Latent air travel preferences: Understanding the role of frequent flyer programs on itinerary choice

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ABSTRACT

Many studies have used air itinerary choice data to identify preferences and tradeoffs of various flight service attributes, such as travel time, number of connections, and fare. Little has been done, however, to estimate the effect Frequent Flyer Programs (FFPs) have on itinerary choice. The goal of this paper is to quantify the impact of FFP membership on itinerary choice and identify discrete patterns of unobserved preference heterogeneity. For this purpose, we apply two modeling techniques using a set of stated preference data collected on 830 individuals. A Multinomial Logit Model (MNL) is first estimated and Willingness-To-Pay (WTP) values are calculated for the choice of flying an airline with which the individual has FFP membership compared with another airline where the individual has no FFP membership. These WTP estimates vary across different trip purposes and levels of FFP status. Our results indicate that FFP membership plays a strong role in airline choice, particularly for individuals with elite membership. We then capture random heterogeneity through the use of latent class models, using sociodemographic variables as class-membership covariates. The latent class model results indicate three groups of individuals with very different sets of preferences, particularly for FFP membership. The discrete segmentation indicates one class with very low WTP, one class with average WTP, and one class with extremely large WTP values. These results provide evidence that latent class models capture preference heterogeneity much better than the MNL model for air itinerary choice, particularly when considering the effects of FFP membership.

1. Introduction

Air travel has changed tremendously in the past decade. Online ticketing sites have replaced travel agents and passengers have access to more information about prices and itineraries than ever before. Airline costs have increased as well, primarily due to the rising costs of fuel (Airlines for America, 2014). Higher costs and more transparency for passengers make it difficult for airlines to attract demand in a profitable way. In the literature of air passenger demand, the focus has been on service attributes, such as flight frequency, on-time performance, and route structure. While these attributes are very important they are often difficult or expensive to change. Recently, increasing attention has been given to another aspect of air travel: Frequent Flyer Programs (FFPs), loyalty programs that are used to distinguish an airline's product from its competitors. These programs are under direct control of the airline and can contribute greatly to the attractiveness of its product

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over competing airlines (Martin et al., 2011). The focus of this work is to quantify the effects that FFPs have on passenger demand and identify market segments that vary with respect to these effects.

It has been claimed that FFPs can distort air transport competition, as the programs have a strong effect on passenger itinerary choice (Chin, 2002; Martin et al., 2011; Toh and Hu, 1988; McCaughey and Behrens, 2011). At the most basic membership level, the flight distance contributes towards future benefits with the airline through the accumulation of miles or points. At higher levels, the benefits are more immediate: free upgrades, complimentary checked bags, and a sense of improved customer service. These benefits likely influence customer itinerary purchasing behavior. A few studies (Adler et al., 2005; Garrow et al., 2007; Proussaloglou and Koppelman, 1999) have looked at the effect of FFP membership on itinerary choice as the part of a larger study of air travel preferences, but this aspect of air travel has received much less attention than other market share determinants, such as fare and on-time performance.

The goal of this paper is to quantify the level of FFP attractiveness by calculating Willingness-To-Pay (WTP) values for flying an airline with which the passenger has FFP membership compared to an airline where the passenger has no FFP membership. We will estimate WTP values using discrete choice models on stated preference survey data. A few studies have estimated WTP in a similar way. Hess et al. (2013) estimated WTP values ranging from $20 for standard FFP membership to $120 for elite FFP membership. Hess and Adler (2011) found similar numbers, ranging from $18 for basic FFP membership to $180 for elite FFP membership. Both papers incorporated WTP heterogeneity through the use of interacting socioeconomic dummy variables, such as income, trip purpose, and FFP status, with the service level variables, such as fare, travel time, and airline indicators.

This paper advances the research on FFP membership by estimating WTP heterogeneity through the use of a latent class model. We identify WTP heterogeneity using a class-membership model with sociodemographic variables as covariates. This approach is advantageous over explicit segmentation due to the lack of constraints on the characteristics of individuals within each segment. Each class reveals a discrete set of preferences defined primarily by the difference in the preferences observed through the choices of the individuals, rather than differences in individual characteristics.

1.1. Literature review

Air travel itinerary choice has been investigated from a variety of perspectives. Airport preferences in multi-airport regions were studied by Harvey (1987), Ishii et al. (2009) and Pels et al. (2003). Adler et al. (2005), Brey and Walker (2011), and Garrow et al. (2007) looked into the preference for desired departure times and arrival times. The choice of air carrier was studied by Hess and Adler (2011) and Proussaloglou and Koppelman (1999).

Chin (2002) used stated preference data to estimate a binary choice model for passengers' choice of flying Singapore Airlines. The model specification used dummy variables for FFP membership in Singapore Airlines' Krisflyer program. The results indicate that FFP membership is a significant driver in itinerary choice, but the effect is smaller in magnitude than flight schedule. No WTP quantification techniques or advanced specifications were used in this study, however. We use WTP calculations that allow us to quantify the tradeoff of FFP membership with various other flight characteristics, such as travel time and number of connections.

Martin et al. (2011) used a stated preference study to identify WTP for various flight characteristics for both FFP and non-FFP members. The results indicate that passengers with FFP membership are generally more willing to pay for certain service attributes, like seat pitch and food quality. Segmentation was made solely based on the FFP membership variable. We are interested in capturing the WTP for flying an airline with which an individual has FFP membership, so we use a different survey structure that allows for this kind of tradeoff between choices for each individual.

Adler et al. (2005) and Warburg et al. (2006) captured heterogeneity through the use of mixed logit models. In addition to extensive interactions through sociodemographic dummy variables, a random parameter specification was used to account for the unobserved heterogeneity across passengers. While useful at addressing preference differences across each passenger, the hypothesis of a continuous WTP distribution might not be the best representation of the true behavior. Latent class models enable us to identify discrete WTP heterogeneity, rather than assuming a continuous distribution. Greene and Hensher (2002) explored the differences between latent class models and random parameter specifications using mixed logit models. They highlighted advantages of both models, including the semiparametric nature of the latent class model, which can prevent the researcher from making "strong or unwarranted distributional assumptions about individual heterogeneity". While both model types are subject to assumptions from the researcher (specifically the form of the distributions for the mixed logit models and the number of classes and the class-membership model for latent class models), for this application we find discrete heterogeneity to give more intuitive results.

2. Data

The data used in this analysis comes from the RSG Air Passenger Survey which was fielded in 2012. The survey sample includes a total of 830 people across the United States. Each person faced a series of stated preference experiments that included two air travel itinerary alternatives. These experimental itineraries were pivoted off a reported trip the respondent recently completed. The itinerary attributes were varied according to a D-optimal design and include the various service levels such as travel time, connections, airline, aircraft type, arrival time and on-time performance. The D-optimality