



Ocean carrier canvassing strategies with uncertain demand and limited capacity



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ABSTRACT

To study ocean carriers' canvassing strategies, we consider a sea cargo service chain where liner companies canvass using two strategies involving freight forwarders and non-vessel-operating common carriers (NVOCCs). This paper uses a principal-agent model to describe the relationships among these partners. We show that high capacity can encourage the freight forwarder to exert effort, whereas low capacity can prevent the liner company from identifying the NVOCC's private information. Using numerical examples, we investigate the effects of several parameters on strategy selection. Finally, liner companies have different strategy preferences for long-term development.

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1. Introduction

Ocean carriage is the most important mode of transportation, supporting the rapid development of international trade. In 2015, the volume of seaborne trade accounted for over 80% of total world merchandise trade, and some observers have estimated that maritime trade accounts for 55% of world trade in value terms (Hoffmann et al., 2016). As the backbone of worldwide ocean freight transportation, liner shipping is the mass transit system of the ocean, with regularly scheduled services of varying capacity between fixed geographical regions. Liner vessels, primarily containerships, transport roughly 52% of international maritime commerce in value terms (Brouer et al., 2014). During the shipping process, liner companies (i.e., carriers) face the risk of excess capacity due to fixed routes and fixed ship characteristics.

To make full use of their space, ships strive to achieve a full load, and liner companies put more weight on canvassing, the sales process through which the liner company provides container capacity to shippers who need to transport their goods by sea. Unlike in traditional sales, the liner company's canvassing can take place long before the shipping date in the contract market. Then, in the weeks leading up to the shipping date, if it has surplus capacity, the liner company also sells capacity in the spot market at a spot price that is lower than the price in the contract market.

A liner company can usually engage in canvassing in the contract market in two ways: (i) hiring a freight forwarder or (ii) involving a third party. In the former case, the freight forwarder acts as an agent of the liner company to canvass and accept reservations for capacity (vessel space measured in terms of TEU containers). At this point, the freight forwarder's only task is to look for shippers, and the liner company provides capacity at the regular price. In the latter case, the third party is usually a non-vessel operating common carrier (NVOCC), which developed from a traditional freight forwarding business and functions as a transportation intermediary between the liner company and the shipper. The NVOCC serves primarily as a whole-

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salers of ocean shipping capacity, booking large blocks of container capacity with the liner company through a purchase contract. Then, the NVOCC sells this capacity to shippers with smaller requirements at a resale price. Consequently, liner companies have two canvassing strategies. One is the *freight forwarder canvassing strategy* (FS) wherein liner companies sell capacity through freight forwarders in the contract market. The other is the *third-party canvassing strategy* (TS) wherein liner companies sell capacity through NVOCCs in the contract market. Both strategies may result in residual capacity that can be sold in the spot market. In the ocean transportation industry, these two strategies exist simultaneously. For example, one of the world's top ten liner companies, COSCO SHIPPING Lines Co., Ltd., operates all over the world through its subsidiary, COSCO International Freight Co., Ltd., a freight forwarder canvassing the Chinese market. Moreover, COSCO subsidiaries canvass many international markets, such as COSCO Germany and COSCO Greece in the European market.¹ In other words, COSCO SHIPPING adopts an FS in the Chinese market and in many international markets. However, on routes to the Americas, the company generally signs contracts with NVOCCs, that is, it adopts a TS. For instance, in the South American market, COSCO SHIPPING contracts with Perezy Cia Americas.²

Although most previous works treat freight forwarders and NVOCCs as the same, the two are quite different. First, freight forwarders, which only arrange the transport of goods, typically do not issue their own bill of lading and are generally not liable for physical loss or damage to cargo. In contrast, NVOCCs are independent transportation companies that are physically responsible for transporting goods; they issue their own bill of lading or equivalent document but do not operate the vessels by which ocean transportation is provided. Second, freight forwarders do not intervene in the transportation process; they provide traditional services such as document services, marina services, and customs clearance, whereas NVOCCs intervene throughout the transport process.³ Third, freight forwarders benefit from charging the liner company commissions, whereas NVOCCs benefit from the difference between the wholesale and resale prices when they resell capacity (Lee and Song, 2017). Moreover, liner companies can encourage freight forwarders to exert effort to improve shipper demand, whereas NVOCCs usually have unobservable abilities to resell capacity in the contract market and to attract shippers. Based on the characteristics of these two strategies, liner companies obtain high unit incomes under an FS but have low unit costs under a TS. Consequently, liner companies need to consider both advantages and disadvantages when selecting an appropriate canvassing strategy.

Based on the above discussion, it is very important to study liner companies' canvassing strategies and the relationships among various participants. Hence, we formulate the following research questions: (i) How should contracts be designed for each strategy? (ii) Which factors affect a liner company's strategy selection, and how do these factors affect the strategy selection? (iii) Which strategy will increase a liner company's sales volume in the contract market? To answer these questions, we utilize a principal-agent model in which a liner company (principal) delegates canvassing in the contract market to a freight forwarder or an NVOCC (agent), depending on the canvassing strategy. Principal-agent models form a very mature research area in economics and can be used to solve problems of moral hazard and adverse selection by designing appropriate contracts.

In our model, the liner company carries out shipping using a fixed ship between fixed geographical regions, running a fixed route with limited capacity and uncertain demand in the contract market. Under an FS, the liner company hires the freight forwarder, who can improve market demand via effort that is neither verifiable nor contractible. Thus, the freight forwarder may have an incentive to act inappropriately, which in turn may damage the interests of the liner company. In other words, the freight forwarder will have shiftless behavior (i.e., exert less effort); this results in a moral hazard problem. Under a TS, the NVOCC resells its purchased capacity in both the contract market and the spot market. In the contract market, the NVOCC usually has superior canvassing ability compared with the liner company, and this increases demand. This ability is the NVOCC's private information and is unknown to the liner company. Hence, the NVOCC may report to the liner company a false ability in order to make higher profits. The result is an adverse selection problem in which the liner company needs to identify this private information. Moral hazard and adverse selection are two classic contracting problems due to asymmetric information. The former occurs because the forwarder's unobservable effort leads to hidden action that involves informational asymmetry that arises after the signing of a contract, whereas private information results in informational asymmetry in the latter problem (Bolton and Dewatripont, 2005).

In both strategies, the liner company's limited capacity is an extremely important factor in the participants' decisions. Specifically, we obtain the following results. First, under an FS, high capacity can inspire the freight forwarder to choose a high effort level when the available capacity is limited. Second, under a TS, it is intuitive that the liner company will pay an information rent in order to discover the NVOCC's private information. The information rent is the difference in profits between possessing the NVOCC's private information and not knowing this private information; thus, the information rent represents the value of this information. Interestingly, when capacity is very limited, the liner company cannot identify the NVOCC's private information despite paying the information rent. Finally, the liner company's marginal profits under both strategies are nonincreasing in capacity: the more limited the capacity, the greater the impact of capacity on profit.

Based on the numerical examples, the liner company's strategy selection depends on many factors. First, with an increase in the regular price, there is a larger gain in the liner company's profits under an FS than under a TS; thus, an FS is preferable. Second, the liner company's high unit cost under an FS will increase the advantages of a TS, eventually making the optimal

¹ <http://www.cnshipnet.com/news/7/32944.html>; http://www.eworldship.com/html/2014/ShipOwner_0409/85270.html.

² <http://info.jctrans.com/news/cgs/20129201529176.shtml>.

³ http://www.fmc.gov/resources/ocean_transportation_intermediaries.aspx.

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