University of Tabriz

EXTENDED ABSTRACT

The Analysis of Effective Factors for the Use of Shared Bicycles Using the Binary Logit Model (Case Study of Tehran)

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1. Introduction

Considering the simple mechanism and low cost of bicycles and its advantages in the transportation industry, the present study intends to analyze the problems, obstacles and the importance of the existence of shared bicycles in the present and future from the perspective of Tehran citizens. Unlike most previous studies that have focused on a specific component of the demand debate, this study analyzes its problems and barriers with a more general view of the importance of shared bicycles.

2. Methodology

2.1. Data

In order to conduct this research, a comprehensive questionnaire was designed by considering various factors including socio-economic variables, information about daily travel, cycling problems and obstacles and other related factors such as psychological questions. Then, a survey of Tehran citizens was conducted at the location of shared bicycle stations by systematic random sampling method. The results of descriptive analysis of the data obtained from the questionnaire according to Table (1) along with the collected information in the field of traffic parameters and the impact of bicycles on transportation are presented.

2.2. Binary logit modeling

Logit models are known as the simplest and most widely used discrete choice models due to their high interpretability and closed form. In this method, the desirability of choosing an option from several options can be divided into known and unknown parts. In the known part or in other words the systematic part (V_{nj}), the observable desirability is determined by a set of parameters by the researcher. The other part, commonly referred to as the unknown part (ε_{nj}), is known as the random part of the utility equation (De Dios Ortúzar & Willumsen, 2011; Khan, 2007; Train, 2009). Eq. (1) shows this relationship.

$$U_{nj} = V_{nj} + \varepsilon_{nj} \tag{1}$$

Assuming an independent and uniform distribution of Gamble for the random part (ε_{nj}), the closed form of multiple logit (the general form, which turns into binary logit if there are only two options) can be explained

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according to Eq. (2). In this regard, P_{ni} indicates the probability of selecting option i for the nth person (Train 2009).

Table 1. Socio-economic information of individuals

	Number	Percent (%)		Number	Percent (%)
Marital status			Gender		
Single	309	51.5	Man	325	54.2
Married	291	48.5	Woman	275	45.8
Age			Income status (tomans)		
Under 20 years	14	2.3	Less than 2 million	72	12
20 to 25 years	98	16.4	2 to 4 million	135	22.5
25 to 30 years	216	36	4 to 6 million	205	34.2
30 to 35 years	118	19.7	6 to 8 million	115	19.2
35 to 40 years	87	14.5	8 to 10 million	65	10.8
40 to 45 years	41	6.8	More than 10 million	8	1.3
45 to 50 years	23	3.8	Volume of traffic on the daily route		
Over 50 years	3	0.5	Very low	15	2.5
Number of household cars			Low	75	12.5
One	516	86	Medium	153	25.5
Two	69	11.5	Much	190	31.7
Three	7	1.2	Very much	167	27.8
No vehicle	8	1.3	Number of vehicles used in daily trips		
The desirability of shared bikes			Personal vehicle	408	68
Desirable	274	45.6	Motorcycle	16	2.7
Medium	268	44.7	Taxi	100	16.7
Undesirable	58	9.7	Bus	47	7.8
			Subway	25	4.1
			Shared bikes	4	0.7

$$P_{ni} = \frac{e^{V_{ni}}}{\sum_j e^{V_{nj}}} \tag{1}$$

3. Results and discussion

3.1. Modeling the analysis of the importance of shared bicycles in the present

This model shows that reducing the volume of traffic alone is the most important factor that is of great importance in the current situation compared to other factors (Table 2). Therefore, it can be said that in places with a large volume of vehicles, the need for more shared bicycles is felt.

Table 2. Modeling the importance of shared bikes in the current situation

Abbrev.	Parameter	Variable	Coefficient	Wald test	Significance	Odds ratio	Positive effect (%)	Negative effect (%)
			U=-0.13016+(0.64533×A)					
IMP_4	A	Reduce traffic volume	0.645	9.652	0.002	1.907	62.6	53.2
C	C	Constant coefficient	-0.130	2.012	0.156	0.878		
Good model fit coefficients								
			Significance of the whole model	Chi sqare block	Chi square model	Cox & snell R square	Nagelkerke R square	Nlogit R square
			0.002	9.914	9.914	0.016	0.022	0.011

3.2. Modeling the analysis of the importance of shared bicycles in the future

According to Table 3 and considering the ideal conditions for the future and considering the condition of providing infrastructure, we can see an increase in demand for shared bicycles. According to the modeling, another important factor in the tendency to use shared bicycles in the future is the lack of the need for driving bicycle license.

3.3. Modeling the analysis of existing problems for shared bikes in the present situation

Table 4 presents binary logit modeling to analyze the existing problems of shared bicycles. This model consists of three factors: insufficient safety, lack of proper infrastructure and unfavorable weather conditions, but it should be noted that although weather conditions are considered as a problem in cycling.

3.4. Modeling the analysis of existing barriers for shared bikes in the present situation

Obstacles or obstacles can be defined as a person's sensory interaction with a goal, and usually the obstacles are more superficial than the problems, and removing them requires less time and better knowledge. After paying for several models, Table 5 shows the paid model for shared cycling barriers consisting of three factors: lack of proper support, low level of cycling culture and long distance of origin and destination. Considering this model and improving the stated factors, a 63.4% probability of demand for shared bicycles can be expected.

Table 3. Modeling the importance of shared bikes in ideal future conditions

Abbrev.	Parameter	Variable	Coefficient	Wald test	Significance	Odds ratio	Positive effect (%)	Negative effect (%)
Model(1) :U1=-3.88624+(1.76598×A)+(1.44389×B)								
IMP_6	A	Natural resource conservation	1.766	6.691	0.010	5.847	33.7	2
IMP_9	B	No need for a certificate	1.444	3.277	0.070	4.237		
C	C	Constant coefficient	-3.866	162.791	0.000	0.021		
Good model fit coefficients								
			Significance of the whole model	Chi sqare block	Chi square model	Cox & snell R square	Nagelkerke R square	Nlogit R square
			0.030	6.820	6.820	0.011	0.052	0.046

Table 4. Modeling the problems of using bicycles in transportation in the current situation

Abbrev.	Parameter	Variable	Coefficient	Wald test	Significance	Odds ratio	Positive effect (%)	Negative effect (%)
Model(1) :U1=-0.15852+(0.49839×A)+(0.60655×B)+(-1.09424×D)								
DIF_2	A	Adequate safety	0.498	4.765	0.029	1.646	46.3	46
DIF_4	B	Proper infrastructure	0.607	7.828	0.005	1.834		
DIF_7	D	Unfavorable weather conditions	-1.094	5.306	0.021	0.335		
C	C	Constant coefficient	-0.159	2.202	0.137	0.853		
Good model fit coefficients								
			Significance of the whole model	Chi sqare block	Chi square model	Cox & snell R square	Nagelkerke R square	Nlogit R square
			0.000	19.694	19.694	0.032	0.043	0.023

Table 5. Modeling the problems of using bicycles in transportation in the current situation

Abbrev.	Parameter	Variable	Coefficient	Wald test	Significance	Odds ratio	Positive effect (%)	Negative effect (%)
Model(1) :U1=-0.18135+(0.74096×A)+(0.90878×B)+(-0.91727×D)								
INH_1	A	Long distance of origin and destination	0.741	5.040	0.025	2.098	63.4	45.4
INH_5	B	Level of culture	0.909	18.265	0.000	2.481		
INH_7	D	Convenient support	-0.917	9.906	0.009	0.400		
C	C	Constant coefficient	-0.181	3.066	0.080	0.834		
Good model fit coefficients								
			Significance of the whole model	Chi sqare block	Chi square model	Cox & snell R square	Nagelkerke R square	Nlogit R square
			0.000	35.323	35.323	0.057	0.076	0.04

4. Conclusions

The purpose of this study is to investigate the demand for the use of shared bicycles and the factors influencing the probability of this demand in Tehran. In this regard, the barriers that can affect the level of demand were evaluated and analyzed by the binary logistic model. The results show the elimination of problems such as lack of special bike lanes, insufficient safety and lack of proper infrastructure, lack of proper support and long distance between origin and destination can affect the demand of using shared bicycles. In addition, unfavorable weather conditions are another important problem and the level of cycling culture is one of the most significant barriers to the use of shared bicycles.

5. References

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