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Passenger airline choice behavior for domestic short-haul travel in South Korea

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ABSTRACT

When the Seoul-Busan line of South Korea's high-speed rail system, dubbed the Korea Train Express (KTX), entered service in November 2010, it was expected that this line would compete with air transport services for short-haul domestic journeys. Therefore this is a study about passengers' choice behavior when traveling short-haul domestic routes in South Korea. It utilizes MNL and NL logit models with selected variables, and the data required for the analyses were gathered through Stated Preference (SP) Techniques. The main SP survey was conducted for three weeks at departure lounges in Incheon International Airport in May 2012. The results reveal that fare, access time and journey time are significantly important with respect to passenger choice. The results further indicate that business travelers are more willing to pay than non-business travelers to reduce access and journey time. It is also noteworthy that reducing access time is more important than reducing journey time for short-haul domestic travelers. The conclusion is that it is significantly important for airline planners or local authorities that want to increase their local market share to invest in relatively fast access modes.

1. Introduction

The history of the low cost carrier (LCC) business in South Korea is relatively young; it is actually in its infancy in terms of its penetration into the country's air transport market. However, the LCC growth rate has been noteworthy in recent years, which indicates that LCCs may have generated new demand by attracting customers who would not have otherwise chosen to pay higher air fares, or it may have deprived the full service carriers (FSCs) of customers, penetrating the incumbent market. Direct competition between FSCs and LCCs is increasing across the market. Many evolving LCCs in Southeast Asia use particular strategies to attract customers such as the reduction or operation costs, greater efficiency and lower ticket prices. These kinds of strategies have become popular with short-haul passengers (Chang, 2010). South Korean LCCs transported 10.5 million passengers in 2011. The LCCs are increasing their presence in the domestic market, having a 29.4% domestic capacity share in 2011, marking it the first time the LCC penetration has approached 30%, as shown in Fig 1. On some domestic routes, including Seoul Gimpo-Busan, Busan-Jeju and Seoul Gimpo-Jeju, LCCs have more than 50% of the market share. Air Busan's Seoul Gimpo-Busan services account for 51.2% of all the carrier seats while Busan-Jeju have 39.7% and Seoul Gimpo-Jeju 9.1%, as shown in Fig 2.

High speed trains are expected to compete with air transport services for short – and medium– distance trips (Potorino, 2010), since high-speed train travel times are becoming shorter than air transport services when traveling from city to city (Nelldal, 1998, 2005). When the Seoul-Busan line of South Korea's high-speed rail system, dubbed the Korea Train Express (KTX), entered service in November 2010, it was expected that this line would compete with air transport services for short-haul domestic journeys. The capacity of the Seoul Gimpo-Busan air route is affected by competition with the KTX, which is depicted in Fig 3. Travel time on the KTX is between 2 and 2.5 h compared to the 55 min time for Seoul Gimpo-Busan. However, once boarding time and travel to and from airports are included, the KTX offers an as-fast or faster door-to-door journey time. LCCs and the KTX also compete in terms of providing the lowest fares. The one-way fare of the KTX is typically between USD 40 to 53. Air Busan's one-way fares are listed at between USD 45 to 61, but expensive fares typically have 5–10% discounts, making the actual ticket price in the range of USD 45 to 56.

In this competitive market situation, for local authorities, airport planners and airlines, it is important to know how passengers decide on their preferred method of travel (Pels et al., 2003). There are a number of airport and airline choice behavior studies in the previous literature. However, there is little research about the

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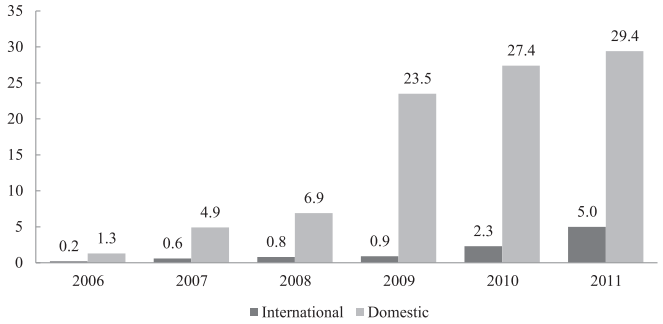

Fig. 1. LCC capacity share (%), 2006–2011.

passengers' choice behavior for short-haul domestic routes travel combining air and rail in South Korea.

2. Conceptual background

Passenger choices between air and rail are driven by a combination of the relevant attributes of time and cost, including travel time, terminal waiting time, access time and so on. When passengers choose a carrier, they may base their decision on a combination of factors, including the airline's market presence, schedule convenience, low fares, on time performance, reliability and the availability of frequent flyer programs (Proussaloglou and Koppleman, 1995). Hess et al. (2007) studied the airport and airline choice behavior with the use of stated preference survey data. This paper analyzes the significant factors affecting passenger choice behavior, including air fare, access time, flight time and airline and airport allegiance using multinomial logit model (Hess et al., 2007). Pels et al. (2003) used nested logit model and found that passengers are sensitive to fare, frequency, airport access time and airport access cost (Pels et al., 2003). Pels et al. (2009) studied the competition between full service and low cost airlines by analyzing the demand structure. They estimated not only the competition for passengers occurring between airports and airlines, but also the own-and cross-price elasticities based on a nested logit model (Pels et al., 2009). There are significant differences in choice behavior between business travelers and non-business travelers (Chang and Sun, 2012). Most business travelers have strict requirements regarding travel time and will seldom strive for lower prices because they are restricted by time inflexibility. On the contrary, leisure travelers will choose the lower price among two acceptable flight choices (Xiao et al., 2008).

In this paper we extend the work or Pels et al. (2009) by developing a model of FSC, LCC and high-speed rail that used the nested logit model to jointly consider air and non-air travel choice mode. We would like to understand passenger behavior in the market related to transport mode choice – these choices are mainly differentiated by their business models – and to find out if there are any differences in choice behavior between business passengers and non-business passengers with FSCs, LCCs and high-speed trains. Logit models are developed to see which factors are more effective in determining choice and if there are any differences in choice behavior among travelers.

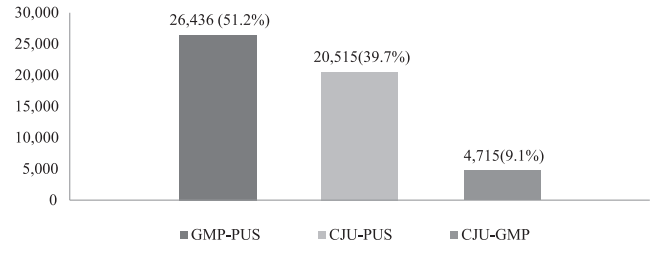

Fig. 2. The three domestic routes ranked based on capacity (seats), 2011.

3. Methodology

Discrete choice models are used to predict the probability that a decision maker will choose one alternative among a finite set. Probability and time series models are easier to implement than discrete choice models, but the former are limited because they do not capture or explain how individual airline passengers make decisions. Currently, there is a growing interest in applying discrete choice models in the airline industry. The interest in integrating discrete choice and other models grounded in behavioral theories with traditional revenue management, scheduling and other applications is also being driven by several factors including the increased market penetration of low cost carriers (Garrow, 2010).

The multinomial logit (MNL) model is a generalization of the binary logit model and is used to describe how an individual chooses among three or more discrete alternatives (McFadden, 1973). As with the binary logit model, MNL probabilities are derived from the assumption that error terms have a Gumbel distribution with mode zero and scale one (which implies a variance of $\pi^2/6$).

The MNL probabilities are given as:

$$P_{ni} = \frac{\exp(V_{ni})}{\sum_{j=Cn} \exp(V_{nj})}$$

An alternative formula for the MNL probability, which more clearly shows that only differences in utility are identified, is obtained by dividing the numerator and denominator by $\exp(V_{ni})$

$$P_{ni} = \frac{1}{\sum_{j=Cn} \exp[-(V_{ni} - V_{nj})]}$$

The nested logit(NL) model appeared just a few years after the MNL model (McFadden, 1977). Similar to the MNL, the NL is a choice model that is used to predict the probability that an individual will select one alternative out of a set of mutually exclusive and collectively exhaustive alternatives. Both MNL and NL models are based on random utility theory, but differ in how they represent substitution patterns among alternatives. The NL model represents a partial relation of the independence of identically distributed (IID) and independence irrelevant alternatives (IIA) assumptions of the MNL model (Hensher et al., 2010).

This study explored the travel mode choices of the domestic traveler using a model that utilized both the MNL and NL models. According to research on the impact of variables on passenger choice behavior, this study accepted the variables affecting the choice behavior of travelers. The logit model calibrates the variables to test, since air fare, access time, frequency and journey time were identified as major variables. This paper adopts an approach of analyzing the choice behavior for three mode alternatives, including FSC, LCC and KTX. The levels that each attribute could take as part of the experiment are shown in Table 1. Depending on the transportation mode or business model, different fare, access time, frequency and journey time levels were selected. It should be noted that fare and access time levels are composed using the current levels as a base; i.e. 60% or 50% for the lower level and 50% for the higher level, respectively. Also, frequency and journey time attribute levels are considered to be the real frequencies and time when making an easier choice. Once the variables have been determined, it is necessary to define an alternative set for the logit model analysis. Given the possible alternatives, a multinomial choice model is used in which it is assumed that a passenger will