An analysis of destination choice for opaque airline products using multidimensional binary logit models

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ABSTRACT

We investigate how customers respond to an opaque airline product offered by a European carrier. In this opaque product design, customers are randomly assigned to travel to one of approximately ten destinations; however, for a fee they may exclude one or more destinations from the choice set (or a particular package design) prior to learning which destination they will travel to. We use a multidimensional binary logit model to predict the probability that one or more alternatives will be chosen by a customer. Results show that customers are more likely to pay to exclude destinations located close to the origin airport and destinations that speak the same language as the origin airport. Length of stay, cost of living at the destination, and measures of destination attractiveness are also found to be significant predictors for some package designs. Based on these findings, we offer general recommendations for how to design opaque packages for airline customers.

1. Introduction and motivation

Over the past 15 years, the competitive structure of the airline industry has dramatically changed due to the emergence of online travel agencies (such as Expedia, Orbitz and Travelocity) that facilitated the comparison of prices across airline competitors. This emergence also coincided with an increased market penetration of low cost carriers (LCCs). LCCs use different pricing models than those used by legacy carriers. Specifically, the majority of LCCs use one-way pricing, which results in separate price quotes for the departing and returning portions of a trip. One-way pricing effectively eliminates the ability to segment business and leisure travelers based on a Saturday night stay requirement (i.e., business travelers are less likely to have a trip that involves a Saturday night stay). Combine the use of one-way pricing with the fact that the internet has increased the transparency of prices for consumers and the result is that today, almost half of all air leisure travelers state that they purchase the lowest price they find when using online channels (Harteveldt et al., 2004).

In this environment, several airlines are beginning to explore the viability of using opaque products to stimulate leisure travelers that exhibit a high degree of travel flexibility without cannibalizing revenue from business travelers. As defined by Post (2010), "an opaque product is defined as a product in which one or more of the attributes that make up the product are hidden from the purchaser (that is, they're not fully specified by the supplier) until after payment is made (e.g., see Gallego and Phillips, 2004; Fay, 2008)." From a historical perspective, it is important to note that the original applications of opaque airline products originated not by airlines, but by new companies such as Priceline and Hotwire. Many of the first articles in this area focused on: (1) Priceline, the first airline reverse auction site that entered the market in 1998 (e.g., see Kannan and

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Kopalle, 2001; Fay 2004; Spann et al., 2004); and, (2) Travelocity which, along with Expedia, entered the market in 1996 as an online travel agency and later started competing with Priceline and Hotwire by providing opaque products (e.g., see Smith et al., 2007; Zhouaoui and Rao, 2009).

To date, there have been several articles examining opaque products in the travel industry (e.g., see Gallego and Phillips, 2004; Gallego and Phillips, 2004) in the context of revenue management. Several authors have observed a potential for profit from the opaque sale of a distressed inventory (e.g., see Jiang, 2007). From a theoretical perspective, other authors have examined opaque products to determine the conditions under which offering opaque products may be worthwhile; the majority of these studies describe several favorable sales environments (e.g., see Fay, 2008; Jiang, 2007; Granados et al., 2008; Jerath et al., 2009).

However, despite the potential to increase revenues, few airlines have investigated the viability of directly offering opaque products themselves. Conceptually, it should be clear that the ability of airlines to offer an opaque product directly to customers has several benefits, most notably, the ability to tailor products to potential customers and the ability to increase brand awareness. Two airline applications of opaque products offered by airlines reported in the literature are overviewed by Post (2010) and include those by Freedom Air, a former subsidiary of Air New Zealand, and Germanwings, a wholly-owned subsidiary of Lufthansa. In the context of Germanwings, Post (2010) notes that "the customer can select a group of possible destinations, any one of which she is prepared to fly onto a particular departure and return date. A penalty fee is charged for each destination that she deletes from the group, thereby making the group smaller and reducing the uncertainty. Only after payment is made is the customer informed of her flight itinerary." Post (2010) continues, noting that this type of opaque product has resulted in increased load factors at Germanwings by 1.5%. Further, a detailed examination revealed that these new passengers are almost completely incremental, i.e., they represent new customer demand (Mang et al., 2009).

Post (2010) also analyzed a second opaque product variant used by Freedom Air in which "the destination and the number of nights at the destination were known, but the outbound and return flights were hidden within a customer-specified time window until some time before the actual departure date. In addition, the consumer could vary this advance warning as an additional parameter to influence the offer price." The increase in airline profits from this opaque product was approximately 6% (Mang et al., 2009).

The objective of this paper is to understand customer behavior as it relates to product selection for an opaque product (such as that offered by Germanwings). The paper does not focus on the revenue management implications of offering such a product, but rather focuses on understanding what features of the opaque product are attractive to consumers. This objective is consistent with prior studies published in *Transportation Research Part A* that have examined one or more aspects of air travel behavior (e.g., see Brey and Walker, 2011; Chen, 2008; Lu and Peeta, 2009; Peeta et al., 2008; Tsamboulas and Nikoleris, 2008).

The remainder of this paper is organized as follows. First, we review the opaque destination choice product. Next, we introduce the multidimensional binary logit model, which was used to investigate which destinations customers are more likely to pay to exclude from packages. This is followed by an explanation of the data used for estimation, results, and model validation. The paper concludes with recommendations on how to design profitable opaque destination products.

2. Flexible destination choice product

Data for this study comes from an opaque destination product offered by a European carrier. The opaque destination product enables customers to receive known prices (at steep discounts) in exchange for their willingness to accept uncertainty in their travel destination (but not their travel dates). Customers traveling from a particular airport are told that for a round trip fare of 39.98 euros, they will be randomly assigned to one of approximately ten destinations. If one or more of these destinations is unappealing, the customer may elect to exclude them for a fee. For each city excluded there is a fee of 5 euros. A minimum of three destinations must remain in the choice set, as the airline company must maintain some opaqueness so as to not dilute revenue from their traditional products. All destinations included in a package are served via non-stop flight.

An example of the flexible destination choice product is shown in Fig. 1. A total of four packages were examined for each of two origin airports. Fig. 1 shows these four packages (defined as the Western Europe, Eastern Europe, Culture, and Party
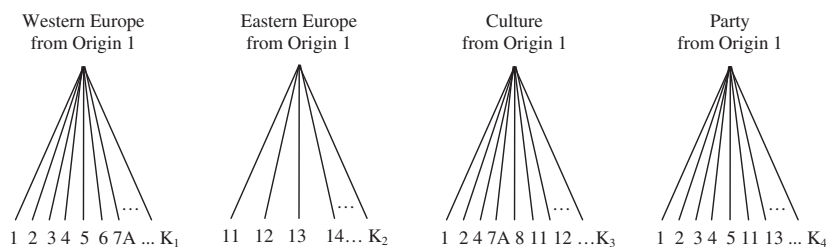

Fig. 1. Examples of different packages.