Analyzing New Ship Investment Behavior in the Dry Bulk Shipping

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Abstract

The ship investment is an extremely important decision for shipping company. It not only affect the strategic layout of the shipping company, but also affect the survival of the shipping company. Based on the ship investment records of 3,086 companies and 9,818 ships between 2000.01 and 2019.12. This study using Xtlogit model to analyzed the factors of the decision of whether to invest in a new ship, and using multinomial logit model to analyzed the factors of ship type selection. According to the regression results of these models, we find that top bulk operators expand to maintain their market share by investing in new ships, and small companies in rapid growth also intend to expand aggressively for getting more market share for get competitiveness. In addition, the Panamax is the best ship type for fast-growing company to choose, because the Panamax is generally accepted as a large ship for most shipping companies that can get economies of scale and can dock at most ports.

Keywords

Ship Investment; Dry Bulk Shipping; Xtlogit Model; Multinomial Logit Model.

1. Introduction

Since the Second World War, as international trade has become the focus of attention in the global economy, the international shipping industry has also developed rapidly. Since most of the goods transported in international trade are bulk goods and sea transport has the advantages of large volumes and low freight rates, nearly 90% of the goods in international trade are transported by ships (UNCTAD, 2019). In the international shipping market, dry bulk shipping accounts for more than 40% of the shipping market. Therefore, the dry bulk shipping market, as an important part of the international shipping market, plays an important role in the development of the international shipping industry (UNCTAD, 2019).The ups and downs of the world economy and trade determine the ups and downs of the international shipping industry, and the dry bulk shipping market in the international shipping industry is the most unstable(Alizadeh, 2013; Alizadeh & Nomikos, 2003). The Baltic Dry Bulk Freight Index (BDI) is a barometer of the international dry bulk shipping market, and it also reflects the overall status of the international economy and trade. The 2008 financial crisis made the shipping market surging, and the BDI index showed a cliff-like decline. Since then, BDI has been fluctuating at a low level. Different from the container shipping market, the dry bulk shipping market is a perfectly competitive market structure with greater competition(Wu et al., 2018). Figure 1 shows the distribution of market share of 3086 dry bulk shipping companies.
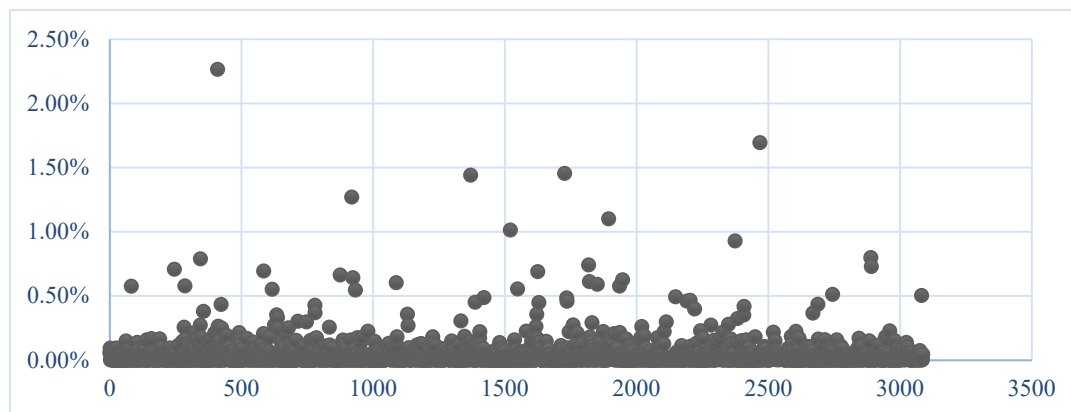
Figure 1. Market Share of 3086 Dry Bulk Shipping Companies from 2000 to 2019
Source: Clarkson Research Services Limited 2019

The uncertainty and competition in the market make new ship investment to be the one of the most complex decisions which plague existing and potential shipping companies. New shipping investment is an important strategy for dry bulk shipping companies to maintain or expand their market share. Economies of scale drive dry bulk shipping companies to tend to invest in large ships (Benacchio, 2007; Stopford, 2004). Because large ships can provide reliable and efficient services at low unit costs, investing in large ships has scale economics and competitiveness. However, due to the valuable asset properties of ships, investing in large ships may limit their own development (Le & Jones, 2004). Besides the effects of shipping market elements about the demand, freight rates, new-building price and bunker price, the shipping company's characteristics including the state of market position, the changes of market share, and the development of competitors also affect the dry bulk shipping company's decision. Therefore, various influencing factors make new ship investment and ship type selection a prudent and important decision for dry bulk shipping companies.

About the factors of new ship investment, most studies consider two elements: benefits and funds, and almost none research take care of the shipping companies' market share. While, this study not only considers the existing market share of shipping companies, but also takes into account the changes of market share, and the changes of the rival' market share. which is one of the innovations of this study. This study synthesizes the above three factors and gives a more comprehensive consideration on the factors affecting new ship investment.

Due to the four categories of dependent variables and multiple explanatory variables considered in this study, the multinomial logit model is more suitable as the research method of this study. this is one of the rarely empirical research used by multinomial logit model in ship investment field. Which has a certain contribution to the field of ship investment.

2. Literature Review

Searching for relevant keywords on major academic websites, we can find that "shipping market, port management, freight rate, economic impact, efficiency, competitiveness and performance" are the most popular topics in maritime transport field. According to the amount of literature, the research on ship investment is generally less than the research fields of ship technology, maritime policy, shipping emission and ship safety.

Shipping investment has always been a significant problem for shipping companies. Which can not only promote the company's gain, but also make the company maintain or enhance its market competitiveness. The literature on ship investment mostly studies investment timing and investment risks. For example, Luo & Kou (2018) studied when to make a ship investment decision based on the relationship between the trigger rate of freight, NPV and ROA, he pointed

out that the investment should be carried out immediately only when the freight rate is higher than the trigger price of ROA. H.Alizadeh and K.Nomikos (2007) analyzed the long-term co-integration relationship between the price and revenue of dry bulk carriers to identify ship investment opportunities.

In terms of investment options, shipping companies will adopt different ship types according to different trade routes and different business for achieving operational efficiency. Dinwoodie et al. (2014) pointed out that different routes or different businesses of the company will have an impact on the ship type selection. Nwokedi et al. (2018) assessed the ship type choice between Nigerian and African shipowners.

Many articles conducted an analysis from the perspective of cost-benefit, for example, Lian et al. (2019) believed that in addition to the traditional cost, the external diseconomy of ports and shippers should also be considered. What' more, Xu and Yip (2012) believe that global fleet size, world trade volume and current freight rate are the most important elements to ship investment. Besides, Fan and Luo (2013) used the binary choice Logit model to analyze whether shipowners choose new ships or second-hand ships in the first step, and used the nested Logit model to analyze how shipowners choose ship types in the second step.

As for the research methods of ship investment, most scholars adopt economic and game theory for analysis, few adopt empirical methods for research, while empirical studies on the selection behavior of new ship investment in dry bulk ship market are rare. Early scholars used NPV to study ship investment, with the discovery of the limitations of NPV technology, real option analysis (ROA) began to appear and became popular. Using ROA, Stent (2005) analyzed liner ship investment under uncertain conditions. Yin et al. (2019) combined ROA method with shipping market transport cycle theory, and use it to assess the investment decisions of dry bulk shipping market. And Sung et al. (2014) try to establish system dynamics modeling (SDM) to help shipowners to get an efficient investment strategy.

3. Methodology

3.1. Data Sources and Description of Variables

The research data mainly comes from two aspects, the contract data for each vessel are originated from the World Fleet Register (WFR) of Clarkson Research (Clarksons, 2019), which includes DWT, builder country. The second data source is the Shipping Intelligence Network (SIN) of Clarkson, which provides bunker, demand, freight, new building prices. And the corporate data covers share, ch and rival is calculated according to possession volume of each shipping company. The data used for the Xtlogit model and multinomial logit model include the observed ship-selection records for the dry bulk companies who owns new ships over the period 2000.01 to 2019.12. There are 3086 companies that invested in 10031 vessels, with 27.38% being Handysize (Type 1), 31.51% being Handymax or Supramax (Type 2), 26.69% being Panamax (Type 3) and 14.43% being Capesize (Type 4). Table 1 lists description of the variables used in the analysis of the new ship investment decision.

About *BUNKER*, the monthly statistics data of HSFO 380cst Bunker Prices (3.5% Sulphur) are selected. The variable is used to reflect the impact of cost factors. Also, the *nbpp* variable is chosen for the same purpose. The *nbpp* is the bulk Newbuilding Prices($m) Per DWT, being used to compute the unit investment cost of a ship type. Which is defined as

$$nbpp = \frac{nbpp}{dwt(the\ lagest\ dwt\ in\ the\ ship\ type)} * 1000$$

DEMAND is the global yearly world seaborne bulk trade at the time of investment. It's the sum of world seaborne iron ore trade, world seaborne coking coal trade and world seaborne minor bulk trade. *FREIGHT* is the monthly data of Baltic Freight Index.

SHARE is a hundredfold of a company's market share of the total capacity controlled by the 3086 bulk companies in a year. It is calculated using$(dwt_{it}/\sum_i dwt_{it}) \times 100$. *CH* is a hundredfold of the market share change rate for a company, which is defined as $(SHARE_{it} - SHARE_{it-1})/SHARE_{it-1} \times 100$. *RIVAL* is a hundredfold of the market share change rate for other companies except the company. It's given by the share of other bulk companies minus the one in the last year, as $(RIVAL'SHARE_{it} - RIVAL'SHARE_{it-1})/RIVAL'SHARE_{it-1} \times 100$.

Dummy variables about builder country are included to reflect the preferences of the four major shipbuilding countries including China, Japan, EA (Europe and America), South Korea. And the remaining countries are named "*BUILDER OTHER*". According to Table 1, we can know the biggest builder of bulk carriers is China, the second is Japan.

3.2. Xtlogit Model and Multinomial Logit Model

Logistic regression is a commonly used system to deal with qualitative dependent variables. Compared with multiple linear regression, logistic regression does not require the variables follow a normal distribution, so the analysis is more robust. According to the decision tree (Figure 2), the dependent variable at the first level are binary variables, that is, whether to invest in new ships. Second level of the decision tree are multi-categorical variables.

From the regression result of Xtlogit model, we can know that how many percentage points change the probability of the explanatory variable when the explanatory variable changes by 1 unit. Therefore, this study chose Xtlogit as the model to analyze the factors of whether or not to invest in new ships. According to Hausmann's test, we find that fixed effects are more suitable for this study, so we get Table 1, which fixed year and company. The second decision level has four types, so the multinomial logit model (MNL) is a suitable model for analyzing which ship type is better for dry bulk ship company. Moreover, MNL model has the advantages of mature technology, low error, and high robustness.
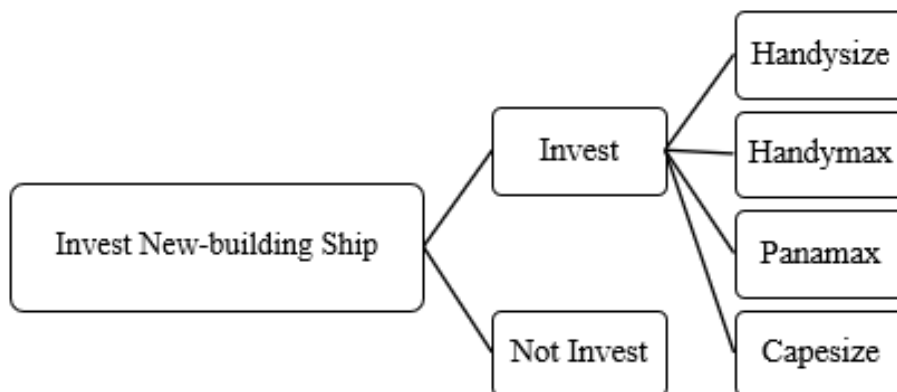

Figure 2. Decision Tree for Dry Bulk Ship Companies

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Table 1. Estimations of the Xtlogit Model

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	(1)
VARIABLES	Invest or not
freight	-0.543
	(-1.59)
demand	-0.311
	(-0.43)
bunker	1.431***
	(5.48)
nbp	1.332***
	(3.00)
share	1.989***
	(9.98)
ch	8.186***
	(7.82)
rival	0.334**
	(2.25)
Constant	-4.317***
	(-13.22)
Observations	61,720
Number of OBS	3,086
Company FE	YES
Year FE	YES
z-statistics in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

4. Conclusion

New ship investment is very important for small dry bulk shipping companies, because insufficient investment may lack of competitiveness, while too much investment may lead to heavy debts, which poses great risks to the survival of the company. Whether to decide on a new ship is the first step for the shipping company. After deciding to invest in a new ship, the choice of ship type is the second step. The two decisions are extremely prudential for dry bulk shipping companies.

According to Table 1, we find that when the shipping company's own market share is high, the probability of tending to invest in new ships is about 19.8%. Moreover, we can see that when the shipping company's market share increases significantly, shipping companies will be very excited to invest in new ships, the probability even reach 81.8% due to the strategy of competitive strategy.

Regarding the country of construction, more than 50% of the world's ships are built in China, followed by Japan. China and Japan have undertaken most of the world's shipbuilding business. Because the two builder countries of China and Japan have a high negative correlation, So China and Japan have a competitive relationship in shipbuilding. In addition, compared with the small boat type, European and American countries build most of the large ship type because the technology of the European and American countries is more advanced.

Dry bulk shipping companies with higher market share and market share increase tend to increase investment, shipping companies with higher market share tend to invest in Capesize, and shipping companies with greater market share growth tend to increase investment in Panamax. And large companies are more likely to implement expansion strategies than small

companies. When competitors are expanding, shipping companies are more inclined to reduce investment in Handymax and Capesize. There is no difference in the response of large and small companies to competitors.

The empirical estimation of stepwise regression shows that the higher the new-building price and bunker, dry bulk shipping companies tend to choose small ship type like Handysize or Supramax due to the less cost. In addition, the higher the freight rate and the demand, the ship company prefer to choose Panamax. Dry bulk shipping companies whose market share is rising rapidly is also prefer to invest in Panamax that can get economies of scale and can dock at most ports.

Studying the investment decision-making factors of dry bulk ships can help shipping companies avoid risks and increase profits. Which has important practical significance for dry bulk shipping companies. Although China is currently the world's largest shipbuilding country and has undertaken a large number of shipbuilding orders, China needs to develop its soft power in shipping if it wants to build a comprehensive international shipping center. And the ship investment is one of key areas. This study's empirical research on new ship investment and ship type selection can give some suggestions to the government and help dry bulk shipping companies formulate future investment and development plans.

References

[1] Alizadeh, A. H. (2013). Trading volume and volatility in the shipping forward freight market. Transportation Research Part E, 49(1).

[2] Alizadeh, A. H., & Nomikos, N. K. (2003). The price-volume relationship in the sale and purchase market for dry bulk vessels. Maritime Policy & Management, 30(4).

[3] Benacchio, M. F., Claudio ; Musso, Enrico. (2007). The liner shipping industry and EU competition rules. Transport Policy, Vol.14(1), pp.1-10.

[4] Clarksons. (2019). Shipping Intelligence Network Timeseries. Clarksons.

[5] Dinwoodie, J., Landamore, M., & Rigot-Muller, P. (2014). Dry bulk shipping flows to 2050: Delphi perceptions of early career specialists. Technological Forecasting & Social Change, 88.

[6] Fan, & Luo. (2013). Analyzing ship investment behaviour in liner shipping. Maritime Policy & Management, 40(6).

[7] H.Alizadeh, A., & K.Nomikos, N. (2007). Investment timing and trading strategies in the sale and purchase market for ships. Transportation research. Part B: methodological, Vol.41(1), pp.126-143.

[8] Le, D. T., & Jones, J. B. (2004). Optimal investment with lumpy costs. Journal of Economic Dynamics and Control, 29(7).

[9] Lian, Jin, & Yang. (2019). Optimal container ship size: a global cost minimization approach. Maritime Policy & Management, 46(7).

[10] Luo, M., & Kou, Y. (2018). Market driven ship investment decision using the real option approach. Transportation Research Part A, 118.

[11] Nwokedi, T. C., Eba, M. N.-U., Ifiok, O., & Leonard, N. (2018). Assessment of Shippers and Ship Owners Ship and Charter Type Choice in the Wet and Dry Bulk Ship Brokering Market: Knowledge Guide for African Indigenous Ship Brokers LOGI - Scientific Journal on Transport and Logistics, 9(1).

[12] Stent, H. B. B. A. F. (2005). Ship Investment under Uncertainty: Valuing a Real Option on the Maximum of Several Strategies. Maritime Economics & Logistics, Vol.7(1), p.19.

[13] Stopford, M. (2004). Maritime Economics. Taylor and Francis, London: Routledge.

[14] Sung, P., Wang, Y., Yeo, G., & Adolf. (2014). System Dynamics Modeling for Determining Optimal Ship Sizes and Types in Coastal Liner Services. The Asian Journal of Shipping and Logistics, 30(1).

[15] UNCTAD. (2019). Review of Maritime Transport. United Nations Publication, New York and Geneva.

[16] Wu, Yin, & Sheng. (2018). The Dynamics of Dry Bulk Shipping Market Under the Shipping Cycle Perspective: Market Relationships and Volatility. Transportation Research Record, 2672(11), 1-9.

[17] Xu, J. J., & Yip, T. L. (2012). Ship investment at a standstill? An analysis of shipbuilding activities and policies. Applied Economics Letters, 19(3).

[18] Yin, Wu, & Lu. (2019). Assessment of investment decision in the dry bulk shipping market based on real options thinking and the shipping cycle perspective. Maritime Policy & Management, 46(3).