The Asian Journal of Shipping and Logistics 33(2) (2017) 085-093

Contents lists available at ScienceDirect

The Asian Journal of Shipping and Logistics

Journal homepage: www.elsevier.com/locate/ajsl

Study of the Optimal Timing of Container Ship Orders Considering the Uncertain Shipping Environment

Jun Woo JEON[a], Gi Tae YEO[b]

[a] *Ph.D. Candidate, Incheon National University, Korea, E-mail:jwjeon0329@gmail.com (First Author)*
[b] *Professor, Incheon National University, Korea, E-mail:ktyeo@inu.ac.kr (Corresponding Author)*

A R T I C L E I N F O

Article history:
Received 15 Feburary 2017
Received in revised form 31 May 2017
Accepted 10 June 2017

Keywords:
Shipping company
Container ships
Ship orders
CCFI
System dynamics

A B S T R A C T

This study aims to apply System Dynamics (SD) to analyze the optimal timing of container ship orders by considering the uncertain shipping environment. The collected monthly data for 12 years was obtained from the China seaborne container trade (CSCT) and the China Containerized Freight Index (CCFI). Containership fleet development and the prices of new and second-hand container ships were classified based on five container vessel sizes (January of 2004–December of 2015). The period of simulation for this study was from 2004 to 2020. To analyze the optimal timing for the container ship orders, container ship fleet development as a supply factor and the CSCT as a demand factor, both of which are components of CCFI, were simulated. After the first simulation, CCFI was simulated holistically. Based on the CCFI simulation results, it was possible to develop three optimal timing scenarios for ship order placement. The CCFI for October 2016 was in the initial entry status of a short-term rebound, which makes it possible for shipping companies to order ships without the risk of revenue loss. The second best time period is May 2018, before the CCFI recovery of May 2019. The third best time for ship orders is later in 2020 for a CCFI recovery after 2021.

1. Introduction

The shipping industry is a capital-intensive industry because high investments are required to purchase ships. For instance, the cost of a 15,000 Twenty-Foot Equivalent Unit (TEU) post-Panamax vessel is around USD $154 million (Clarkson's Shipping Intelligence Network, 2015). Shipping companies should pay half of the total costs to purchase a large new ship (Luo & Fan, 2010). Therefore, liner shipping companies must consider the cost involved in investing in ships. Either insufficient investment or over-investment may result in not only a decrease in a company's market share but also deficits. Furthermore, it endangers a company's long-term competitive position, which results in a deficit due to the high costs during a time of low freight rates (Fan & Luo, 2013).

A shipping company can find it difficult to decide on an optimal time to

http://dx.doi.org/10.1016/j.ajsl.2017.06.006

2092-5212/© 2017 The Korean Association of Shipping and Logistics, Inc. Production and hosting by Elsevier B.V.
Peer review under responsibility of the Korean Association of Shipping and Logistics, Inc.

invest in ships due to the complex and volatile environment of the shipping industry. (Alizadeh & Nomikos, 2007). Thus, the timing and decision to invest are significant factors that impact a shipping company's ability to be competitive in the shipping market (Celik et al., 2009).

The total volume of world traffic has increased gradually, except for 2008, due to the financial crisis, during which the traffic volume dramatically decreased. After the crisis, the traffic volume bounced up and freight rates soared and the number of ships a company needed to purchase was based on the shipping lines' overestimation as a recovery of the financial recession. Since 2010, a shipping company's decision to buy ships has out-lasted the shipping market recession; this has resulted in an oversupply of ships and a decrease in the freight rates. Based on this perspective, this study aims to analyze optimal time as the primary factor that shipping companies use to order a container ship.

The remaining parts are organized as follows: Chapter 2 covers the theoretical background of the ship investment and relevant research. Chapter 3 introduces system dynamics and Chapter 4 suggests the model for ship order and the results. As the last, Chapter 5 concludes and summarizes the meaning of the results.

2. Literature Review

Celik et al. (2009) extended the principles of Quality Function Deployment (QFD) to the shipping investment process via the initially suggesting the vessel of the quality framework. In addition, by incorporating Fuzzy Analytic Hierarchy Process (FAHP) and Fuzzy Axiomatic Design (FAD) algorithms into the Ship of Quality (SoQ) framework, quantitative results were included in the shipping investment decision. Performance of SoQ guarantees the consequences described for regular datasets and for recent trends in major markets of mega crude oil tankers, Suezmaxes and Aframaxes. Luo and Fan (2010) applied the selected model of the observed ship investment data to verify the ship owner's actions in investment decision making and the selection of a specific ship. They found that ship investment increased with increasing demand, but the prices did not increase. They also noted that the preference for large ships is more sensitive to the unit costs. They found that the replacement possibilities for new ships of the same size increased with the ship size, and it decreased for used vessels. Merikas et al. (2008) indicated that the ratio of proportion to the various ships in the tanker sector can be investigated and utilized as an efficient approach for investment decisions. The ratio of the anticipated motion is determined by owners, brokers, and entrepreneurs, and it is based on expectations and corporate decisions, with the expectation that an organization is operating in the appropriate operating sector. They created a correction error model using the size of Suezmax, Handysize, Aframax, and very large crude carrier (VLCC) ships. Investment decisions depend on many factors, which vary depending on the degree of the price ratio and the rate of adjustment of the degree of adjustment relative to the equilibrium level. Overall, Merikas et al. (2008) argued that they determined the ratio of the anticipated motion, namely the expectation and the corporate decision, with the expectation that the organization was operating in its appropriate operating sector. Alizadeh and Nomikos (2007) first investigated the combination of basic analysis and technical transactions based by the performance of trading strategies for dry bulk ship-oriented procurement markets. Alizadeh and Nomikos (2007) also identified the long-term relationship between imports and prices, which they used as an indicator of the investment in the transportation sector and the timing of the sale in the dry bulk shipping sector. To avoid potential damage in the trading model related data and the robustness evaluation, they conducted a test using the stationary bootstrap approach. The earnings–price ratios used for trading strategies performed better than strategies based on hold and buy in the old ship market, particularly in larger vessels, due to the high volatility in the market.

Fan and Luo (2013) analyzed the decision to expand capacity and ship choice. They characterized the possibility of scaling up capacity in accordance with market and corporate properties, and they examined the impact of these factors on expanding the scope of the expansion. Most of the expansion decisions were driven by the market, and larger companies are expanding to maintain market share. From the perspective of choosing vessels, the analysis outcomes reinforced the hypothesis that shipping companies make a decision about placing orders for new ships or second-hand ships prior to considering the ship size. Fans and Lou (2013) also argued that second-hand ship purchases are not preferred over new ship orders. For new orders, length reductions in the shipbuilding, the ship size, and the demand growth rate are factors generating increases in ship purchase preferences. For second-hand ships, the optimum size is the handy size. Gkochari (2015) demonstrated the perfect competitive investment strategy based on optional game options in dry bulk shipping. Gkochari (2015) investigated the impact of the delayed completion of building new ships and found that departing from an incomplete delay reduces the trigger value. He argued that the analysis could gain additional insight, and he explained the existence of boom-and-bust cycles in shipping. Rau and Spinler (2016) developed a real options investment model by the container industry with oligopolistic competition, taking into consideration the function of endogenous price, endogenous lead times, endogenous price formation of the market for old vessels, and effective fuel investment. They evaluated how to optimize capacity via cost, lead time, fuel use efficiency, competitive intensity, and number of players. They also investigated optimum investing policies. Finally, Rau and Spinler (2016) argued that strategic behavior can enhance corporate value, depending on the alliance.

A summary of the existing studies on ship investment shows that the following topics have been studied the most: the appropriateness of the ship price and an analysis of the effects of the ship price. In particular, fuel costs, economic factors, and ship operation-related variables were the factors that affected ship prices. However, the existing studies are limited since they only analyzed the determining factors of ship price. Furthermore, although the shipping freight rate is an important variable that is directly related to the revenue of shipping companies, few studies have been conducted on ship order time focusing on shipping freight rate. The present study contributed to the literature by conducting a simulation of a shipping freight index considering demand and supply and by proposing an optimum ship order time based on the shipping freight index. In the present study, demand was defined as the container freight volume, and container ships around the world were divided into 3,000–5,999 TEU, 6,000–7,999 TEU, 8,000–11,999 TEU, 12,000–14,999 TEU, and 15,000+ TEU, which were applied to the model. Furthermore, most of the existing studies that analyzed optimal ship order time targeted bulk industries. The present study investigated the optimal timing of a container ship order.