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The impact of hub hierarchy and market competition on airfare pricing in US hub-to-hub markets

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A B S T R A C T

This paper explores factors influencing the pricing behaviour of full-service carriers in hub-to-hub markets, which to date have rarely been the exclusive focus of research. Drawing on a 2009 dataset containing route and airfare information, we estimate a pricing model for the hub-to-hub markets in the United States. Our econometric analysis suggests that an airport's position in carriers' hub hierarchies, competition from low-cost carriers, and other market structure variables influence average airfares.

1. Introduction

Air travel demand in the United States is expected to increase to 1.2 billion passengers in 2032, a near-doubling compared to the 731 million passengers in 2011 (Federal Aviation Administration, 2012). In principle, such further growth of the domestic market implies major business opportunities for US carriers. However, there are on-going concerns about the poor financial performance of US carriers. American Airlines' recent filing for Chapter 11 bankruptcy implies that the largest full-service carriers (American, Continental, Delta, Northwest, United and US Airways) have recently gone through a period of major restructuring. Part of the recent financial woes can of course be attributed to the on-going financial and economic crises that began in 2007, which have temporarily stifled demand (Dobruszkes and Van Hamme, 2011). Nonetheless, whatever the source of the poor financial performance of US carriers, it is clear that constantly (re)examining pricing strategies will be of key importance in order to reap the potential benefit of an expanding market.

The extensive literature on airfare pricing strategies in the US aviation market predominantly focuses on (i) individual carriers' overall route networks (Chi and Koo, 2009; Lee and Luengo-Prado, 2005), (ii) the United States air transportation network as a whole (Borenstein, 1989; Brueckner et al., 1992) or (iii) specific airports (Borenstein, 2005; US Department of Transportation, 2001). As a consequence, there has been relatively little research exclusively focused on how carriers determine airfares in hub-to-hub (HH) markets, where both origin and destination are to some degree dominated by a full-service carrier (FSC). A major exception is the work of Vowles (2006), who found that route structure and competition between carriers (especially from low-cost carriers) play prominent roles in determining airfares in HH markets.

In his analysis, Vowles included two route structure variables: routes where a single carrier controls both endpoints (i.e., ROUTE1, such as Newark–Houston in the erstwhile Continental network) and routes where two different carriers control the endpoints (i.e., ROUTE2, such as Salt Lake City–Cleveland for Delta and Continental). However, what remains unclear is how hubs and their service levels are defined because 'the lack of any universally accepted definition of hub can be confusing in debate' (Button, 2002, p. 180). In addition, the operationalization of ROUTE1 did not consider the variation in the 'levels' of hubs within a carrier's network. However, previous research has shown that service levels do not simply vary between 'hubs' and 'non-hubs', but also amongst a carrier's hubs.[1] For instance, Shaw (1993) divides hubs into 'national hubs' and 'regional hubs' based on the 'importance' of an airport in a carrier's network, while Ivy (1993) distinguishes between 'primary hubs' and 'secondary hubs' based on the levels of transfer traffic. This 'hierarchy of hubs' suggests that the service levels of the routes connecting these hubs within a carrier's network will also be different, while the ensuing difference in HH routes may thus also impact the pricing strategies of the different carriers: it can be hypothesized that routes involving more dominant hubs can be related to higher airfares. This information is

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[1] It is worth noting that this angle of defining hubs is different from that of the Federal Aviation Administration (FAA), who classifies hubs based on the share of the total number of US domestic airline passengers rather than an airport's place in a carrier's network.

important for carriers and global alliances willing to maintain or establish multi-hub-and-spoke networks when they determine airfare pricing, frequencies and capacities for inter-hub routes (Holloway, 2008).

The purpose of this paper, therefore, is to extend Vowles' research through a more refined analysis of the impact of hub hierarchies on pricing in US HH markets. We hypothesize that (1) the presence of hub hierarchies may be relevant as there may be differential impacts based on the level of 'hubness' of both points on a route, while (2) there may be duopolistic effects or intensive competition in routes connecting hubs of different carriers. In our model, we therefore adopt a more refined operationalization of the notion of 'hub-to-hub routes' and hierarchies among hubs. Our empirical framework is thereby centred on the overall HH market as 'produced' by the six largest FSCs (at the time of the data gathering) in the US.

The remainder of this paper is organized as follows. Section 2 reviews previous studies on the ways in which network structure and market competition determine airfares and yield in the US airline industry. Section 3 defines HH networks in the US and introduces our data and model. This model is operationalized in Section 4, where the results of the overall HH market are used to illustrate how network structure, market competition, demand and cost variables, and market structure influence pricing strategies. In Section 5, we summarize the main implications of our analysis and outline some avenues for further research.

2. Literature review

2.1. Network structure in the business models of US carriers

Network structure is related to the business model adopted by US carriers and has dramatically shifted since the industry deregulation in 1978. Although devising carrier typologies becomes an increasingly difficult task, the literature generally distinguishes between two types of carriers: full-service carriers (FSCs) and low-cost carriers (LCCs).

FSCs are associated with a hub-and-spoke (HS) network structure, whereby a significant proportion of national and international flights is concentrated at their hubs (Button, 2002; O'Kelly, 1998). HS network structures allow airlines to exploit productive efficiencies from economies of traffic density (Nero, 1999). Associated with this type of network structure, FSCs run a complex business model by bundling a series of services. For instance, they develop sophisticated yield management techniques to utilize their fleet with multiple aircraft types. In addition, they offer in-flight entertainment, VIP waiting lounges, and other 'frill' services (Hazledine, 2011).

LCCs deploy a different network strategy from FSCs: point-to-point (PP) network structures offering more direct flights (Gillen and Morrison, 2005). The PP organization has distinct productivity advantages, such as reduced transaction costs and travel time related to the absence of a transfer system (Taneja, 2004). LCCs also have a simpler business model in terms of the 'extra' services being offered beyond the mere connection. For instance, the US Department of Transportation definition of LCCs focuses on dimensions like (i) the presence of a single passenger cabin class, (ii) 'no frills' service, (iii) standardized aircraft utilization and other characteristics.

Although this distinction between FSCs and LCCs continues to stand as the foremost difference amongst carriers, the reality is far more complex. For LCCs with sound PP networks, it is possible to leverage their networks by providing connecting services between existing airports within their networks to enjoy economies of airport costs (such as Southwest's network strategy) (Boguslaski et al., 2004). This strategy is, however, markedly different from the FSCs' HS network, whereby network economies are realized by adding more new destinations to their hubs and profitability heavily depends on connecting traffic. Moreover, recently launched LCCs tend to organize HS networks (e.g., Air Tran at Atlanta, Frontier at Denver and JetBlue at John F. Kennedy) (Reynolds-Feighan, 2001). It should be noted that their entry pattern (such as JetBlue) is still dominated by providing non-stop services, while opening new one-stop connections may be considered after non-stop entry (Müller et al., 2012). Meanwhile, FSCs have launched their own low-cost subsidiaries in response to the low-cost competition (e.g. Song by Delta) (Graham and Vowles, 2006).

2.2. The impact of network structure and market competition on the pricing behaviour of US carriers

Broad literature deals with the factors influencing airfares and yields. This paper focuses on studies that explicitly consider the role of network structure and competition. In the next section we will use this review to select variables in our analysis of the HH market.

The relationship between network structure and pricing originates from the dominance of carriers adopting a HS business model at their hubs. Pricing tends to be influenced by dominance for two reasons. First, the very presence of hubbing tends to reproduce its engendered monopolistic tendencies as it deters other carriers from entering (Goolsbee and Syverson, 2008; Oum and Tretheway, 1990). Second, and more implicitly, carriers may dominate airport facilities at hubs (e.g., slots and gates), thus providing a better level of service (Ciliberto and Williams, 2010; Williams and Snider, 2011). Based on these advantages, carriers adopting a HS network can charge higher fares on routes to/from their hubs (Borenstein, 1989; US Department of Transportation, 2001), especially on the routes connecting their hubs (henceforth termed 'dominant routes'). Even though this so-called 'hub premium' has decreased over the last 10 years, some routes from/to hubs (e.g., those centred in Charlotte, Cincinnati, Minneapolis, and Memphis) are still characterized by significantly higher fares (Borenstein, 2005).

A carrier's pricing strategy is, however, also strongly influenced by its competitors' behaviour (Bresnahan and Reiss, 1991). This includes the routes between hubs of different carriers (henceforth termed 'strategic routes') characterized by either fierce competition to 'steal' passengers or the replication of hub premiums because of duopolies.

The dramatic growth of LCCs has been a principal driver for shifting airfares in the US airline industry. Research by Windle and Dresner (1995) and Dresner et al. (1996), for instance, has shown that LCCs tend to lower airfares on the routes they enter. It is useful to distinguish between the influence of Southwest Airlines and other LCCs, as the former has had the most significant impact in this regard. Dresner et al. (1996) found that yield was reduced by approximately 53% when Southwest served a route, while a 38% yield reduction occurred when other LCCs were included in the model. Incumbent FSCs also continue to respond differently to the entry of Southwest compared to the entry of other LCCs. Daraban (2007) suggests that incumbents cut their fares twice as much when Southwest entered the market compared to other LCCs.

Addressing the relevance of a competitor's behaviour is, however, more intricate because of the presence of airports in close proximity to hubs. Airports are increasingly part of multi-airport systems (MAS) (de Neufville, 1995; Derudder et al., 2010), implying multiple gateways for accessing metropolitan areas. Recent research has shown that LCCs not only influence pricing and traffic patterns at the airports they serve, but also at the other airports in a MAS (Brueckner et al., 2013; Tierney and Kuby, 2008; Vowles, 2001). This competitive effect has, for instance, been