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The relationship between on-time performance and airline market share: a new approach

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Abstract

We propose a new method of modeling the relationship between on-time performance and market share in the airline industry. The idea behind the method is that the passengers' decision to remain (use same airline) or switch (use other airlines) at time t depends on whether they have experienced flight delays at time $t-1$ or not. More specifically, we posit that the passengers who experienced flight delays are more likely to switch airlines for the subsequent flight than those passengers who did not experience delays. To capture such effect, we develop an aggregate-level Markovian type model that estimates the transition probability matrices separately for the passengers who experienced flight delays at time $t-1$ and for those who did not experience delays. The model was calibrated with the US DOT data. The study results imply that, once experiencing flight delays, passengers are more likely to switch airlines. The results also imply that on-time performance affects a carrier's market share primarily through the passengers' experience, and not though the "advertisement" of performance.

Keywords: Airline demand; On-time performance; Markov model; Non-linear regression

1. Introduction

Consider the following scenario. You and your colleague made a business trip from point A to point B. You used ABC airline, while your colleague chose airline XYZ. The ABC flight did not arrive on time because of some minor engine problems that were found just before the departure. Consequently, you arrived at point B 1 h behind the scheduled arrival time, and missed a very important business negotiation. Your colleague, on the other hand, arrived on time and was able to attend the important business negotiation that you had to miss. In this scenario, are you more

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likely to switch to another airline for the next business trip than your colleague? Most likely, the answer is "Yes".

The above example shows that the passengers' choice of airlines may be affected by the on-time arrival experience of passengers. This example also suggests that the passengers may show stronger reaction (switch to other airlines) when they experience utility losses (service level below their expectation) than when they experience utility gains (service level above their expectation). This type of asymmetric pattern in human response to gains and losses is known as the *loss aversion* (Tversky and Kahneman, 1991), and was recently introduced to the transportation literature by Suzuki and Tyworth (1998). Simply put, the property of loss aversion suggests that human beings evaluate product/service quality relative to a certain reference point (e.g., expectation), and give heavier weights to the losses (negative deviations from the reference point) than to the equivalent-sized gains (positive deviations). Although developed recently, the property of loss aversion is supported by significant empirical evidence. For example, a recent empirical study by Hardie et al. (1993) utilized the concept of loss aversion in their multinomial logit model of consumer brand choice, and showed that the model performance can be improved significantly by incorporating the loss aversion effect.

The loss aversion property seems to have potential for providing important managerial implications in the air transportation area, especially for gaining deeper insights into the nature of the relationship between airline demand and customer service quality such as on-time performance. The loss aversion property, however, has not been utilized in the studies of airline demand. A typical approach to modeling the effect of on-time performance on airline passenger demand is to express a carrier's sales (or market share) as a function of the carrier's on-time performance and other exogenous variables. Both linear and non-linear specifications are widely used. Examples of this approach include the studies by Dresner and Windle (1992), Nako (1992), Ghobrial and Soliman (1992), Dresner and Xu (1995), Proussaloglou and Koppelman (1995), Yoo and Ashford (1996) and Suzuki (1998). This approach, however, implicitly assumes that all passengers are homogeneous, i.e., all of the passengers show identical airline choice behaviors at time t regardless of whether they have experienced flight delays at time $t-1$ or not. This condition indicates that, if passengers are loss averse, the existing models will not capture the portion of data variance that is explained by the passengers' loss aversion tendencies.

In this paper we model the aggregate-level relationship between airline market share and on-time performance by using the framework that captures the effect of passenger loss aversion. To incorporate the loss aversion tendencies of airline passengers, we formulate a model that permits separate estimation of airline choice probabilities for the passengers who experienced flight delays at time $t-1$ and for those who did not. Although a model that possesses such a characteristic may best be constructed by using a discrete choice (disaggregate) modeling framework, we do not employ this approach for a practical reason. The disaggregate models can incorporate individual heterogeneity and may be more appropriate for modeling choice behaviors, but its use in the airline industry is difficult because of data unavailability. If using disaggregate choice models, one must use the data that are collected from a group of people over time (panel data), which probably are not available in the airline industry. The aggregate models, on the other hand, can be estimated by using the *available data*, such as the aggregate passenger travel data published by the US DOT. This condition implies that our model may be used quite conveniently by the airline management.