Strategic entry to regional air cargo market under joint competition of demand and promised delivery time

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In air cargo industry, mainline carrying and regional carrying are complementary services that form an air cargo service supply chain. Recently, many mainline carriers (MCs) have strategically entered upstream regional carrying service market to offer “one-stop-delivery” service and hence, competed with incumbent regional carriers (RCs). Note that promised delivery time (PDT) competition is essential and common in this industry. We study a MC’s entry decision using a joint demand and PDT competition model. We investigate the entry mode issue (fully-controlled or joint-venture), which influences the equilibrium profits and channel structure, and characterize the value of upstream competition and vertical cooperation between the MC and incumbent RC. Interestingly, we find that the MC’s upstream entry can result in a win-win situation, or a lose-lose situation for the MC and the incumbent RC. Comparing parties’ profits with and without PDT competition, we find that multi-dimensional competition may weaken the negative effect of upstream entry on the incumbent RC, resulting in a price advantage and PDT disadvantage for the MC. We also find that a fully-controlled entry mode is always a dominant strategy with or without PDT competition. Moreover, by assuming power distribution of the PDT, we find that the increase in service rate can result in a lower price and shorter PDT quotation for the MC. A(n) decrease (increase) of service rate strengthens (weakens) the PDT disadvantage, and this effect is strengthened with fully-controlled entry mode. We also examine Bertrand models and characterize the entry effects and the MC’s entry decisions under joint price and PDT competition.

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1. Introduction

Air cargo has become an increasingly significant source of revenues for airlines (Feng et al., 2015a). On average, cargo business generates more than twice the revenues from the first class segment (IATA, 2017). In 2016, industry wide FTKs (Freight Tonne Kilometers) grew 3.8%, the highest growth rate since the 2011 (Anjaparidze, 2017). Boeing forecasted that the air cargo market would continue growing by 4.7% per year and triple in revenue by 2033 (Feng et al., 2015b). The Asian markets, particularly China, are expected to grow even faster at over 15%. The express volumes increase explosively at average 54.66% in China since 2011. One critical driver for this dramatic growth is larger demand for faster and timelier delivery
(Li et al., 2009). This indicates an increasing competition on capacity and delivery logistics, especially in the emerging air cargo markets like China.

In air cargo industry, delivery logistics is an important competitive factor (Wen et al., 2011) to evaluate service quality. A recent experimental work by Park et al. (2009) reveals that promised delivery time (PDT) becomes the most important service measurement of an air cargo carrier. By definition, PDT is the sum of loading and unloading time, inventory time, airport processing time, waiting time and flight time (Feng et al., 2015b). Many air cargo carriers, especially the express carriers, make efforts to shorten delivery time and provide delivery service with time guarantee. For example, S.F. Express makes the delivery time commitment (e.g., SF Same-Day Delivery) when it signs service contracts with cargo shippers. S.F Express also offers monetary compensation (full refund) if the shipments are delivered later than the committed transit time.1 Similarly, UPS provides delivery time guaranteed service (e.g., UPS Next Day Air Freight), and the UPS Air Freight Terms and Conditions of Contract states that UPS will refund the transportation charges if it fails to deliver cargos within the committed time.2 Therefore, air cargo carriers must be very careful to make delivery time commitment (i.e., PDT), and delay may bring profit loss, such as delay cost and reputation loss. Being aware of this, in this paper, we mainly focus on the express service, where carriers place paramount emphasis on PDT in air cargo industry.

Traditionally, competition on demand or price is commonly practiced in many industries. In air cargo market, multi-dimensional competition comprising PDT and demand-price is of great practical significance. Multi-dimensional competition involving PDT has also received increasing attentions in service industries (Wu and Chen 2014). This motivates us to characterize the most important property in air cargo industry: joint demand and PDT competition. In air cargo industry, mainline cargo carrying and regional cargo carrying are complementary services and form a supply service chain. For example, FedEx Express (FedEx) as a MC is responsible for mainline carrying. It takes orders and tells the PDT sum to shippers. In regional market, FedEx contracts with the RCs, who are in charge of the regional carrying and quote price and PDT of regional service to the MC. In practice, delivery time of mainline service is stable while regional service’s delivery time is volatile and elastic. Thus, for model tractability we focus on the PDT competition in upstream regional market by assuming the PDT of mainline service to be constant and exogenously given.

Many MCs rely on their RCs to provide regional services from smaller airport to the hub airports (Zou et al., 2016). In order to generate more profits and provide better services, many mainline carriers (MCs) strategically enter the upstream regional markets by owning a regional carrier (RC) and forming a new type of operator, the integrator (Zhang et al., 2007). For example, Air China Cargo, one of the three major MCs in China air cargo industry, has rapidly developed regional service in recent years and its cargo destination network has covered more than 100 cities in China.3 Fig. 1 shows its regional air cargo network coverage in West and East China. Similarly, in Euramerican market, it has become a common practice that MC enters the regional market by operating a RC under the MCs brand. As Table 1 shows, FedEx cooperates with 14 contract RCs, who operate regional services under FedEx’s brand. For instance, West Air provides feeder service on behalf of FedEx in California. Following their steps, in recent years, the Chinese government has invested many financial and material resources to develop the regional market. This induces an increasing tendency for MCs to enter the upstream regional air cargo market in China.

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1 Official website of S.F Express (http://www.sf-express.com/cn/en/).
3 Official website of Air China Cargo (http://www.airchinacargo.com/en/).
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