Transportation Research Part A 96 (2017) 64–78

Contents lists available at ScienceDirect

Transportation Research Part A

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

An airline itinerary choice model that includes the option to delay the decision

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ARTICLE INFO

Article history:
Received 26 June 2015
Received in revised form 27 November 2016
Accepted 12 December 2016

Keywords:
Decision making
Dynamic settings
Choice modeling
Air transportation
Marketing

ABSTRACT

Choice situations with variable supply characteristics are found in many applications, including airline itinerary selection. This paper discusses the airline itinerary choice problem in dynamic supply settings. The paper develops a specially designed stated preference (SP) survey, which emulates an air travel website. The survey includes the option to delay the decision to choose an airline itinerary. The rich data set allows the estimation of discrete choice models of airline itinerary choice.

The paper presents selected model estimation and application results for two market sectors (tourists and business travelers) and two flight types (medium-haul and long-haul flights). In addition to expected results for several level-of-service variables such as flight cost, cancellation fees, connection times and punctuality percentages, the model estimates the expected value of delaying a flight purchase.

1. Introduction

Choice situations with variable supply characteristics are found in many applications, including airline itinerary selection. Typically, in airlines and travel agencies' websites, several itinerary characteristics change frequently, such as ticket prices and seat availabilities. In these situations, the internet acts as a data source and commerce platform, serving both firms and consumers. Firms are able to publish the dynamic adaptation of their supply according to demand and production cost, while consumers can continuously search for the most preferred product which maximizes their utility.

A significant number of air transportation applications using discrete choice modeling (DCM) are concerned with itinerary choices in various settings, mainly in the airline or airport levels. Early DCM studies on air transportation applications applied multinomial logit (MNL) models to investigate the effect of cost/fare on airline/aircraft choice (Gronau, 1970; Kanafani and Sadoulet, 1977; Nason, 1980). Following these early examples, a variety of topics related to airline choice were further investigated, such as the effect of frequent flier program (FFP) membership on choice, using econometric models (Nako, 1992; Chin, 2002). Airline choice research was done also on domestic and international air travel using MNL models. These include choice of international airlines in South Korea (Yoo and Ashford, 1996), choice of U.S. domestic airlines (Proussaloglou and Koppelman, 1999) and choice of domestic airlines in Israel (Bekhor and Freund-Feinstein, 2006).

More advanced DCMs in air transport research were implemented mainly due to their better flexibility. Hess and Polak (2006) investigated the effect of airline, airport and airport's access mode, using a nested logit model (NL). Warburg et al. (2006) focused on the influence of business travelers' characteristics such as demographics on their itinerary choice using Mixed MNL (MMNL) and MNL models.

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http://dx.doi.org/10.1016/j.tra.2016.12.004
0965-8564/

Another branch, with relatively limited attention, focused on choice behavior using online websites (Collins et al., 2012) and dynamic pricing (Lin and Sibdari, 2009), both using MNL models. The effect of departure date proximity to choice date on consumers' decision making was recently modeled (Drabas and Wu, 2013). This estimation was conducted on three periods (90, 30 and 5 days prior to departure) using segment-specific Cross-Nested Logit (CNL) models.

Although almost all studies mentioned above modeled choice in a static fashion, itinerary choice situations are dynamic in their nature, with pricing, availability and other product characteristics allowed to change over time. Given these product characteristics, the individuals might delay their decisions, sometimes in anticipation of possible better options or till they finalize their trip arrangements. This paper develops and estimates DCMs for the flight product choice problem in a dynamic context using standard model estimation methods. In contrast to previous models developed in the literature for airline itinerary choice, the models in this paper take into account the option to delay the purchase during the sales period.

The rest of this paper is organized as follows. Section 2 presents a general model framework for the itinerary choice model problem. Section 3 describes an empirical investigation of medium-haul and long-haul flights. In this section, a specially designed stated preference survey (SP) and DCM is described, and estimation results are presented. Finally, Section 4 provides conclusions regarding the case study results.

2. Itinerary choice model framework

The itinerary choice is being modeled here as a quasi-continuous process affected by the occurrence of airlines' yield management and other dynamic processes. A graphic representation of this model framework is depicted in Fig. 1. We start by defining three fundamental issues namely, the supply and demand sides, and the timeframe allocated to each of them.

Supply is provided by various airlines and online travel agents (OTA's). We assume that each player's actions on the supply side are driven by yield management practices causing price, seat availability and other variables to change dynamically over a designated timeframe (Talluri and van Ryzin, 2004). In addition to dynamic variables, an array of static variables is also included in each itinerary (departure and arrival times, in-flight entertainment system, etc.). Consumers, forming the demand side, are able to monitor price changes online for a given itinerary. We assume that consumers, behaving as utility maximizers, will try to find the itinerary which best fits them (Ben-Akiva and Lerman, 1985). Defining both players' types' actions as a continuous event raises the need to define the timeframe scope in which their actions are conducted. Incorporating each player's timeframes into a choice model is not trivial and is unique compared to other air transportation studies. Both airlines and consumers act during two time scopes, which consist of *sales period* and *choice period*, respectively. The airlines set a period starting with initial presentation of a flight on a website and ends when a flight departs, with most yield management and consumers' choice activity taking place during 90 days prior to departure. Therefore, the choice period, in which consumers choose their itineraries (or decide not to choose at all), is identical to the sales period, or shorter ($t_{Choice} \leqslant t_{Sale}$).

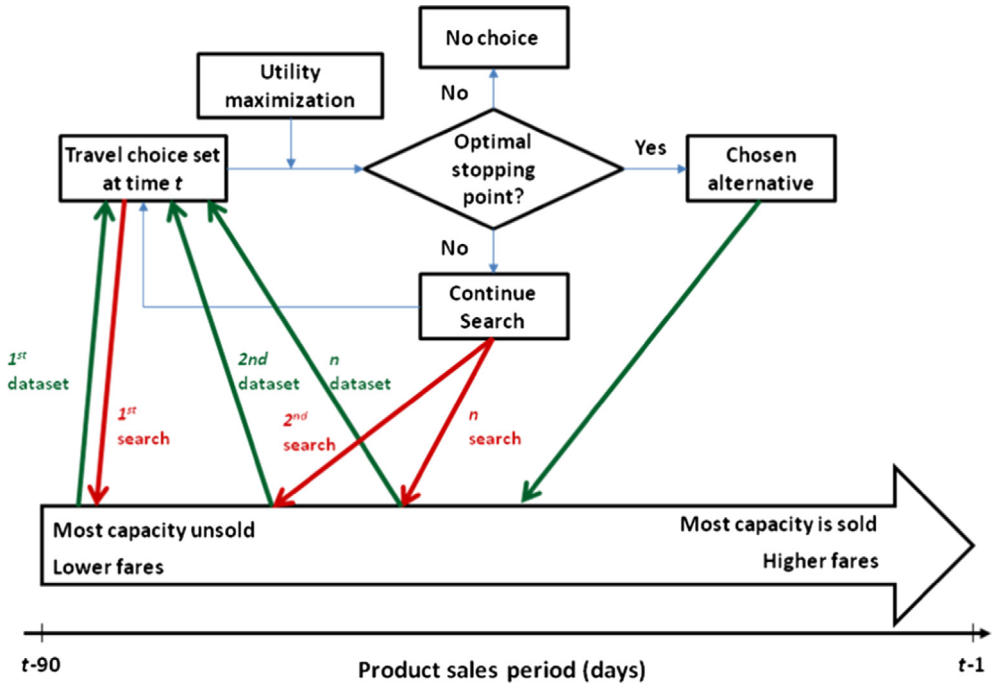

Fig. 1. Airline itinerary model framework.