A Stated Preference Approach to Modeling Airport Access

A.R. MAMDOOHI [1*], M. SAFFARZADEH [2] , A. TAHERPOUR [3] , M. YAZDANPANAH [4]

[1]Department of Civil & Environmental Engineering Faculty,
Tarbiat Modares University, TEHRAN, IRAN
[2]Department of Civil & Environmental Engineering Faculty,
Tarbiat Modares University, TEHRAN, IRAN
[3]Department of Transportation Engineering, Islamic Azad University, South branch,
TEHRAN, IRAN
[4]Department of Transportation Engineering, Islamic Azad University, South branch,
TEHRAN, IRAN
*Email: armamdoohi@ modares.ac.ir

1 Introduction

The identification of characteristics and factors affecting airport access mode choice is an important component in airport transportation system management and planning, which can assist decision makers in predicting air passenger behavior necessary for a better planning of airport public transportation system (type, capacity, fare, level of service, adding a new mode, …).

One of the early studies in the field was conducted by Ellis et al. using data collected in Baltimore-Washington airport, and multinomial logit model as the statistical tool; and found that purpose, travel cost and travel time were the significant parameters in passengers access mode choice [1]. Harvey developed multinomial logit models to investigate air passenger behavior in the San Francisco Bay Area. He concluded that travel time and travel costs have a significant effect on the choice of airport access mode [2]. Choo et al. used multinomial logit model to explore the most effective factors in travelers' choice in Korea and found that the choice of airport access mode is significantly affected by travel time, travel distance, trip purpose, age, gender, occupation, and income. Also they estimated access mode choice models for business and non-business travels and

found that the choice of non-business travels are more significantly affected by demographic characteristics than choice of business travels [3]. Alhussein developed a binary logit model to evaluate the access mode choice to King Khaled International Airport (KKIA) in Riyadh. He found that income, luggage, travel access time and nationality significantly affect mode choice [4]. Jou et al. using RP (revealed preference) and SP (stated preference) data, calibrated mixed logit models to identify air passenger behavior for new mass rapid system (TIA MRT) that connect Taoyan International Airport (TIA) to important traffic hubs. Results of their study indicate that in-vehicle travel time and out-of-vehicle travel time are two important factors in passenger choice. They also showed that the extent to which travel time improvements associated with public transportation reduces the market share of private transportation and taxi [5]. Tsambloulas et al. developed a multinomial logit model using revealed and stated preference data to investigate airport employees' commuting mode choice. Their results indicated that the employees are particularly sensitive to travel time, money costs and their income in the mode choice to airport [6].

Based on the results of literature survey, this paper presents a stated preference approach to modeling airport access. Multinomial logit modeling is used to explore air passengers' preferences for ground access mode choice to Mehrabad International Airport (MIA) in Tehran multi airport region using stated preference survey data. MIA, located in the west part of Tehran, the capital city of Iran, is now serving nearly 13 million passengers per year only in domestic flights and some pilgrimage international flights (haj flights to Kingdom of Saudi Arabia and Syria).

2 Methodology

Due to the nature of the response variable, a discrete choice random-utility model is used to predict air passengers' behavior., Multinomial logit models are calibrated for departing air passengers' access mode choice to MIA. Six modes proposed to access MIA includes metro, shuttle bus, shuttle van, private car-drop off, private car-parked and rental car.

Multinomial Logit model is presented by equation (1):

$$P_A = \frac{\exp(U_A)}{\sum_{j=1}^{J} U_j} \qquad (1)$$

P_A = The probability of choosing alternative A from among J alternatives

U_A = Utility function of alternative A

U_j = Utility function of alternative j

3 Data Collection and Data Characteristics

3.1 Data Collection

The survey designed for gathering necessary data is in compliance with Airport Corporative Research Program (ACRP report 26) [7]. About 90 percent of air passengers use private transportation for accessing MIA: rental car 75%, private car-parked 9%, private car-drop off 9%, bus 3%, and other modes 4% [8]. Two stated-preference face-to-face interview surveys were designed and conducted exclusively for this purpose. The stated-preference questionnaires were designed and administered on a 24-hour basis for a duration of 2 weeks in May and June 2011. 1581 departing passengers in MIA and 1068 in Imam Khomeini International Airport (IKIA) were interviewed for this purpose. It should be noted that both airports were targeted for the survey, despite the higher expenses, because the statistical population included all air passengers and their stated preference for accessing MIA. The questionnaires designed in 4 parts contained questions about passengers' socio-economic data, airport choice characteristics, airline choice characteristics and access mode choice characteristics. From among the 2958 gathered questionnaires, 309 were partly incompletely filled and thus identified as incomplete questionnaires and the rest (including 2649 questionnaires) made up the data base for this paper and were used in the modeling process.

Trip characteristics collected in the questionnaires are showed in Table 1.

Table 1: Trip characteristics used in questionnaires

ATTRIBUTE / MODE	COST (DOLLAR $)	OFF-PEAK TRAVEL TIME (MINUTE)	PEAK TRAVEL TIME (MINUTE)	RELIABILITY (DELAY-MINUTE)
TAXI	30, 40	45	80	15
CAR-PARKED	9, 10, 11, 12, 13	60	95	10
CAR-DROP OFF	10	50	85	5
METRO	1.5, 2, 2.5	70	85	15
SHUTTLE BUS	2, 3	85	120	30
SHUTTLE VAN	10, 15	65	90	30

3.1 Data Characteristics

From among the study sample, 83.2% were male; 35.7% aged 30 or younger; 47.8%were aged between 31 and 50. Significant groups of respondents (about 59.8%) had a monthly income between $500 and $1500; 63.6% were owners of at least one car and 43.5% chose rental car; 21.7% preferred

private car; 21.5% preferred metro; and the rest chose shuttle bus (4.7%) and shuttle van (8.6%) to access the airport, from which they were to fly.

4 Results

Model results calibrated to explore the behavior of air passengers in accessing MIA are shown in Table 2. Results showed that number of past air trip, age, gender, monthly income, education level, number of vehicle ownership, travel time and travel cost were the most effective variables on passengers' mode choice.

Table 2: Multinomial Logit model results for access mode choice to MIA

modes / variable	Rental car		Private car		Metro	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Number of air trip*	0.27960	2.111	-	-	-	-
Age	-	-	-	-	-.01061	-1.786
Gender	-0.89084	-4.145	-1.40170	-6.269	-0.41380	-1.703
Monthly income 1 (less than $500)*	-1.00251	-3.592	-1.03220	-3.436	-	-
Monthly income 2 ($500-$999)*	-0.84659	-3.602	-1.30604	-5.102	-	-
Monthly income 3 ($1000-$1499)*	-0.77629	-3.195	-0.74084	-2.853	-	-
Monthly income 4 ($1500-$2500)*	-	-	-0.74938	-2.265	-	-
Education level	-	-	-	-	-0.10320	-1.903
Number of vehicle ownership	0.24334	2.326	0.49543	4.349	-	-
Travel cost	-0.21540	-7.886	-.38428	-5.791	-3.60300	-5.854
Peak travel time	-	-	-	-	-0.06642	-3.718

L(c) (log-likelihood at market shares) = -3406.7472 Number of observation = 2649

L(β) (log-likelihood at convergence) = -3250.795

$\rho^2 = 1 - (L(\beta)/ L(c)) = 0.0458$

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