DEFINE THE INFLUENCE OF THE VOLATILE FUEL PRICE ON THE FREIGHT OF DRY BULK SHIPPING

XÁC ĐỊNH ẢNH HƯỞNG CỦA SỰ BIẾN ĐỘNG GIÁ NHIÊU LIỆU TỚI CƯỚC VẬN TẢI BIỂN HÀNG RỜI

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Abstract

This research aims to explore the impact of fuel price on the dry bulk shipping freight over the last few years. The volatility of fuel price recently has significantly contributed to the uncertainty of freight market. The paper first reviewed the literature to define the importance of fuel cost in the shipping industry. Afterward, we applied the simple regression model using the data from week 01/2018 to week 18/2020 and discovered the significant positive relationship between bunker fuel price and the dry bulk shipping freight. Further discussion of how current global issues influence the fuel price and freight market were provided accordingly.

Keywords: *Impact, fuel price, dry bulk, freight, regression.*

Tóm tắt

Nghiên cứu này nhằm đánh giá ảnh hưởng của giá nhiên liệu đến thị trường cước tàu hàng rời trong những năm đã qua. Sự biến động của giá xăng dầu gần đây có ảnh hưởng lớn đến sự bất ổn về giá cước tàu biển. Đầu tiên chúng tôi nghiên cứu cơ sở lý luận để xác định tầm quan trọng của giá nhiên liệu trong thị trường vận tải biển. Sau đó bằng việc áp dụng mô hình hồi quy với dữ liệu từ tuần 01 năm 2018 đến tuần 18 năm 2020, chúng tôi tìm ra mối tương quan đồng biến đáng kể giữa giá nhiên liệu và cước biển hàng rời. Sau đó nghiên cứu thảo luận về các vấn đề thế giới hiện tại có tác động lớn tới giá nhiên liệu và thị trường thuê tàu.

Từ khóa: *Ảnh hưởng, giá nhiên liệu, cước biển, hàng rời, hồi quy.*

1. Introduction

The maritime freight rate market is highly volatile over time (Figure 1). Among the factors affecting the fluctuation of dry bulk freight rates, fuel price appears as an indispensable and the most dominant criterion [1]. To assist the organizations in gaining the understanding of this issue to be able to forecast the dry bulk freight rates and fuel price variation, we determine to investigate further the influence of fuel cost by using simple regression model.
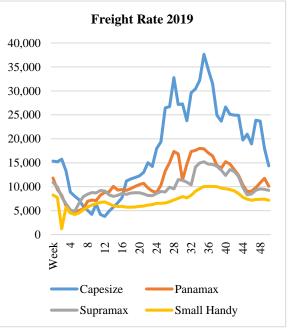

Figure 1. Freight rate 2019

Fuel prices affect the freight rates by altering operation costs which account for most transportation charges especially when new IMO regulations of maritime fuel usage are introduced. It is estimated that fuel cost covers 35%-45% of the freight rates component [1]. It also broadens the fleet variety and numbers which deploying more efficient ship or consolidation into bigger vessels to amortize fuel costs for extra shipment units.

In this research, we first review the literature to gain knowledge from other researchers. Then we present a data collection with the range of figures from week 1/2018 to week 18/2020. Afterward the data analysis is presented, followed by the conclusion and discussion section.

2. Literature Review

Freight market is influenced by many macro factors, such as national economies, trade agreements, uncertain shock and fuel [2]. Among these factors, fuel price plays a significant role affecting the fluctuation of the freight rate [1]. Therefore, the importance of this factor has been examined by a number of previous studies as summarized as follows.

An exploration followed the qualitative approach provided by Eastman [3]. Based on this model, the study pointed that transportation consumed half of the total national petroleum quantity. The research also proved that proper fuel management can reduce the risk of production disruptions on farms and factories. In special cases, it also plays an important role in the allocation of transport work. Besides, the fluctuations in fuel prices also motivated transportation companies to focus more on improving the efficiency of their business processes.

Another study using the econometric approach written by Jonkeren et al. [4]. They investigated the influence of the freight, fuel prices on the navigation speed. The fluctuations of speed lead to the differences in decisions of shippers in choosing the mode of transport. Moreover, the transport system operation depended dramatically on speed. It is clear from the literature that fuel prices had a negative effect on speed. More particularly, when the fuel prices went up, the speed declined, and vice versa.

In a follow-up research, Chou [5] demonstrated how to manage the risks by fuel oil index and forward freight agreements. He concluded that fuel price is a crucial criterion in transportation causes it is a fixed cost and accounts for a significant proportion of freight rates even the whole transportation industry.

The research of Wright [6] focused on freight rates and its vital criterion affect the rates. While fuel cost is an indispensable factor that the changes in it altered the supply curve. Moreover, the use of fuel depends on the shipping speed that affects the depreciation cost of the vessel.

However, there have been no recent studies summarizing data on fuel prices worldwide. Given the context that current global issues have substantial impact on fuel price, this paper will provide specific data and use a statistical model to verify the impact of fuel prices on dry bulk freight rates over last few years.

Table 1. Data collection summary

No	Name	Explanation	Measure	Source
1	MGO LS price in Singapore	Marine gas oil low sulfur price in Singapore.	US$/mton	BIMCO
2	Panamax rates Transatlantic RV	The rates of chartering a Panamax vessel for a round voyage (RV) in the Transatlantic region.	US$/day	Pioneer Shipbrokers
3	Panamax rate TCT CONT/F.EAST	The rate of time charter trip for a Panamax vessel from Continents to Far East.	US$/day	Pioneer Shipbrokers
4	Panamax rates F.East/CONT	The rates of chartering Panamax vessel from Far East to Continents.	US$/day	Pioneer Shipbrokers
5	Panamax rate TCT F.East RV	The rate of time charter trip for a Panamax vessel for a round voyage (RV) in the Far East.	US$/day	Pioneer Shipbrokers
6	Supramax rate Atlantic RV	The rate of chartering a Supramax vessel for a round voyage (RV) in the Atlantic region.	US$/day	Pioneer Shipbrokers
7	Supramax Pacific RV	The rate of chartering a Supramax vessel for a round voyage (RV) in the Pacific region.	US$/day	Pioneer Shipbrokers
8	Supramax TCT Cont/F.East	The rate of time charter trip for a Supramax vessel from Continents to Far East.	US$/day	Pioneer Shipbrokers
9	Supramax freight rate	The rate for chartering a Supramax vessel.	US$/day	Pioneer Shipbrokers
10	Small handy freight rate	The rate for chartering a Small handy vessel.	US$/day	Pioneer Shipbrokers

3. Methodology

In this paper, statistical analysis is applied for examining the relationship between the bunker fuel price and the freight rates. All data used in the statistical model were collected on a weekly base from week 1/2018 to week 18/2020, including the marine gas oil low sulfur price in Singarepore and dry bulk shipping freights in terms of different typical vessel types and main maritime routes (Table 1). From the weekly report of Pioneer Shipbrokers [7], we compiled the data of rates of chartering Panamax and Supramax vessel for a round voyage in the Atlantic, Pacific, Far East, and the time charter trip of the route Continent - Far East. Those data are Panamax rate TCT CONT/F.EAST, Panamax rates F.East/CONT, Panamax rate TCT F.East RV, Supramax rate Atlantic RV, Supramax Pacific RV, Supramax TCT Cont/F.East. In total, data from 117 weeks were collected. However, some data were missing in 6 weeks, so we decided to exclude these weeks in our data analysis. In the end, 1110 observations from 111 weeks were used for further analysis. All features are normally distributed and summarized in Table 2.

Finally, the data of the Supramax rate and the Small Handy rate are used as the dependent variables in the model and to verify whether the fuel price has influence on dry bulk freight rates. By using Linear Regression model, we analyze the result in the next section.

4. Data Analysis

We first run the correlation to see the relation between fuel price and the freights. As shown in Table 3, the MGO LS price has an important impact on the freight rates of different shipping routes. The two stars (**) in the Pearson correlation column present the significance at the 99% level of the fuel price for the freights. The importance can also be seen in the table as the p-value is less than 0.01. Since all coefficients are positive, the fuel price has a positive relationship with all freights. The impact is moderate high in the cases of Panamax rate Far East to CONT., Supramax Pacific RV, Supramax freight rate, Small handy freight rate. The correlation is medium at Panamax rates Transatlantic RV, Panamax rate TCT F.East RV and Supramax rate Atlantic RV. Lastly, the influences of fuel prive over Panamax rate TCT CONT to F.EAST and Supramax TCT Cont to F.East are weak as shown in the Pearson correlation values.

Table 3. Pearson correlation

Freight rate	Pearson correlation	Sig. (2-tailed)(p)
Panamax rates Transatlantic RV	.371**	.000
Panamax rate TCT CONT to F.EAST	.290**	.002
Panamax rates F.East to CONT	.512**	.000
Panamax rate TCT F.East RV	.418**	.000
Supramax rate Atlantic RV	.413**	.000
Supramax Pacific RV	.597**	.000
Supramax TCT Cont to F.East	.282**	.003
Supramax freight rate	.566**	.000
Small handy freight rate	.581**	.000

Table 2. Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
MGO LS Price in Singapore ($/mton)	111	228	755	593.44	98.714
Panamax rates Transatlantic RV	111	767	21335	11230.89	4976.620
Panamax rate TCT CONT to F.EAST	111	10350	29714	19328.48	4974.057
Panamax rates F.East to CONT	111	388	8100	4116.23	1663.260
Panamax rate TCT F.East RV	111	3320	16181	9952.48	2943.384
Supramax rate Atlantic RV	111	3980	18389	12124.07	3413.667
Supramax Pacific RV	111	3564	12786	9161.89	2373.422
Supramax TCT Cont to F.East	111	7714	28686	18535.47	4822.092
Supramax freight rate	111	4292	15199	10274.11	2711.477
Small handy freight rate	111	1214	10059	7533.72	2025.752
Valid N (listwise)	111				

Table 4. Effects of MGO LS price on Supramax freight

Model Summary

R	R Square	Adjusted R Square	Std. Error of the Estimate
.576[a]	.331	.325	2227.549

Coefficients[a]

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	892.694	1294.203		.690	.492
MGO LS Price in Singapore ($/mton)	15.808	2.152	.576	7.348	.000

In terms of Supramax vessel (Table 4), the p-value is less than 0.01, so the MGO LS price has a significant influence on Supramax freight rates. The table shows that the coefficient equals 15.808. Therefore, it is concluded that a rise of 1 USD/mton in fuel price will lead to an increase of 15.808 USD in Supramax freight. In this study, we use R squared as the measure of model validity. According to [8], using R square calculation is simple and can be applied for most types of problems and validation tests. It can be observed that the adjusted R squares equals 0.331, which means 33.1% of the volatility of the freight can be predicted by the model. According to [9], a low R squared values could be accepted if the study field has an inherently greater amount of unexplainable variation, which reflects the situation of dry freight shipping market.

Regarding to small handy size vessel (Table 5), the value of p is less than 0.01, thus the small handy freight rates are affected considerably by the fuel price. The coefficient is 12.189; as a result, the small handy rate will increase by 12.189 USD when the fuel price goes up 1 USD/ mton. Since the adjusted R square given in the table is 0.347, the model can predict 34.7% of the small handy freight fluctuation.

5. Conclusion and Discussion

The target of this paper was to inspect the impact of fuel price on the dry bulk shipping freight. Through Simple regression, the research reveals that the price of fuel is positively related to the rates. More specifically, the estimated results perform that a growth of 1 USD/mton in fuel price will lead to an increase of 15.808 USD in Supramax freight and the small handy rate will go up by 12.189 USD when the fuel price climbs 1 USD/ mton.

The year 2020 is experiencing significant events in the world causing fluctuations in the fuel market. First, Covid-19 pandemic is the reason for the decline in the price of fuel. Under the impact of this pandemic, the world is facing with the combination of an unprecedented decrease in demand and a supply shock. The most considerable hit on demand comes from the plummet of the need to transport around the world. On the supply side, because of the huge investment in fuel storage, a large number of organizations had to lower the prices for the inventory reduction.

Second, China - USA trade war affects the economic growth rate because of its effect on the demand by reducing the purchasing power of the US that is the most import country and supply by applying a higher tax on China goods which is the largest export country. The above reason describes how commercial altered export-import industries which directly affect the fuel price. It sank sharply to the bottom of 4 years recently. Another cause is China is crucial fuel, oil partner of the USA so when the contract breakdown, the global energy prices will be collapsed.

The outcome of this paper will be able to support the organizations in the shipping industry in the rate decision-making process. We highly recommend maritime companies to pay more attention to the fuel price. In the current context, having a group of experts to follow and analyze the volatility of the fuel price may necessary. It will help the organizations predict the trend of the freight to have the proper strategies for the company to adapt, survive, and minimize the negative influence of this period.

Due to the restriction of data access, this study is limited at the application of simple regression with

only two variables in the models. Further researches with more variables' involvement in a multiple regression potentially provide better insight of the volatile fuel price impact on the freight of dry bulk shipping market.

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