Transportation Mode Choice Analysis for Accessibility of the Mehrabad International Airport by Statistical Models

N. Mirzaei Varzeghani, M. Saffarzadeh, A. Naderan, A. Taheri

Abstract—Countries are progressing, and the world's busiest airports see year-on-year increases in travel demand. Passenger acceptability of an airport depends on the airport's appeals, which may include one of these routes between the city and the airport, as well as the facilities to reach them. One of the critical roles of transportation planners is to predict future transportation demand so that an integrated, multi-purpose system can be provided and diverse modes of transportation (rail, air, and land) can be delivered to a destination like an airport. In this study, 356 questionnaires were filled out in person over six days. First, the attraction of business and non-business trips was studied using data and a linear regression model. Lower travel costs, more passengers aged 55 and older using this airport, and other factors are essential for business trips. Non-business travelers, on the other hand, have prioritized using personal vehicles to get to the airport and ensuring convenient access to the airport. Business travelers are also less price-sensitive than non-business travelers regarding airport travel. Furthermore, carrying additional luggage (for example, more than one suitcase per person) undoubtedly decreases the attractiveness of public transit. Afterward, based on the manner and purpose of the trip, the locations with the highest trip generation to the airport were identified. The most famous district in Tehran was District 2, with 23 visits, while the most popular mode of transportation was an online taxi, with 12 trips from that location. Then, significant variables in separation and behavior of travel methods to access the airport were investigated for all systems. In this scenario, the most crucial factor is the time it takes to get to the airport, followed by the method's user-friendliness as a component of passenger preference. It has also been demonstrated that enhancing public transportation trip times reduces private transportation's market share, including taxicabs. Based on the responses of personal and semi-public vehicles, the desire of passengers to approach the airport via public transportation systems was explored to enhance present techniques and develop new strategies for providing the most efficient modes of transportation. Using the binary model, it was clear that business travelers and people who had already driven to the airport were the least likely to change.

Keywords—Multimodal transportation, travel behavior, demand modeling, statistical models.

I. INTRODUCTION

TRANSPORTATION economics and planning is highly influenced by a society's economic progress and environmental and social principles. As a result, one of transportation planners' key roles is to forecast future transportation demand and how demand will evolve due to various transportation regulations [1]. Air, train, road, and sea transportation are the four modes of transportation. Airports are essential national assets that play an important role in people and commodities' transit and regional, national, and worldwide trade [2]. The airport is a hub for connecting the country's aviation system to other kinds of transportation [3]. Most passengers will suffer increased congestion on airport access routes since they use private vehicles or taxis to go to airports in local cities and communities [4].
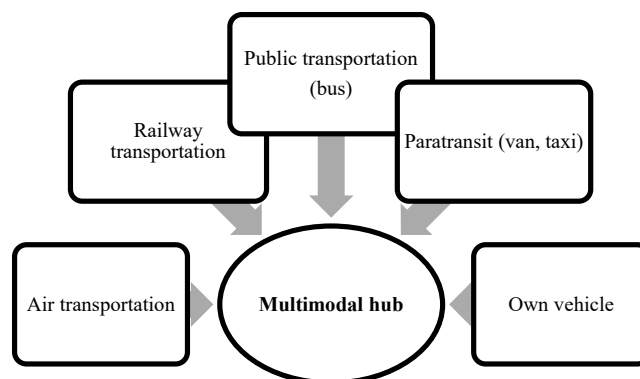

Fig. 1 Integration of transportation systems to create multimodal transportation system

Transportation is a collection of thousands or millions of individual travel decisions at the level of an urban area [5]. It is critical to comprehend the characteristics of these trips to determine transportation options. In truth, the interaction between travel patterns, transportation infrastructure, and the region's economic, social, and environmental factors is often the basis [6]. Multi-modal transportation is a system that connects different modes of transportation into a single unit (for example, a terminal), allowing travelers to choose methods that can cut travel time and expenses. It may also help minimize traffic congestion by lowering pollution and improving air quality.

Increased traffic congestion and airport capacity constraints can have substantial economic and social consequences, such as squandering passengers' time and money, decreasing air

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quality, reducing trade, and increasing energy usage. As a result, airports should be able to choose from various ways to transport passengers and products rather than rely on a single mode of transportation to get from point A to point B [7]. The importance of this research becomes apparent when it is determined that only four of Iran's nine international airports have a connection to the railway system; the same trains are only connected to the city centers, and no plans have been made for the surrounding cities and villages, which are in high demand [8]. Due to the international nature of several airports and the presence of international flights, many people from the neighboring cities arrive and depart. Increasing the efficiency of the air, rail, and road transportation systems can also potentially generate hubs [9].

II. LITERATURE REVIEW

Most airport operators across Europe see rail access as a helpful feature in improving the region under their control. Railroads are considered environmentally benign transportation modes that sometimes substitute for short-haul flights at high-traffic hubs [9]. Buses and trains are also employed to go to airports on short or regular routes [10]. So far, research has focused on land access to airports (rather than mixed modeling), with data collected from passengers at significant airports via a questionnaire. Table I lists several articles published in this field.

TABLE I
A SUMMARY OF THE NEWEST LITERATURE REVIEW

Researcher	Topic	Variables	Methods
Gokasar & Gunay (2017) [11]	Access modes	Employment statues, travel time, travel cost, distance from airport, trip purpose, household size, household income, car ownership	Multinomial logit
Wang &Yeo (2016) [12]	Evaluation of different modes of transportation	Travel time, travel cost, level of safety, level of security, level of confidence	Fuzzy-Delphi method
Malandri et al. (2017) [13]	Automated people mover, airport shuttle bus, bus line when delays happen	Flight departure, OD matrix, travel time, vehicle capacity, passenger delays and costs, recovery time	Discrete choice models
Oprea et al. (2017) [14]	Evaluation of bus mode, utility	Sex, age, level of education, distance to/from airport, number of people who accompany, OD matrix	-
Tłoczyński & Hebel (2020) [15]	Access modes	Distance to airport, size of luggage, travel time, travel cost	-

III. METHODOLOGY

In this section, the methodologies employed are described in depth. The questionnaire is used to collect data, which are then analyzed using multiple regression and binary logit models, among other statistical methods.

A. Questionnaire Design

Consideration was given to both revealed and stated preferences while developing the questions. Currently, user behavior in picking alternatives is known as disclosed preference data. In contrast, expressed preference data reflect user behavior in choosing future options in response to system modifications. The questionnaire enquires about socioeconomic factors, starting and ending locations, travel objectives and methods, transportation facilities (time, cost, comfort, safety, and security), the number of times people use Mehrabad Airport annually, the weight of their luggage, and how they might use public transportation in the future if the system improves.

The following items were asked in the questionnaire as variables in the regression models: passenger's suitcase (less than 10 kg), airport use (once per year), passenger's suitcase (more than 30 kg), age bracket (over 56), short flight duration, distance (less than 10 km), educational degree (diploma or less), travel cost, railway transportation system, airport use (8 to 12 times per year), ground access time (less than 10 minutes), passenger's suitcase (more than 30 kg), private car, security and safety, income (40 to 60 million Rial), passenger's bag (more than 30 kg),

It is important to note that the binary models' variables are as follows: Gender, age (25 years or below, 26 to 35 years, 36 to 45 years, 45 to 55 years, above 56 years), income (less than 20 million rials, 20 to 40 million rials), distance from the airport (less than 10 km, 10 to 20 km, 20 to 30 km), car ownership, travel cost convenience, access time (less than 10 minutes, 10 to 20 minutes, 20 to 30 minutes, more than 30 minutes), group (one person, two people, three people, five or more people), business trip, using Mehrabad airport (once per year, twice per year, three times per year, four times per year, more than eight times per year), passenger's luggage (less than 10 kg, 10 to 20 kg, more than 20 kg), arrival time.

B. Multiple Regression Model

Number regression is a statistical model for predicting one variable from one or more other variables. The dependent variable is the variable to be expected as a linear combination of the independent variables [16].

$$Cap = \theta_0 + \theta_1 X_{1,i} + \theta_2 X_{2,i} + \cdots + \theta_k X_{ki} + E_i \qquad (1)$$

Y = dependent variable; X = independent variable; Θ = the coefficients of the independent variables in the corresponding region; E = model error value.

C. Binary Logit Model

For multiple independent variables and a dependent variable, the binary logit model is as follows [17]:

$$P(y) = \pi_i = \frac{e^{b_0 + b_1 x_2 + b_2 x_2 + \cdots + b_n x_n}}{1 + e^{b_0 + b_1 x_2 + b_2 x_2 + \cdots + b_n x_n}} \qquad (2)$$

$$one \, logit(\pi_i) = \log\left(\frac{\pi_{ij}}{1 - \pi_i}\right)$$

P = the probability that Y will occur; e = natural logarithm base; b_0 = width of origin; b_1 = line gradient; b_n = the regression coefficient for Xn; X_n = predictor variable.

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D. Innovation

Unlike previous studies that looked at and evaluated each passenger [11]-[15], the current research focuses on passenger groups, one of the essential elements in assessing behaviors. Furthermore, the origin-destination matrix for each individual or passenger group was established first. Another add-on is the travel time and cost matrix. Significant variables were investigated by improving passenger travel modes on personal and semi-public transportation.

IV. RESULTS

A. Mehrabad Airport Travel Attraction Model for Different Purposes

The statistical analysis created two linear regression models for each variable and characteristic that attract travelers. These models were based on the meaning of passenger airport trips, which were split into business and non-business trips.

B. Business Trip Regression Model

Table II shows the things that make business trips more or less appealing for people who have already gotten from where they live to where they are going (the airport).

TABLE II
BUSINESS TRIP REGRESSION MODEL

Equation coefficients				
Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	3.050	.348		8.769	.000
Passenger's suitcase (less than 10 kg)	.691	.131	.326	5.286	.000
Using Mehrabad Airport (once yearly)	-.495	.202	-.156	-2.445	.016
Passenger's suitcase (more than 30 kg)	-1.570	.389	-.250	-4.033	.000
Age bracket (above 56)	1.251	.371	.199	3.375	.001
Short flight duration	1.110	.326	.215	3.402	.001
Distance (less than 10 km)	-.604	.179	-.217	-3.372	.001
Degree (diploma or less)	.654	.208	.189	3.140	.002
Travel cost	.585	.135	.302	4.339	.000
Railway transportation system	-.668	.173	-.275	-3.858	.000
Using Mehrabad Airport (8 to 12 times yearly)	.671	.163	.266	4.129	.000
Ground access time (less than 10 minutes)	.703	.346	.136	2.032	.044

In Table II, the following factors have a substantial direct relationship with the number of business travelers:

1. People who carry loads weighing less than 10 kg have attracted more business trips. Because almost all business TRIPS ARE BRIEF, BUSINESS PEOPLE DO NOT BRING MUCH PERSONAL gear.
2. Passengers with an average age of more than 55 years (in old age) like to travel with lighter luggage.
3. Individuals with a high school diploma or less, because this set of passengers typically travel with their families and share their stuff with family.
4. Those who wish for lower travel expenses want to travel with less luggage to save on travel costs. Individuals can

use public transportation, which is less expensive than other modes of transportation in this case. In addition, passengers will not be charged for extra luggage.

5. People who travel eight to 12 times a year use this airport more. When people travel more frequently throughout the year, there are two critical reasons for their more relaxed travel style. To begin with, they will most likely have a lower travel period. Second, they are more aware of their needs and will not bring extra things when traveling.
6. Those passengers who travel by plane to save time are looking to make the most of their time, as airplanes are the fastest modes of transportation. Heavier stuff will slow them down.

While the following variables are indirectly related to business travelers;

1. Individuals who travel with less than 30 kg of luggage; the more passengers' suitcases are carried, the less attractive Mehrabad Airport becomes to business travelers, who frequently commute to their destinations through this airport, implying that they are more likely to take less luggage than non-business travelers. Those who use Mehrabad Airport once a year for business purposes use airports more. As a result, people who fly yearly are more inclined to do so for non-business reasons.
2. People who do not travel more than 10 km from the origin to the airport would like to access this airport for their business purposes because less distance to reach the airport can increase the attractiveness of using the airport. As most of the commuters who use the subway system are business passengers, this is common practice for companies to offer their staff members financial help. Because of this, there is a greater chance that persons with professional responsibilities will not take the subway.

C. Non-Business Trip Regression Model

Another linear regression model has been built to attract non-business trips to Mehrabad Airport from the origins of travel. Table III lists all of the significant variables and their relationships with this trip attraction.

There is a direct link between the following factors and the number of people who go to the airport for non-business trips:

1. People who drive their cars are attracted to non-business trips. It can be suggested that for more convenient access to the airport, most of those on non-business trips utilize their private vehicles.
2. Among other educational degrees, most non-business trip passengers hold a bachelor's degree.
3. Passengers in two or three individual vehicles indicate that these people come from wealthy families. As a result, their chances of flying on a non-business trip are boosted. Furthermore, individuals prefer to commute to the airport by private automobile.
4. Tehran is one of Iran's and the Middle East's most populous cities. Intercity travel is quite expensive. As a result, when individuals live near an airport, it is more feasible for them to go by plane. Especially when the trip is for non-business goals, it causes people to overlook minor expense

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differences.

TABLE III
NON-BUSINESS TRIP REGRESSION MODEL

Equation coefficients					
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	2.923	.198		14.748	.000
Passenger's suitcase (more than 30 kg)	1.104	.199	.339	5.553	.000
Private car	.808	.204	.236	3.955	.000
Security and safety	-.801	.167	-.269	-4.796	.000
Monthly income (40,000,000 to 60,000,000 Rial)	-.972	.199	-.284	-4.893	.000
Passenger's suitcase (less than 10 kg)	-.497	.169	-.181	-2.937	.004
Being easy to access	.596	.164	.223	3.630	.000
Age (26 to 35)	-.706	.159	-.264	-4.445	.000
Degree (master)	.696	.169	.237	4.110	.000
Car ownership (two)	.703	.220	.177	3.199	.002
Car ownership (three)	1.766	.683	.149	2.588	.011
Access time (20 to 30 minutes)	.514	.181	.182	2.831	.005
Distance from airport (more than 30 km)	.565	.207	.173	2.723	.007

5. More family groups are enthusiastic about traveling by plane for vacations, and the majority of passengers' trips are not for business purposes (they are for vacations), which causes them to remain longer at the destination; thus, their luggage is bulkier. Passengers carry bags weighing more than 30 kg.
6. Passengers who drove more than 30 kilometers to the airport from their starting point are non-business passengers in the habit of using Mehrabad Airport.
7. Travelers choose it for easy access to the airport. When traveling for non-business purposes, people tend to overlook slight cost disparities in favor of more convenient accessibility.

Non-business travelers also had an indirect relationship with the following variables:
1. The average age range is 26 to 35 years old. This group usually lives alone and does not have well-paying jobs. As a result, they are less likely to fly for non-business travel.
2. Passengers carrying less than 10 kilograms of luggage traveling for leisure are more likely to bring large bags since their travel time is frequently longer.
3. The plane is the most expensive in Iran among the several types of transportation available. As a result, low-income people cannot afford the charges. Passengers with an annual income of 40 to 60 million Rials were the only group that could afford the flight costs. People unconcerned about their comfort and safety prefer to travel more comfortably for non-business purposes.

D. Generating Trip from Each Region Separately for the Trip Purpose and the Behavior of Passengers to Access the Airport

Following the significance of each variable in attracting airport trips, this section covered trip creation in various traffic

districts of Tehran and adjacent cities and how users accessed Mehrabad Airport. According to the results, district 2 has the largest trip generation, accounting for 13% of all trips investigated, followed by Alborz province and the city of Karaj, accounting for 11% of all journeys. These results are represented by districts in Table IV, Table V and Fig. 2.

TABLE IV
GENERATE TRIP FROM EACH DISTRICT TO ACCESS THE AIRPORT

District	Total number of passengers attracted to the airport	Total number of trips in each district	Total number of business trips	Total number of non-business trips
Karaj	33	19	13	6
District 2	58	23	9	14

TABLE V
SEPARATE PASSENGER'S MODE CHOICE BEHAVIOR

District	Online taxi	Private cars	Metro	Taxi & Van	Multi-mode
Karaj	2	5	6	3	3
District 2	12	4	0	4	3
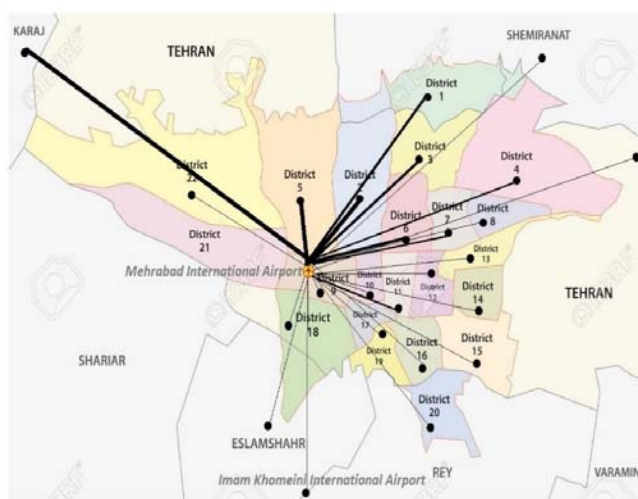
Fig. 2 Spider web trip generation of each district

Fig. 3 Mode choice overview

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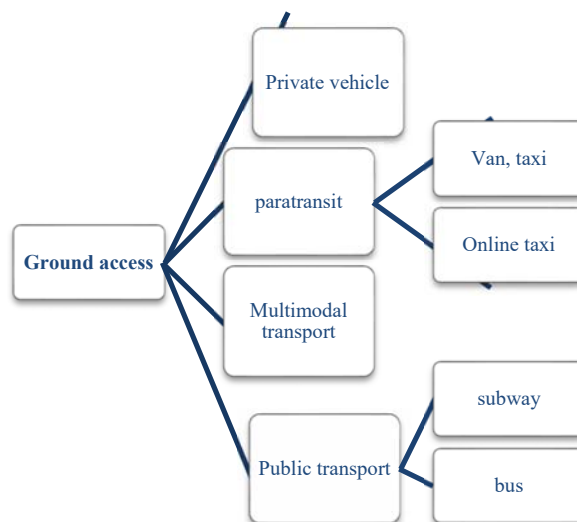International Journal of Transport and Vehicle Engineering
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E. Travel Behavior of Choice Modes

The binary logistic regression model is used to model the travel behavior of mode choices. Taxis, subways, and private vehicles are all modeled in this section. Other modes were overlooked due to a lack of users and their inadequacy.

F. Binary Model of Subway Mode Choice

Table VI indicates the factors influencing the subway mode choice for travelers who have already traveled from their origin to their destination (Mehrabad Airport).

The following variables have a significant impact on subway mode choice:

1. Monthly passengers with a monthly income between 20 and 40 million Rial: The lower cost of a subway ticket makes it more accessible to low-income travelers.
2. Passengers travel between 0 and 30 kilometers from their point of departure to their final destination (the airport).

However, the average distance that passengers travel is between 10 and 20 kilometers.

3. People who do not own a car have less accessibility to vehicles, so the subway will be a good option due to its lower cost and better access.
4. Budget-conscious vacationers: The lower subway fare is a good option for people looking to save money on their trip.
5. Passengers who can easily afford the transportation mode's lowest price: Among the other options in Tehran, the subway has the cheapest fare.
6. Users who travel for non-business reasons: Time-saving is not a consideration for non-business visits. Furthermore, practically all business people receive financial assistance from their companies. Subways are an excellent choice for people who are not traveling for business and care more about price than time.

TABLE VI
BINARY LOGIT MODEL OF SUBWAY MODE CHOICE

Subway	Coef.	Std. Err.	z	P>z	[95% Conf.	Interval]
Gender (male)	1.2914	1.3660	0.95	0.344	-1.385927	3.96878
Age (25 years or below)	-19.393	81275	-0.00	1.000	-1.59e+07	1.59e+07
Age (26 to 35 years)	-10.152	81275	-0.00	1.000	-1.59e+07	1.59e+07
Age (36 to 45 years)	-.88414	81275	-0.00	1.000	-1.59e+07	1.59e+07
Age (45 to 55 years)	-6.3120	81275	-0.00	1.000	-1.59e+07	1.59e+07
Age (above 56 years)	1.9077	81275	0.00	1.000	-1.59e+07	1.59e+07
Monthly income (less than 20000000 Rial)	9.0983	3.2440	2.80	0.005*	2.7401	15.456
Monthly income (20,000,000 to 40,000,000 Rial)	5.005	2.1085	2.37	0.018*	.87268	9.1380
Distance from airport (less than 10 km)	7.1939	3.0925	2.33	0.020*	1.1326	13.255
Distance from airport (10 to 20 km)	6.6681	2.4068	2.77	0.006*	1.9509	11.385
Distance from airport (20 to 30 km)	15.202	4.8998	3.10	0.002*	5.5988	24.805
Zero car ownership	12.619	3.8573	3.27	0.001*	5.0595	20.180
Travel cost	12.920	4.1642	3.10	0.002*	4.7583	21.082
Convenience	-4.863	1.636	-2.97	0.003*	-8.0703	-1.6558
Access time (less than 10 minutes)	-2.5672	2019.7	-0.00	0.999	-3961.2	3956.1
Access time (10 to 20 minutes)	-10.246	2019.7	-0.01	0.996	-3968.9	3948.4
Access time (20 to 30 minutes)	-8.819	2019.7	-0.00	0.997	-3967.5	3949.9
Access time (more than 30 minutes)	-1.7854	2019.7	-0.00	0.999	-3960.5	3956.9
Group members (1 person)	-.79949	159.46	-0.01	0.996	-313.35	311.75
Group members (2 persons)	-12.779	159.50	-0.08	0.936	-325.40	299.84
Group members (3 persons)	-8.3187	159.47	-0.05	0.958	-320.88	304.25
Group members (5 or more individuals)	-.40547	159.44	-0.00	0.998	-312.91	312.10
Business trip	-6.9082	2.1759	-3.17	0.001*	-11.172	-2.6435
Using Mehrabad Airport (once yearly)	-9.8219	3.1852	-3.08	0.002*	-16.064	-3.578
Using Mehrabad Airport (twice yearly)	-2.5822	2.1730	-1.19	0.235	-6.8414	1.6769
Using Mehrabad Airport (three times yearly)	-1.4080	1.8148	-0.78	0.438	-4.9651	2.1490
Using Mehrabad Airport (three times yearly)	-6.0603	2.8832	-2.10	0.036*	-11.711	-.40926
Using Mehrabad Airport (5 to 8 times per year)	-5.3272	2.293	-2.32	0.020*	-9.8219	-.83263
Passenger's luggage (less than 10 kg)	-10.567	2359.7	-0.00	0.996	-4635.50	4614.36
Passenger's luggage (10 to 20 kg)	-8.1690	2359.7	-0.00	0.997	-4633.09	4616.75
Passenger's luggage (more than 20 kg)	-22.531	2359.7	-0.01	0.992	-4647.48	4602.42
Arrival time	1.9030	1.8955	1.00	0.31	-1.8121	5.6181
_cons	7.8723	81275	0.00	1.00	-1.59e+07	1.59e+07

G. Binary Model of Taxi Mode Choice

Table VII outlines the factors that influence people's decisions to take taxis to and from their destination (Mehrabad Airport).

The following variables have a significant impact on taxi mode choice:

1. For people aged 55 years and up, taxis are less crowded than other types of public transportation, such as the metro. The calmer and more convenient surroundings that a taxi

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provides are gaining interest for people over 55 years.

TABLE VII
BINARY LOGIT MODEL OF TAXI MODE CHOICE

Taxi	Odds Ratio	Std. Err.	z	P>z	[95% Conf.	Interval]
Gender (Male)	1.738	.69933	1.37	0.169	.79007	3.8244
Age (25 years or below)	4.5398	5.2767	1.30	0.193	.46524	44.300
Age (26 to 35 years)	3.1585	3.2947	1.10	0.270	.40885	24.400
Age (36 to 45 years)	1.4961	1.6318	0.37	0.712	.17642	12.687
Age (45 to 55 years)	2.3262	2.5489	0.77	0.441	.27160	19.923
Age (above 56 years)	13.525	18.133	1.94	0.052*	.97707	187.21
Monthly income (less than 20,000,000 Rial)	.18687	.19699	-1.59	0.112	.02367	1.4752
Monthly income (20,000,000 to 40,000,000 Rial)	.18243	.18196	-1.71	0.088	.02583	1.28854
Monthly income (40,000,000 to 60,000,000 Rial)	.32283	.34028	-1.07	0.283	.04090	2.54803
Degree (diploma or less)	3.4476	3.2542	1.31	0.190	.54212	21.9260
Degree (associate)	1.4980	1.4241	0.43	0.671	.23244	9.65434
Degree (bachelor)	1.7608	1.3722	0.73	0.468	.3822	8.11054
Degree (master)	6.9135	5.5994	2.39	0.017*	1.4134	33.8148
Distance (less than 10 km)	.2307	.16879	-2.00	0.045*	.05504	.967780
Distance from airport (10 to 20 km)	.80609	.44346	-0.39	0.695	.27422	2.36955
Distance from airport (20 to 30 km)	.38231	.22660	-1.62	0.105	.11964	1.22163
Zero car ownership	19.979	13.767	4.35	0.00*	5.1763	77.1162
Car ownership (one)	11.1830	7.1807	3.76	0.00*	3.1768	39.3662
Travel cost	.25874	.09998	-3.50	0.00*	.12132	.551809
Travel time	.37476	.14008	-2.63	0.009*	.18012	.779714
Security, safety	1.4050	.59309	0.81	0.420	.61429	3.21362
Convenience	1.3847	.56165	0.80	0.422	.62535	3.06632
Access time (less than 10 minutes)	.0181923	46.218	-0.00	0.999	0	.
Access time (10 to 20 minute)	.01584	40.26	-0.00	0.999	0	.
Access time (20 to 30 minute)	.02410	61.237	-0.00	0.999	0	.
Access time (more than 30 minute)	.00828	21.036	-0.00	0.998	0	.
Group members (one person)	67.19609	28487.5	0.01	0.992	0	.
Group members (2 persons)	128.38	54429.5	0.01	0.991	0	.
Group members (3 persons)	30.118	12768.6	0.01	0.994	0	.
Group members (4 persons)	90.341	38300.	0.01	0.992	0	.
Group members (5 or more individuals)	29.337	12437.	0.01	0.994	0	.
Trip purpose	1.2194	.52921	0.46	0.648	.52087	2.8547
Using Mehrabad Airport (once yearly)	6.43e-08	.00012	-0.01	0.993	0	.
Using Mehrabad Airport (twice yearly)	1.43e-08	.00002	-0.01	0.992	0	.
Using Mehrabad Airport (three times yearly)	1.50e-08	.00002	-0.01	0.992	0	.
Using Mehrabad Airport (four times yearly)	1.60e-08	.00003	-0.01	0.992	0	.
Using Mehrabad Airport (5 to 8 times per year)	3.44e-08	.00006	-0.01	0.993	0	.
Using Mehrabad Airport (9 to 12 times per year)	5.33e-06	.01007	-0.01	0.995	0	.
Using Mehrabad Airport (more than 12 times)	9.87e-09	.00001	-0.01	0.992	0	.
Passenger's luggage (less than 10 kg)	2.31e-10	9.59e-07	-0.01	0.996	0	.
Passenger's luggage (10 to 20 kg)	5.22e-10	2.16e-06	-0.01	0.996	0	.
Passenger's luggage (more than 20 kg)	2.49e-09	.00001	-0.00	0.996	0	.
Arrival time	.2252119	.19578	-1.71	0.086	.04098	1.23759
_cons	1.57e+16	1.08e+20	0.01	0.996	0	.

2. Those who have completed a master's degree are more likely to have higher-paying jobs or are traveling for business purposes. As a result, they have a taxi as a choice.
3. For long-distance travel between cities, cabs are preferable to subways since there is no need to change lines or take additional complex procedures. From their starting point to their final destination, individuals travel over 10 kilometers.
4. Users who do not own a vehicle or intend to buy one are the groups that arrive at the airport by taxi. Passengers who own zero cars are most likely to access Mehrabad Airport by online taxis, which are currently widely used.
5. Taxi passengers are less concerned with the trip's duration and cost. Taxis are the best option for this group of travelers.

H. Binary Model of Private Vehicle Mode Choice

Table VIII indicates the factors that influence the personal vehicle mode choice for travelers who have already traveled from their origin to their destination (Mehrabad Airport).

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TABLE VIII
BINARY LOGIT MODEL OF PRIVATE VEHICLE MODE CHOICE

Car	Odds Ratio	Std. Err.	z	P>z	[95% Conf.	Interval]
Gender (Male)	.0525	.0576	-2.69	0.007*	.006136	.4508441
Age (25 years or below)	.01689	34.135	-0.00	0.998	0	.
Age (26 to 35 years)	.01754	35.44	-0.00	0.998	0	.
Age (36 to 45 years)	.0396	80.117	-0.00	0.999	0	.
Age (45 to 55 years)	.00156	3.1579	-0.00	0.997	0	.
Age (above 56 years)	.00001	.03392	-0.01	0.996	0	.
Monthly income (less than 20,000,000 Rial)	2.7771	12.97	0.22	0.827	.00029	26373
Monthly income (20,000,000 to 40,000,000 Rial)	88.605	417.21	0.95	0.341	.00869	902576.5
Monthly income (40,000,000 to 60,000,000 Rial)	45.42	219.55	0.79	0.430	.00349	591058.4
Degree (diploma or less)	51.154	144.009	1.40	0.162	.20539	12740.4
Degree (associate)	143.85	351.38	2.03	0.042*	1.1989	17260.7
Degree (bachelor)	261.86	606.71	2.40	0.016*	2.7917	24561.96
Degree (master)	6.9983	14.868	0.92	0.360	.10879	450.1984
Distance from airport (less than 10 km)	2.7404	4.2817	0.65	0.519	.12820	58.58207
Distance from airport (10 to 20 km)	1.2388	1.2329	0.22	0.830	.17612	8.713753
Distance from airport (20 to 30 km)	17.374	20.820	2.38	0.017*	1.6590	181.9465
Car ownership (one)	.00473	.00777	-3.26	0.001*	.00018	.1185012
Travel cost	.07834	.07601	-2.62	0.009*	.0116	.5246803
Travel time	4.7814	4.7405	1.58	0.115	.6849	33.37943
Security and safety	9.9506	9.3075	2.46	0.014*	1.5909	62.23555
Convenience	5.4837	6.1871	1.51	0.131	.60075	50.0567
Access time (less than 10 minute)	.0103	20.845	-0.00	0.99	0	.
Access time (10 to 20 minute)	.08115	164.00	-0.00	0.99	0	.
Access time (20 to 30 minute)	.02060	41.635	-0.00	0.99	0	.
Access Time (more than 30 minute)	.02591	52.362	-0.00	0.99	0	.
Group members (1 persons)	.01339	.02187	-2.64	0.008*	.00054	.3289459
Group members (2 persons)	.00579	.00868	-3.44	0.001*	.00030	.1092732
Group members (3 persons)	1.8773	2.6664	0.44	0.65	.11603	30.37416
Group members (4 persons)	.01668	.03624	-1.88	0.060	.0002	1.1790
Group members (5 or more individuals)	1	(omitted)				
Business trip	27.820	30.881	3.00	0.003*	3.1587	245.03
Using Mehrabad Airport (once yearly)	21.188	35.769	1.81	0.070	.77465	579.54
Using Mehrabad Airport (twice yearly)	273.09	618.76	2.48	0.013*	3.2188	23169.8
Using Mehrabad Airport (three times yearly)	34.392	67.228	1.81	0.070	.74570	1586.1
Using Mehrabad Airport (four times yearly)	64.887	128.02	2.11	0.034*	1.3574	3101.5
Using Mehrabad Airport (5 to 8 times per year)	5.9566	9.6825	1.10	0.272	.24625	144.08
Passenger's luggage (less than 10 kg)	5.1665	7.6601	1.11	0.268	.28260	94.454
Passenger's luggage (10 to 20 kg)	1.839383	2.3771	0.47	0.637	.1460	23.158
Arrival time	4539.436	12004.5	3.18	0.001	25.467	809123
_cons	2.603561	7441.05	0.00	1.000	0	.

The following variables have a significant impact on private vehicle mode choice:

1. Male passengers were less likely to use their vehicles than female passengers. Males are more likely than females to use public or semi-public transportation in Iran. As a result, men are more inclined to drive their cars [18].
2. Users with a post-diploma and a bachelor's degree were more likely to drive their cars. Because this group of travelers has a greater employment rate, they are more likely to drive their vehicles.
3. Passengers who lived between 20 and 30 kilometers from the airport were more likely to use this mode of transportation since it would make trips more convenient.
4. Those who own a private vehicle are unlikely to use this mode of transportation to get to the airport. Getting to the airport by private car is more expensive than other modes of transportation. The cost of parking at the airport, for example, is factored in.
5. Travel expenses are unimportant to users. Even though it is a more expensive model, the private car user's group chose it.
6. This mode is used by those concerned about safety and security because passengers will have more comfortable conditions in a private vehicle.
7. One- and two-person groups expressed a slight desire to travel in private vehicles. When people travel in private cars, the cost per passenger is prohibitively expensive, and they are less likely to use them in this situation.
8. Business travelers prefer this mode. As previously stated, business travelers are financially supported by their companies and as a result, they choose more convenient and costly solutions such as private vehicles.

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9. Passengers who use this airport no more than five times per year and those who travel infrequently are more likely to overlook the high prices.

I. Alternative Modes in the Future in Exchange for Systems Improvement

One preferred question about alternatives to the modes passengers choose to get to the airport was what kinds of users would prioritize various modes of public transportation if the current public systems were enhanced. Out of all the questions prepared and filled in the questionnaire, considering a variety of replies, a binary model was used to determine the influential and significant variables. Table IX indicates the results.

TABLE IX
BINARY LOGIT MODEL FOR AN ALTERNATIVE MODE IN THE FUTURE IN EXCHANGE FOR SYSTEM'S IMPROVEMENT

Improvement	Odds Ratio	Std. Err.	z	P>z	[95% Conf.	Interval]
Gender (Male)	1.8458	.99138	1.14	0.254	.64419	5.288902
Age (25 years or below)	282.39	17654	0.01	0.993	0	.
Age (26 to 35 years)	916.07	572712.1	0.01	0.991	0	.
Age (36 to 45 years)	389.50	243512.6	0.01	0.992	0	.
Age (45 to 55 years)	2484.1	15530	0.01	0.990	0	.
Degree (diploma or less)	71.254	108.03	2.81	0.005*	3.6499	1391.05
Degree (associate)	5.7222	7.1264	1.40	0.161	.49830	65.711
Degree (bachelor)	7.454	7.3082	2.05	0.040*	1.0913	50.922
Degree (master)	6.7393	6.2177	2.07	0.039*	1.1048	41.109
Monthly income (less than 20,000,000 Rial)	1.4008	1.7239	0.27	0.784	.12556	15.628
Monthly income (20,000,000 to 40,000,000 Rial)	1.7621	1.8622	0.54	0.592	.22207	13.983
Monthly income (40,000,000 to 60,000,000 Rial)	3.7732	4.4255	1.13	0.258	.37875	37.589
Monthly income (60,000,000 to 80,000,000 Rial)	5.2629	6.955	1.26	0.209	.39469	70.175
Car	.23851	.15068	-2.27	0.023*	.06914	.82278
Zero car ownership	3.0352	5.1743	0.65	0.515	.10742	85.756
Car ownership (one)	9.0266	14.074	1.41	0.158	.42493	191.74
Car ownership (two)	.27453	.44239	-0.80	0.422	.01166	6.4604
Business trip	.20048	.12539	-2.57	0.010*	.05884	.68308
Distance from airport (less than 10 km)	.53685	.57735	-0.58	0.563	.06522	4.4184
Distance from airport (10 to 20 km)	1.7295	1.4917	0.64	0.525	.31902	9.3771
Distance from airport (20 to 30 km)	1.2121	1.1445	0.20	0.839	.19047	7.71443
Travel cost	.24163	.13712	-2.50	0.012*	.07945	.7348406
Travel time	.45942	.25030	-1.43	0.153	.15792	1.336485
Convenience	1.2448	.76616	0.36	0.722	.37257	4.15916
Security and safety	1.4788	.82043	0.71	0.481	.49849	4.386876
Access time (less than 10 minutes)	.14753	.15161	-1.86	0.063	.01968	1.105743
Access time (10 to 20 minutes)	.26162	.18438	-1.90	0.057*	.06573	1.041339
Access time (20 to 30 minutes)	2.6276	1.8992	1.34	0.181	.63730	10.83427
Group members (1 persons)	.2006	107.25	-0.00	0.998	0	.
Group members (2 persons)	.14343	76.670	-0.00	0.997	0	.
Group members (3 persons)	.09392	50.209	-0.00	0.996	0	.
Group members (4 persons)	1.3816	738.54	0.00	1.000	0	.
Group members (5 or more individuals	.01942	10.382	-0.01	0.994	0	.
Using Mehrabad Airport (once yearly)	5.350	5.9445	1.51	0.131	.60645	47.2129
Using Mehrabad Airport (twice yearly)	10.921	13.500	1.93	0.053*	.9683	123.17
Using Mehrabad Airport (three times yearly)	.46482	.48218	-0.74	0.460	.0608	3.5503
Using Mehrabad Airport (four times yearly)	24.665	29.103	2.72	0.007*	2.4420	249.14
Using Mehrabad Airport (5 to 8 times per year)	3.6569	3.4942	1.36	0.175	.56208	23.792
Using Mehrabad Airport (9 to 12 times per year)	4.3012	4.2269	1.48	0.138	.62676	29.518
Passenger's luggage (less than 10 kg)	.68097	.65327	-0.40	0.689	.10388	4.4638
Passenger's luggage (10 to 20 kg)	.48002	.4712	-0.75	0.455	.07007	3.2882
_cons	.00100	.82487	-0.01	0.993	0	.

Based on how things are likely to change, the following factors are essential for passengers to consider when making decisions in the future:

1. Travelers with a high school diploma or less and those with a bachelor's or master's degree will prefer public transit in the future. It means that practically all educational groups are interested in using public transit in the future in the event of growth.

2. Those who travel to the airport in a private vehicle will be the least likely to switch. This group's expectations are unlikely to change in the future. It could be due to their exceptional financial circumstances, which do not indicate

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high sensitivity to changes.

3. Passengers who travel for business are less likely to change flights.

4. People who do not put travel costs first will not use public transportation. Passengers will still pick convenience, time savings, and other factors over price when choosing their preferred form of transportation.

5. Passengers who fly twice or four times per year are less likely to change their habits. Predictably, the development will be less critical for individuals who use airports less frequently.

V. CONCLUSION

One of the essential tasks for transportation planners is to forecast future transportation demand and how demand will alter due to various transportation policies. Passenger capacity has been steadily increasing, causing substantial issues in airports, although the usage of large planes has resulted in relocation limits. However, the ability of air vehicles seems not to affect quick entry and exit options.

This study aims to assess the utility and quality of existing systems, the influential elements in each scenario, those that contribute to public mode distrust, and the zones with the most demand. To achieve our purposes, 356 questionnaires were collected over six days and nights between March and May. The survey answers were then utilized in linear regression models to simulate the appeal of business and leisure travel. The "lower cost of travel" and "age range greater than 55 years" were the most critical factors for business travel. On the other hand, variables such as "use of the personal car" and "easy access to the airport" were identified as the most critical considerations for non-business trips. The areas with the greatest number of travelers heading to the airport have been listed based on the mode of transportation and the location of the trip. Tehran Region 2 with 23 visits and Internet taxis with 12 were the most popular. The practical and significant variables in the separation and behavior of the travel method for access to the airport were then analyzed using the binary model for all choices. When it comes to upgrading current conditions and developing modes that are less expensive and take less time to travel, business travelers and those who already drive to the airport in private cars will be less likely to switch.

Future research could concentrate on the most vulnerable members of society (e.g., the elderly and children). Members of this group must take a taxi to get to the airport so that they may be scrutinized, and efficient techniques for them can be outlined [19]. Also, more airports can be evaluated to get more accurate results and make it easier for people to get to airports [20].

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