm the existence of a long-term relationship between the macroeconomic environment and freight rates, as well as between that and newbuilding orders. Most importantly, we find that when the source of the shock is less clear but still causes an increase in freight rates, shipping investors respond with a delay, which could last almost a year. The thinking behind this “inaction period” is rational, given that the only way to observe whether a shock is permanent or transitory is to wait it out.

Following this introduction, the remainder of this paper is organized as follows: section 2 provides a review of the literature on the issue, section 3 describes the methodology and the data used, section 4 discusses the empirical results obtained, and section 5 concludes on the findings.

Literature review

The research is fruitful when it comes to the driving forces of investments in the shipping industry. Researches have been conducted for the bulk market (Ådland et al., 2016; Kyriakou et al., 2007), the tanker market (Alizadeh & Nomikos, 2006; Merikas et al., 2008) as well as the containership market (Fan & Luo, 2013; Rau & Spinler, 2017, 2016). Nevertheless, while the inter-relation that the shipping markets have between them (Tsouknidis, 2016) is long documented, the main difference that these segments have is primarily the concentration of ownership among the market players. More precisely, the dry bulk market has dispersed ownership given the numerous companies that have invested in the segment (Glen & Martin, 2002), especially after the 1950 s. Thus, bulk markets are considered by many economists as good settings for perfect competition models (Kalouptsidi, 2014; Stopford, 2013). On the other hand, the liner containership trade has a very concentrated ownership structure since in 2019 more than 80% of the total capacity was held by the largest 20 companies in the market (UNCTAD, 2019). The latter creates a conundrum on the factors that affect the different segments when it comes to investment decisions.

Bulk shipping markets bear various behavioral patterns when it comes to investment given the disperse of ownership. Various studies have documented that market fundamentals (Melas et al., 2020) as well as behavioral biases have an important role on the decision of shipping investors to acquire dry bulk or tanker vessels (Duru, 2018, 2013; Melas & Michail, 2022; Melas, 2019; Michail & Melas, 2021b, 2021). Adland and Jia (2015) in their exercise concerning the dry bulk Capesize market have shown that new-building prices remain sticky for a period of time before they start to increase or decrease accordingly. They suggest that, ceteris paribus, investors expect newbuilding prices to be less volatile compared to the second-hand market before they decide to invest in this.

On the contrary, the large concentration that is evident in the containership market makes this segment unique both in terms of economy (since it serves as a great example of oligopoly) (Stopford, 2013) and of alliance formations (Panayides & Wiedmer, 2011; Rau & Spinler, 2017). When it comes to the investment decisions of containership companies research is limited. Jansson and Shneerson (1982) have provided evidence that containership companies make investments in regards to the optimal vessel size for the specific route that the vessel will follow.

In a more recent research, Fusillo (2003) shows that containership companies are not particularly interested in creating barriers of entry to new companies as they do not consider alike strategies to deter new entrants. Fan et al. (2021) explore the investment behavior of the containership shipping investors in regards to the second-hand vessels. They provide evidence that they invest in a more rational manner when compared to the dry bulk segment investors and additionally that they seek to buy low and sell high. Last but not least, we should mention on the recent conditions that has arisen since the 2008 collapse of the financial markets. Yoon et al. (2021) provide evidence that due to the minimization of the potential financial resources in the maritime industry the sale-leaseback (SLB, thereafter) transactions have gained a significant popularity among the market players. More specifically, they investigate the use of SLB transactions in the Korean market, where they find that the use of such financial vehicles are helpful for the balance sheets of the companies, especially when a back-up policy is used by the government.

Nevertheless, while there is a fruitful discussion on the investment decisions that containership shipping investors exhibit concerning the second-hand market, the evidence is limited concerning their decision to acquire new vessels. Thus, the current paper comes to fill in this gap by examining the response times between the shocks in the market and the reaction time of the decision to acquire a new-building vessel.

Methodology and dataset

As mentioned earlier, identifying the nature of the shock is of paramount importance. As such, in order to be able to observe the behaviour of shipping investors we need to be able to identify a permanent shock to freight rates. To do this we need to first define a permanent shock as one that forces a model estimate to deviate from its current equilibrium path. Hence, we first need to employ an equilibrium model, which would capture the interrelations of freight rates with other variables in a specific long-run equation. In such a setup, a permanent shock would be more easily identifiable, while at the same time we can control for the impact from other macroeconomic variables. To capture these, we propose the use of the general Vector Error Correction specification, following (Johansen & Juselius, 1990) which is defined as:

$$\Delta M_{j,t} = \alpha_j + \sum_{i=1}^{p} \beta_{1,i,j} \Delta M_{j,t-i} + \sum_{k=1}^{K-1} \sum_{i=1}^{p} \gamma_{k,i,j} \Delta \boldsymbol{W}_{t-i} + \varphi_j \boldsymbol{Z}_t + \delta_j (M_{t-1} - \theta_{1,j} \boldsymbol{W}_{t-1} - \theta_{0,j}) + \varepsilon_{j,t} \quad (1)$$

where the total number of variables is K, $M_{j,t}$ is the natural logarithm of variable j, and $\boldsymbol{W}_t$ is a $(K-1 \times N)$ matrix that contains all variables included in the estimation, other than variable j. Δ is the first difference operator, while $\beta_{i,i,j}$ and $\gamma_{k,i,j}$ refer to the own and other variable coefficient values in each of the K equations.

Again, j signifies that the coefficient refers to the equation identified with variable j, while k refers to the specific variable within matrix $\boldsymbol{W}_t$. $\boldsymbol{Z}_t$ is a matrix of the exogenous variables potentially included in the estimation, with φ_j being the equation-specific estimates of the coefficients, and $\varepsilon_{j,t}$ refers to the error processes in each equation.[2] The long-run relationship between the K variables is within the brackets of Eq. (1) with δ_j determining the speed of adjustment to the long-run equilibrium. As usual, the δ_j term is expected to be negative in order for a return to the equilibrium to be ensured after a shock (see also Enders, 1995).[3] In total, we employ five variables (i.e. K=5), which will form the equilibrium equation.

As in most applications in the shipping industry, our data selection is constrained by data availability. As such, we employ the price of Brent oil as a proxy of supply costs (Michail & Melas, 2020b), the Wilshire 5000 index as a proxy of the state of the world's economic condition at the time (Michail & Melas, 2020a), and Chinese exports as a proxy for demand for shipping given the prevalence of the country as the main exporter in the world (Michail & Melas, 2020b). The three variables can be viewed as a global proxy of macroeconomic conditions, capturing both supply and demand factors that can potentially affect the shipping industry. All three variables were obtained from the St. Louis Federal Reserve Bank Database (FRED).

At the same time, we employ two shipping-specific variables, namely the containership orderbook and, naturally, the CCFI China – Europe Freight Index. Both variables were obtained from Clarksons Shipping Intelligence Network. For freight rates in particular, we have opted to use the rate from China to Europe, even though the choice of a specific route from China would not have made much difference given the very high correlation between the China-Europe and China-US data. The data range from March 2003 to December

[2] In this case, no exogenous variables were included in the model.

[3] The long run, as per Johansen and Juselius (1990), refers to the equilibrium relationship between the variables, i.e. one that would be reached in the absence of any external shocks. Similarly, short run refers to the fluctuations that take place and allow for deviations from the equilibrium value. As such, the terms "long run" and "short run" do not refer to any predetermined period but simply relate to how econometricians refer to these relationships, derived from theoretical models that define the long run as a period with no shocks.

Table 1
Unit Root Tests.

	Wilshire 5000	Ch. Exports	Brent	Orderbook	Freight Rates
Level	-1.67	-2.51	-3.15 *	-1.03	-2.67
First Difference	-12.72 * *	-15.73 * *	-10.02 * *	-5.04 * *	-8.18 * *

Test values for 1%, 5%, and 10% levels for trend and intercept are at − 4.00, − 3.43, and − 3.13 respectively. * , and * * denote a rejection of the unit root null hypothesis at the 1% and 10% level respectively.

Table 2
Descriptive Statistics.

	Wilshire 5000	Ch. Exports	Brent	Orderbook	Freight Rates
Mean	69.6	139,825.7	71.7	750.4	1292.2
Median	54.9	158,404.1	66.1	589.0	1316.5
Maximum	152.9	259,561.9	132.7	1434.0	1897.2
Minimum	27.2	32,817.6	25.1	354.0	635.0
Std. Dev.	32.9	56,275.7	27.1	348.1	294.6
Skewness	0.8	-0.4	0.4	0.8	-0.1
Kurtosis	2.5	1.9	2.1	2.0	2.1
Jarque-Bera	25.15	14.83	11.43	27.74	7.44
	(0.00)	(0.00)	(0.00)	(0.00)	(0.02)
Observations	202	202	202	202	202

2019, for a total of 202 observations.[4] All variables are in natural logarithm form.

To confirm the presence of a long-run equilibrium between the variables, we first examine for the presence of a cointegrating relationship between the five variables. In other words, there needs to be an empirical justification for the use of the term in the brackets. However, before we are able to perform the Johansen test for cointegration we first need to establish that both variables are I(1), i.e. they follow a unit root process (for more details see Hendry & Juselius, 2001, 2000).

The unit root tests in Table 1 confirm that the series are I(1), with the minor exception of Brent crude oil, something which is mostly related to the sample size. Then, we proceed with the testing for a cointegrating equation. While not reported here, the estimates suggest the presence of either one or two cointegrating equations on the basis of trace or maximum eigenvalue test respectively. However, given that the two cointegrating graphs appear to overlap, we follow Hendry and Juselius (2001, 2000) and use one cointegrating equation.[5]

Table 2 presents the descriptive statistics of the freight rates employed in our estimation. As it can be seen from the estimates, a large standard deviation in the case of freight rates and the orderbook is evident, in accordance with Theodossiou et al. (2020). The only reason that Chinese exports have a larger standard deviation relates to the units of measurement as these are in millions. As such, and given the presence of a cointegrating relationship, we proceed with the estimation of the model.

Following the Granger representation theorem (Engle & Granger, 1987), if two variables are cointegrated, then at least one variable should Granger-cause the other and, by default, they can be combined in an equilibrium relation. To obtain this equilibrium relation, we use a Vector Error Correction (VEC) model, as it is justified by the data generating processes. The following section presents the results from this estimation.

Results

Fig. 3 presents the estimates from the above Vector Error Correction model, in the form of impulse responses to a one standard deviation shock. Impulse response provide the response of a variable following an exogenous one standard deviation (from the errors distribution) shock in the system, while at the same time allowing for the shock to be passed through the whole system of equations, given the interconnectedness of the equations with their lags. In other words, for a shock in the stock market, we would observe the change in freight rates, which could then also affect newbuilding orders, which would again potentially influence the stock market and so on. As such, it allows us to obtain a more holistic view of the impact from a shock.

For a shock to be considered permanent, we need to observe a continuing stable path for the variable, whereas when the shock is transitory we observe a movement of the response towards zero. As per the literature, ordering scheme is a Cholesky decomposition, while the estimates are presented using a 68% confidence interval (Bernanke et al., 2005). Five lags have been employed in the estimation on the basis of the AIC and BIC criteria, while the confidence intervals were obtained using a bootstrapped method for the errors.

Firstly, we note that the response of the Wilshire5000 (stock market) index to its own shock results in a permanent impact on the index. As such, it can be used to gauge whether improved macroeconomic conditions, or at least the perception of improved macroeconomic conditions, can affect the behaviour of shipping investors (see also Michail, 2020). On the other hand, Chinese exports do not appear to affect the stock market, while a shock in freight rates causes just a short-term movement in the market. This impact is small, at around 0.6% and dies out after about a year. Interestingly, the stock market appears to be heavily influenced by the Brent oil price, where a positive shock in Brent oil prices would affect the stock market by almost 1%. However, the long-term impact of this shock appears to be statistically insignificant.

On the other hand, Chinese exports record a significant increase when a shock in the US stock market takes place. In particular, it appears that a one standard deviation permanent shock in the Wilshire5000 (such as the one depicted earlier) would cause Chinese exports to rise by more than 2% in the first year, with the impact remaining above 3% in as much as 50 months ahead. Similarly, freight rates also record a strong response when the stock market index rises, with the impact more pronounced in the short-term, giving rise to the known volatility issues in the industry (Theodossiou et al., 2020). As it appears, the response of the freight rates is fast and strong, rising by around 5% in less than a year after the shock. From that peak onwards, the impact declines but never returns to zero, roaming around 2.5% at 50 months following the shock.

As also expected, the freight rates record a positive response to an increase in the quantity of Chinese exports, a result that is in accordance with Michail & Melas (2020b), who also show that higher demand increases freight rates. Naturally, the response is lower than the one reported when the stock market rises, given that this is specific for the Chinese economy and does not capture any global effects. As such, and as Fig. 3 shows, Chinese exports rise by almost 2% in the first couple of months following the shock, but

[4] The coronavirus period of 2020–2021 has been excluded on purpose given that its inclusion, especially at the end of the sample, would have most likely impacted the results. Given that, unlike Michail & Melas (2020a) we do not aim to capture of Covid-19 on shipping, it is most likely that the strong Covid-19 impact would have distorted the estimates.

[5] In robustness checks for the model, we have also employed two cointegrating equations for said specification, with discernible impacts on the estimates. The same holds if the cointegrating case changes and three cointegrating equations are employed.

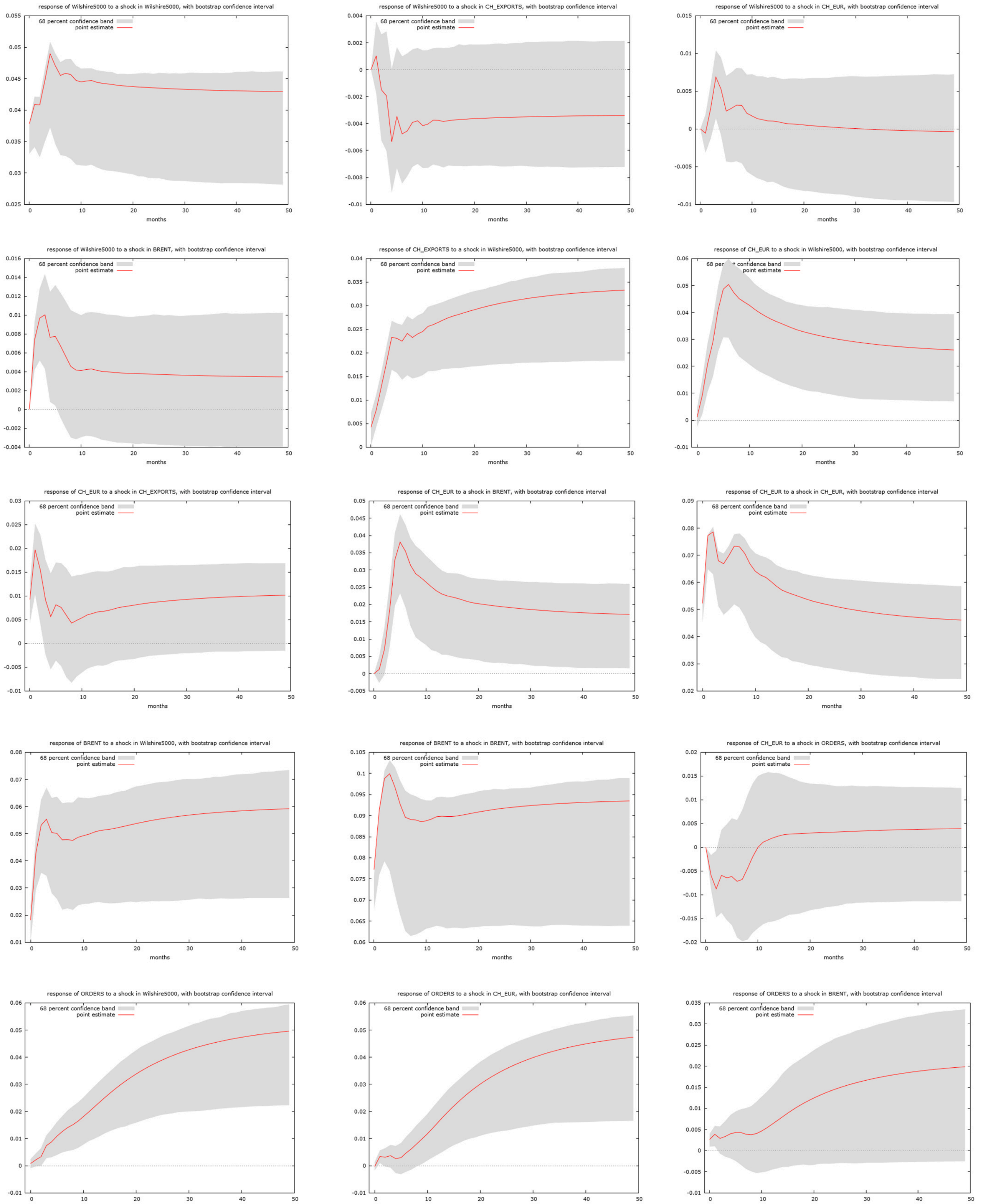

Fig. 2. Impulse Responses.

quickly return to zero, as the impact becomes statistically insignificant after around six months. Similarly, but more permanently, a permanent shock in oil prices will result in a positive and persistent increase in freight rates, with the effect peaking at 3.5% eight months after the initial impact, while slowly moving towards a permanent 1.5% increase compared to the pre-shock levels.

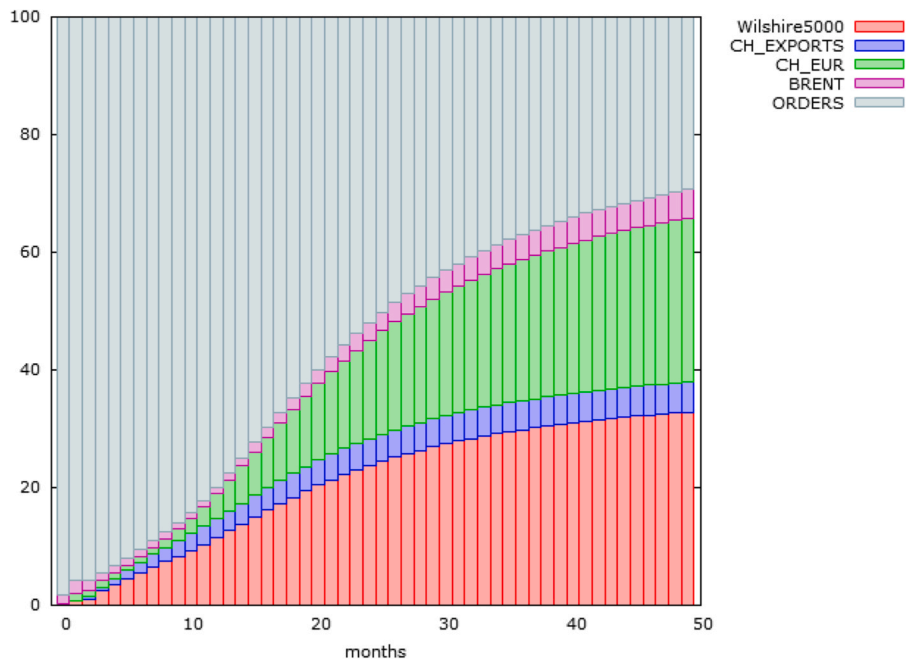

Fig. 3. Forecast Variance Decomposition (Newbuilding Orders).

When it comes to own shocks, i.e. shocks to the variables which occur from within the variable itself and are not caused from any other variable of the system, a permanent shock in Brent oil price raises prices by slightly more than 9%. This extent is indicative of the idiosyncratic shocks that have an impact on the price of oil, namely the OPEC decisions to increase or cut production. Similarly, a shock in freight rates has a less permanent impact, with the effect moving from 8% a couple of months after the shock to less than 5%, suggestive of the fact that there is always some idle fleet able to capture at least part of the increase in freight rates (Stopford, 2013).

Moving to the main thrust of the paper, the last row of Fig. 2 illustrates the response of newbuilding orders to the various shocks. Interestingly, an increase in the stock market causes an increase in new orders, with the 4.3% permanent impact of the Wilshire5000 being translated into almost 5% new orders, around 50 months after the shock. The impact is in support of previous findings of the literature (Michail & Melas, 2021a, 2020a) as they suggest that the macro environment plays a crucial role on the markets. On the other hand, higher oil prices do not translate into higher orders, given that the response is statistically insignificant across the whole horizon. This suggests that an increase in costs does not coincide with a move to more cost-effective vessels, despite fuel cost being the most important cost type when operating a vessel (Kilian et al., 2020).

Of greatest interest is what happens when a shock in the freight rates takes place. In particular, an almost 8% increase in the freight rates results in a near-zero impact on new orders, for at least seven months after the initial effect. However, after this “inaction period”, newbuilding orders escalate fast, rising by almost 5% in the long run. This suggests that when the impact is generic on the freight rate, and it is not clearly driven by an increase in the macro estimates, shipping investors opt to wait for while in order to ensure that the rise is not driven by a transitory factor but is in fact a permanent shock.

The results are also complemented by the forecast variance decomposition of newbuilding orders (Fig. 3). In particular, it appears that in the long run, idiosyncratic shocks (e.g. cash flow-driven or contract-driven decisions to order new vessels) account for around 30 % of the total developments, while the stock market and the freight rate account for around 27 % and 25 % respectively. Interestingly, and in accordance with the impulse response results, the significance of freight rate shocks increases over time, as they start to become larger about a year after the shock. This again supports the view that shipping investors seek an “inaction period” during which they wait to see if the shock is permanent or transitory in nature.

Conclusions

Overall, the estimates from this paper firstly confirm the existence of a long-term relationship between the macroeconomic environment and freight rates, as well as between that and newbuilding orders. In particular, it appears that the stock market, acting as a proxy for the macroeconomic developments and the investors' expectations about the future, has the strongest impact on newbuilding order decisions. When a clear, permanent, macroeconomic shock hits the market, then shipping investors appear to be very fast in placing new orders.

On the other hand, and perhaps most importantly in practice, when the source of the shock is less clear, but still causes an increase in freight rates, shipping investors respond with a delay, which could last almost a year. The thinking behind this “inaction period” is rational, given that the only way to observe whether a shock is permanent or transitory is to wait it out. As such, by waiting for a few months, shipping investors reduce the probability of the shock being transitory, something which could have adverse effects on a company's cash flow given the 2-3 year waiting period before the vessel is delivered.

Furthermore, the results could also suggest that a large part of the fleet always remains idle, again in an effort to Michailcapture short-term fluctuations that could potentially decline in less than a year. While the interplay between newbuilding orders and idle fleet is important, we leave this question open for future researchers.

The above findings have important policy implications not only for shipping investors but moreover for countries that rely heavily on their ship-building industries (namely China, South Korea, Japan). Given the cost that shipbuilding operations bear the exact timing of the arrival of new orders would greatly benefit shipyards' management on deciding on how they will they will allocate their resources cost wise. Primarily, the first decision that shipyards will have to account for is the acquisition of raw materials that are the prime cost in the production process (Jiang and Strandenes, 2012). In addition to this, the shipyards' management teams will have to allocate the remaining capital between machinery and labor (Chou and Chang, 2004; Hengst and Koppies, 1996). Given the high costs that the industry bears, our results provide a systematic approach on the timing that shipyards should start enhancing their resources, following an increase in demand, based on the change in freight rates.

Lastly, we must acknowledge that our research does not cover the full extent of the containership newbuildings domain. For example, one could extend the study using the potential over- or under-supply in the market, which could also have an impact on shipping investors' decision. We leave this intriguing question open for future research.

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