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Cooperation through capacity sharing between competing forwarders

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ABSTRACT

In this paper, we consider a shipping system consisting of one carrier and two shipping forwarders who compete on price for businesses from potential shippers. The carrier may quote different prices or a single price to the two shipping forwarders who will then order shipping capacity from the carrier and set the selling prices to the shippers before market uncertainties are revealed. Inspired by cooperation between competing parties in many industries including the maritime shipping industry, we propose a new model under which the shipping forwarders are allowed an opportunity to purchase shipping capacity from each other after they order capacity from the carrier but *before* they set the selling prices and satisfy demand, referred to as the *capacity reservation model*. We show analytically that capacity reservation between competing forwarders benefits both the carrier and the forwarders, leading to a win–win situation under various market conditions. Furthermore, capacity reservation can offset the negative effect of a carrier's pricing power which enables the carrier to charge discriminatory shipping prices to squeeze more profits out of the forwarders.

1. Introduction

The logistics and transportation industry is playing a more and more important role in global businesses nowadays. It is reported that the logistics and transportation industry in the United States is a $1.3 trillion business and accounts for 8.5% of the annual gross domestic product (GDP) in 2011. Among all the transportation sectors in the logistics and transportation industry, maritime shipping is the dominant component with about 78% of the U.S. exports by tonnage. Many multinational companies, e.g., GE, Philips and LG, have been relying on ocean ships to deliver their products from their factories to the markets and they are referred to as shippers.

In the maritime shipping industry, most ships are operated by a small number of shipping carriers, such as the A.P. Moller – Maersk Group, China Ocean Shipping (Group) Company and Hanjin Shipping. These carriers are huge in size and powerful in the industry. Between the carriers and shippers are a large number of shipping forwarders who serve as the key intermediaries in international trade. Shipping forwarders are international trade specialists who can provide a variety of functions to facilitate the movement of cross-border shipments (Murphy et al., 1992). Empirical research by Murphy et al. (1991)

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shows that over 90% of the large shippers in the United States use international shipping forwarders to help them with their importing or exporting businesses. For instance, Kuehne + Nagel, one of the largest shipping forwarders in the world, is handling over 2.9 million containers each year with the net revenue over $413 million in 2010 from the American market alone. Typically, a forwarder will preorder a certain amount of shipping capacity on a certain route from a carrier at a price and then try to fill the space with shipments from shippers who wish to transport their products on the route. The forwarders compete for businesses from the shippers on prices as well as service quality.

Nowadays, cooperation between competing parties is more and more common in many industries in various forms. For example, Samsung Electronics produces all the iPad displaying screens and a large proportion of the iPhone screens for Apple Inc., a competitor in the smart phone and pad markets worldwide. In Europe, co-marketing alliance is set up between two oil giants British Petroleum (BP) and Mobil (Robson and Dunk, 1999). American Airlines shares codes with Hainan Airlines on services between the United States, Canada and China. Eli Lilly and Ligand Pharmaceuticals formed a R& D alliance to develop a drug called ONTAK for the treatment of patients with recurrent cutaneous T-cell lymphoma (Xiao and Xu, 2012). Alliances are also common in the maritime shipping industry and allow ocean carriers to share their network capacity and improve profits, e.g., the CKYH Alliance consists of four leading Asian ocean carriers, COSCO, "K" LINE, Yang Ming, and Hanjin Shipping. Although the members are competing to attract customers in the same market, they cooperate with each other to take full advantage of the regional transship hubs and to build extensive feeder networks. Their cooperation extends to the North/South trades and new emerging markets, and to other sections of the transport chain by optimizing the alliance's resources such as terminals, chassis, inter-modal facilities and equipment. Recently, there is a call for cooperation between competing container ports in Hong Kong and south China to build a countervailing power and such a strategy is called *co-opetition* by Song (2003), which is a combination of competition and cooperation. However, there is little mentioning of cooperation between competing shipping forwarders, which are the key intermediaries in the maritime shipping industry. Motivated by various forms of cooperation between competing carriers as well as horizontal cooperation between competitors in other industries, we propose a brand new model to allow shipping forwarders to share their shipping capacity *before* setting the selling prices and satisfying demand from shippers.

In this paper, we consider a shipping system consisting of one carrier and two shipping forwarders since carriers often behave like monopolists or shipping cartels on certain routes (Podolny and Morton, 1999; Booz-Allen & Hamilton, Inc., 1991; Hoffman, 1998). As in some practice, the carrier as the leader may quote different prices or a single price to the two shipping forwarders who will then order shipping capacity from the carrier and engage in price competition for businesses from the shippers (Baluch, 2006). If there is extra capacity at one forwarder and extra demand at the other after satisfying demand from the shippers, capacity sharing will occur to mitigate capacity imbalance, which is also referred to as request allocation by Krajewska and Kopfer (2006) and referred to as the *Benchmark model* in our paper. In the *Capacity reservation model* that we propose, the shipping forwarders are also allowed an opportunity to purchase or reserve shipping capacity from each other after ordering capacity from the carrier but *before* setting the selling prices and satisfying demand from shippers. We analyze the effect of capacity reservation on the carrier and the forwarders' decisions and profitability and show that capacity reservation benefits both the carrier and the forwarders, leading to a win–win situation. It encourages the forwarders to collectively order more capacity from the carrier and generate more demand from the shippers at any carrier's shipping prices. Thus, the carrier has the motivation to charge discriminative prices to encourage the forwarders to engage in capacity reservation, even when the forwarders are identical, in which case capacity reservation occurs from the forwarder with a lower shipping cost to the one with a higher shipping cost. In general, the carrier will charge the small forwarder a lower price to encourage the small forwarder to order more and sell some of it to the large forwarder for a profit. By doing so, the low cost forwarder can raise the selling price, which allows the high cost forwarder to do the same. As a result, all the parties benefit and capacity reservation results a win–win situation. Furthermore, it is obvious that discriminative shipping prices provide the carrier with more flexibility and allow it to extract the maximum profit under the benchmark model. We show that the shipping forwarders can mitigate such a negative effect through capacity reservation.

The remainder of this paper is organized as follows. We review related literature in Section 2 and provide the detailed models in Section 3. We then analyze the equilibrium solutions and compare the system performances for the two models with deterministic demand in Section 4 and stochastic demand in Section 5. The paper is concluded in Section 6.

2. Literature review

In the transportation literature, there has been much study on the competition and cooperation between different parties in the transportation networks. Acosta et al. (2007) analyze the factors affecting a port's competitiveness from the perspective of the shipping companies most active in container traffic in one of the Mediterranean ports. Lam and Yap (2008) study the competition for container transshipments between some major ports in southeastern Asia. Song (2003) suggests a strategy option called *co-opetition*, which is a combination of competition and cooperation between ports, and empirically explains the case of *co-opetition* between the container ports in Hong Kong and south China. He (2002) considers the interaction and tradeoff between efficiency and profitability on port pricing. Krajewska et al. (2008) study the collaborations among freight carriers by combining the scheduling problems and profit sharing problem under a cooperative game based model. Houghtalen et al. (2011) consider air cargo carriers alliances and propose a pricing mechanism to equitably allocate both alliance resources and profits. As for the cooperation between forwarders, Krajewska and Kopfer (2006) present