Transportation Research Part E 98 (2017) 151–170

Contents lists available at ScienceDirect

Transportation Research Part E

journal homepage: www.elsevier.com/locate/tre

Dynamic pricing and market segmentation responses to low-cost carrier entry

Rafael R. Varella, Jessica Frazão, Alessandro V.M. Oliveira *

Center for Airline Economics, Aeronautics Institute of Technology, Brazil

ARTICLE INFO

Article history:
Received 20 September 2016
Received in revised form 14 December 2016
Accepted 23 December 2016

Jel classification:
D22
L11
L93

Keywords:
Airlines
Yield management
Distribution management
Online travel agency

ABSTRACT

This paper develops an empirical model of online airfares to inspect the impact of the entry of a low-cost carrier (LCC). We utilize a database collected from the website of an online travel agent in Brazil. We test whether incumbents reshape their airfare temporal profiles in an attempt to attract the price-sensitive passengers who constitute the target market of the newcomer. Our results suggest that LCC entry partially spoils the existing market segmentation schemes of incumbents, forcing them to revise their distribution management strategy, simplify their fare structure and migrate from a non-monotonic to a weakly monotonic price curve.

1. Introduction

Airline dynamic pricing has traditionally been associated with the notion of proactive management of fare offerings by airlines as a flight departure nears - the average "temporal profile" of airfares over the reservation period. One of the most recognized motivations for dynamic pricing in the air travel industry is profit maximization through market segmentation. Airlines segment customers by carefully customizing their products - flight attributes, price, associated restrictions and ancillaries - to induce not only self-selection but also a "self-revelation" of individual preferences and, ideally, of each individual's willingness to pay. The most traditional scheme of airline market segmentation considers the timing of flight/fare searches by passengers to be a mechanism for such revelation. Different price curve patterns may emerge according to the different patterns of booking arrival requests by the passenger segments identified in the market. Additionally, the effectiveness of carriers' yield management systems in avoiding revenue dilution through passenger buy-down behavior dictates the relative success of the overall market segmentation approach.

Thus far, the literature on airline dynamic pricing has virtually ignored the important issue of how incumbent airlines adjust their temporal profiles when exposed to competition from low cost carriers (LCCs). Although the impact of LCCs on the *aggregate* prices of incumbents is well documented by the literature, including Windle and Dresner (1999), Morrison (2001), Hofer et al. (2008), Goolsbee and Syverson (2008) and Brueckner et al. (2013), among others, few studies

* Corresponding author.
E-mail addresses: rafael.r.varella@gmail.com (R.R. Varella), jessica.frazao@gmail.com (J. Frazão), alessandro@ita.br (A.V.M. Oliveira).

http://dx.doi.org/10.1016/j.tre.2016.12.010
1366-5545/

have considered the consequences of LCC entry on the *dynamic pricing* of incumbents. Most studies of airline dynamic pricing focus on the temporal profiles of low cost carriers *per se* - such studies include Alderighi et al. (2015b), Bilotkach et al. (2015) and Gaggero and Piga (2011). Two of the few exceptions are Mantin and Koo (2009) and Alderighi et al. (2015a). Mantin and Koo (2009) develop an econometric model of dynamic price dispersion and find evidence of an intensification in the "high-low" pricing strategy to respond to the LCCs and thus an increase in airfare volatility in the market from full-service carriers (FSCs). Alderighi et al. (2015a) utilize data collected from an online travel agency to investigate how the temporal profile of FSC prices is affected by code-sharing agreements, controlling for the total number of low cost carriers operating on the route in their Heckit specification. They estimate that the presence of an LCC reduces not only the fares of incumbent airlines by 4–5% but also the likelihood of offering code-sharing agreements. Although these papers have investigated the temporal profiles of major incumbents facing LCC competition, they have not addressed the issue of how temporal profiles may be adjusted by carriers in response to such increased competition. Our main contribution is to specify and estimate an econometric model of dynamic airline pricing that aims to empirically examine the possible changes in the temporal profiles of fares after the entry of an LCC rival. We test whether incumbents reshape their airfare temporal profiles in an attempt to attract the price-sensitive passengers who constitute the target market of the newcomer. In addition to the price responses to entry, we consider the possibility of reactions in another important dimension of airline competition: the management of distribution channels. Specifically, we test whether incumbents increase the availability of their airfares on an online travel agent (OTA) to intensify competition with the LCC for the early-booking price-sensitive passengers in that sales channel.

Our econometric approach utilizes an original database of airfares collected from the website of an important OTA player in Brazil. The database comprises the domestic airport-pairs of the São Paulo Multiple Airports Region in Southeast Brazil - the most populous metropolitan area and the largest aviation market in the country. As a case study, we investigate the impact of the entry of the LCC Azul Airlines at a secondary airport in the region on the airfares of the two dominant carriers in the domestic market, Tam and Gol airlines. The LCC had rapidly expanded in the region, increasing from 0.66 million enplanements in 2009 to 3.61 million in 2012 and reaching a 15.7% market share. We utilize a Heckit estimation approach to correct for sample selectivity issues that may arise due to the unobserved interaction between yield management and distribution management strategies. We also investigate whether the entry of the LCC produces any effect on the incumbents' distribution management strategies to allow the incumbents to better face the enhanced competition on that sales channel.

The remainder of this paper is organized as follows: Section 2 presents the theoretical framework, with a description of relevant issues related to airline fare distribution and availability in the modern air transport industry. We also present a literature review of airline dynamic pricing and price responses to LCC entry, along with our proposed conceptual model. Section 3 presents our research design, with a description of the application, the data set, the development of our empirical model and the estimation strategy employed. Section 4 presents the estimation results, along with some robustness checks and the discussion of the limitations of the study. The final section contains the concluding remarks.

2. Distribution management and dynamic pricing in the airline industry

In this section, we present a brief description of relevant issues regarding the distribution and pricing management in the airline industry (2.1). Additionally, we survey the literature related to airline dynamic pricing and price responses to LCC entry (2.2 and 2.3). And finally, we present a conceptual model of airfare determinants that constitute the guidance framework for our empirical strategy (2.4).

2.1. Airline strategic distribution management and airfare availability

Traditionally, the industry classifies the distribution of airline tickets into two categories: *direct channels* - such as airline-owned websites and call centers - and *indirect channels* - such as brick-and-mortar travel agencies, travel management companies, online travel agents (OTAs) and metasearch websites. See Although the "airline dot com" is possibly the fastest growing sales channel for carriers - see Alamdari and Mason (2006) -, third-party distributors still account for approximately 50–60% of their bookings.[1] In the United States - one of the largest online travel market in the world, with more than 150 billion dollars in revenues - the brands Expedia, Priceline, Orbitz, and Travelocity account for 44% of the flight bookings.[2] One of the most important benefits of OTAs and metasearch sites is that they potentially *reduce entry barriers* by providing information to consumers about most alternatives available in the market. The consequent reduction in search costs may therefore enhance market contestability by facilitating the entry of new airlines and inhibiting incumbents from exerting market power and increasing fares.

With respect to the online availability of fares, a progressive movement of carriers towards a more strategic use of their distribution channels has created a multiplicity of market situations. For example, whereas OTAs produce their screen results primarily by collecting the fare data through Global Distribution Systems (GDSs) such Amadeus and Sabre, the airlines' own websites are directly connected to their host systems. In principle, these differences may dictate the relative availability of

[1] "*The real NDC: Decoding the planned (r)evolution in airline distribution by IATA and airlines*" - tnooz, Jan 17, 2013.

[2] "*Competitive Landscape Of The U.S. Online Travel Market Is Transforming*" - forbes.com, Apr 8, 2014, and "*Benefits of Preserving Consumers' Ability to Compare Airline Fares*" - Charles River Associates, Prepared for Travel Technology Association, May 19, 2015.