Comparing the Important Transit Information and Their Service Levels in Turkey both for Transit and Non-transit Users

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1. Introduction

This study investigates the effects of Transit Information Systems (TIS) both on transit and non-transit users. Transit information systems are wide range of systems that provide travelers information about travel options such as; travel times, delays and/or incidents. In this study, the important transit information and their service levels to improve the satisfaction level of travelers are investigated in Izmir City, Turkey. This will help to keep actual users with public transit and provide better comfort level. In addition, appropriate TIS attract non-transit users to use transit. For these purposes, a stated preference scenario was prepared, which includes the considered important information types of respondents and a function of their actual travel time.

In this study, static pre-transit information systems were considered in the survey. The main objectives of the study are; to determine which types of transit information are considered as important by users, to identify the significant service levels of transit, and to compare the important information types both for transit and non-transit users.

2. Conducted Survey

Survey was conducted in metropolitan area of Izmir City, Turkey. In the city, four survey areas were chosen to collect samples from different socioeconomic groups. Data was collected by in-person interviews from May 22 to Jun 17, 2005. Most commonly, weekend days were chosen. Totally 645 interviews were conducted during this time period.

Survey has two main parts; first, the questions to identify the socioeconomic characteristics of the respondent then, the main part. Main part of the questionnaire was prepared separately for transit and non-transit users. Main structure of the questions for transit and non-transit users is almost same.

(1) Socioeconomic Characters

In this part, ten questions were asked to the respondent to identify socioeconomic characters of the respondent and some other significant factors that could effect the trip decision. Considered personal and socioeconomic characters are; gender, age income, education level and occupation. Each respondent were asked if they own a car and use car-pooling as a commute mode. In addition, flexibility of work starting time and if the respondent travels to multiple locations from the work were asked. Finally, all respondents were asked actual work/school trip time. Sample characteristics of the survey are indicated in Table 1.

Table 1 Sample characteristics

Socioeconomic characters		Total	Transit users	Non-transit Users
Gender	Male	54%	46%	69%
	Female	46%	51%	31%
Age	Young (<39)	71%	74%	22%
	Old (40<=)	29%	26%	88%
Income	Low (<1,000 YTL)	75%	73%	19%
	High (1,000 YTL <=)	25%	27%	81%
Education	Low (high school and lower)	29%	30%	27%
	High(higher than high school)	71%	70%	73%
Car ownership	Yes	54%	46%	82%
	No	46%	54%	18%
Commute to multiple locations	Yes	65%	68%	57%
	No	35%	32%	43%
Carpool	Yes	32	25	55
	No	78	75	45
Flexibility of work starting time	No flexibility	63%	65%	58%
	There is flexibility	37%	35%	42%

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Table 1 shows the sample characteristics. In the table, YTL is Turkish money unit (1 YTL= 80¥).

(2) Main Part

The main part of the questionnaires was prepared in two different forms for transit and non-transit users. Before starting the main part, respondent were asked, "Have you used transit at least once in last 7 days as a commuter?" to identify if he/she is a transit user or not. The structure and questions in both parts prepared for transit and non-transit users are similar. Differences between the parts are additional questions for the actual transit mode and satisfaction level from the current transit conditions. Totally, 493 users (76%) declared that they have used transit at least once in last one week and 152 (24%) did not.

Transit users were asked the questions which were prepared for them. Non-transit users were asked one more question before the second part of questionnaire, because these questionnaires were prepared for transit users and non-transit users who will consider transit as an alternative commute mode. Thus, non-transit users were asked, "If you have more information, might you consider transit as an alternative commute mode at least once in a week?". Respondents who had answered "yes" were asked the main part of the questionnaires and the ones who had answered "no" were not asked any more questions. 102 (73.4%) of the non-transit users answered "no" and their interview were finished and 45 (26.6%) of the non-transit users told they would consider transit as an alternative commute mode if they had more information about it.

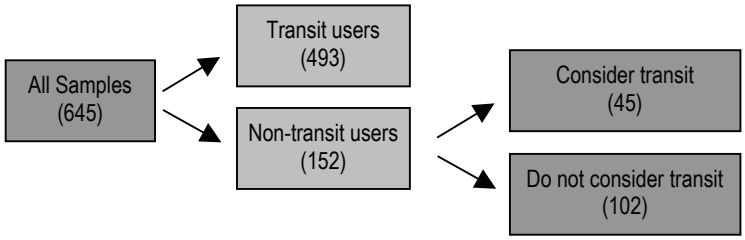

Figure 1 Distribution of samples

The main structure of the questionnaires includes a stated preference scenario, which depends on the chosen transit information types and commute time of the respondents. As discussed, main objective of this survey is to investigate the important information types, which are important for transit and non-transit users. Prepared hypothetical scenarios both for transit and non-transit users are same. However, there are slight differences in the questions.

Before the hypothetical scenario, each respondent was asked to rank three information types from the list, which are important for him. Ten transit information types were shown to the respondent (Abdel-Aty, 2000):

- Park & Ride information.
- Information about how often transit vehicles run.
- Fare information.
- Information about walking time to/from the station.
- Information about transfers, and transfer locations.
- Transit route map.
- Information about operating hours.
- Information about waiting times.
- Information about seat availability.
- Information about station locations.

Chosen information types and commute time of each respondent were used to prepare the hypothetical scenario separately for all respondents. The scenario was designed as follows:

I. The commute time of the respondent were multiplied randomly with a parameter (0.75, 1.00, 1.25 and 1,50)
II. Each chosen information type was presented with its service levels. For each information type, maximum four service levels were prepared and presented randomly in the scenario.
III. Finally, transit users were asked their satisfaction level under given conditions by transit service and non-transit users were asked if they are satisfied by given conditions to consider transit as an alternative commute mode.

Service levels of information types were prepared by considering the actual and improved service conditions in Izmir City. The service levels of information types were not shown to the respondents. They only saw randomly chosen service levels, depending on the information types that they have already chosen, in the hypothetical scenario. Respondents were asked for five ranked satisfaction levels. They had chosen their satisfaction among; not satisfied, a little satisfied, neutral, satisfied and very satisfied.

As an example, if the transit user's travel time is 24 minutes, he had chosen seat availability as an important information type in the first place, transit route map and information about waiting times at the stops second and third, respectively. The scenario for these answers is as follows:

*Please think that if your travel time is 30 minutes (24*1.25), the chance of seat availability is 75%, a transit route map is available with you and waiting time at the stop is 15 minutes.*

Please rank your satisfaction level for listed service conditions above.

Then respondent chose his satisfaction level. This scenario was prepared two times for the same respondent. Respondent chose important information types once. In the second scenario, random number, which is multiplied by the travel time and service levels of chosen information types were changed. Second scenario helps to collect two data sets from one respondent.

The main objective of these scenarios was to identify the significant information types and their service levels for transit and non-transit users.

3. Modeling the Survey Data

In some cases, multinomial choice variables are naturally ordered. In these kind of cases, if the dependent variable takes more than two values, ordered probit model is appropriate to solve the discrete choice problem.

In ordered probit modeling, it is not possible to estimate the coefficients of a constant term and *j-1* cut points (thresholds) in *j-category* case. In this case, a shift in the constant term cannot be distinguished from a shift in the cut points. In short, the distribution curve can be shifted in the X-axis, the values of cut point's change, but probabilities are kept constant. For that reason, *j-2* threshold are estimated in *j-category* case (Dublin and Rivers, 1988; Greene, 2000). First threshold is fixed to zero.

As defined in the estimation, service levels of information types and socioeconomic variables with the actual travel times of the respondents are introduced as variables in the model.

4. Modeling Results

Totally, 645 data was collected and 493 of them were classified as transit users. Among the non-transit users, 45 of them agreed to consider transit as an alternative commute mode if transit information is available. Two models were estimated in same format separately for transit and non-transit users to identify the differences between them. Survey was designed with two scenarios to obtain more data. However, since two observations were collected from one respondent to use, these both data sets in the model without any correction causes some biases. Thus, in this study the results are a little inflated.

In the ordered probit model, two sets of parameters are estimated. First one is the threshold parameters, which indicate the cut points on the normal distribution curve. Three of the estimated parameters were assigned to threshold values; the first threshold was set to zero. Second one is explanatory variables, which were considered in two groups; service levels of each information type and socioeconomic variables with travel time of the respondent. In the model, explanatory variables are defined as dummy variables. Ten information types were divided into 26 dummy variables by considering the service levels, 7 dummy variables were prepared for socioeconomic characters. Travel times of the respondents are used as they were presented in the scenario (not dummy variable).

Table 2 Important service items for transit and non-transit users

Thresholds		Transit users	Non-transit users
		Estimate (t-statistics)	Estimate (t-statistics)
T1	(μ_1)	0.4654 (27.91)	0.6507 (8.46)
T2	(μ_2)	0.8598 (25.76)	0.9869 (5.98)
T3	(μ_3)	2.2386 (22.27)	2.3210 (3.67)
Service level of transit information			
X_2	Frequency of service (1 if frequency is 15 min, 0 otherwise.)		0.7513 (2.39)
X_4	Frequency of service (1 if frequency is 30 min, 0 otherwise.)	-0.4052 (-3.43)	
X_5	Fare information (1 if fare is 50 YKR. , 0 otherwise)	0.4295 (3.71)	1.1093 (1.88)
X_8	Walking time to/from the station (1 if walking time is 5 min. , 0 otherwise)		-1.4901 (-2.67)
X_9	Walking time to/from the station (1 if walking time is 10 min. , 0 otherwise)		-0.8684 (-1.91)
X_{12}	Transfer information (1 if 2 transfer is needed, 0 otherwise)	-0.5895 (-4.20)	
X_{13}	Transfer information (1 if 3 transfer is needed, 0 otherwise)	-0.7441 (-3.32)	
X_{15}	Operating hours (1 if operating hours is between 6.00 am- midnight, 0 otherwise)	0.4170 (3.38)	1.0132 (2.03)
X_{16}	Operating hours (1 if operating hours is between 6.00 am- 2.00 am, 0 otherwise)	0.3761 (3.03)	
X_{17}	Operating hours (1 if operating hours is 24 hours, 0 otherwise)	0.8895 (6.47)	
X_{19}	Waiting times at the stops (1 if waiting time is 20 min., 0 otherwise)	-0.3099 (-2.92)	
X_{20}	Waiting times at the stops (1 if waiting time is 30 min., 0 otherwise)	-1.1625 (-6.81)	-1.9782 (-2.43)
X_{25}	Distance of the stop to the resident of the respondent (1 if 750m, 0 otherwise)		-1.2083 (-3.02)
X_{26}	Distance of the station to the resident of the respondent (1 if 1000m, 0 otherwise)	-1.3697 (-5.95)	
Socioeconomic characteristics and some other significant factors			
S_1	Actual travel time of the respondent	-0.0016 (-1.15)	0.0116 (1.80)
S_2	Gender (1 if male, 0 otherwise)		0.5774 (1.68)
S_4	Income (1 if lower than 1,000 YTL., 0 otherwise)	0.5641 (8.54)	
S_7	Having a car (1 if respondent has no car, 0 otherwise)	0.2819 (4.19)	
S_8	Flexibility of work starting time (1 if there is no flexibility, 0 otherwise)		-0.7527 (-2.04)
Number of samples		975	90
Log likelihood at zero		-2402.73	189.08
Log likelihood at convergence		-1348.81	-101.02

In the first step, all variables were considered in the estimation. Then, some other modeling attempts were done. In this paper, the final models were presented. Estimated model for transit users and non-transit users who would consider transit as an alternative commute mode, are presented in Table 2.

In both estimated models, 6 information types were considered as significant by respondents. Mostly important information types are same for transit and non-transit users. For transit users, income and having a car are significant (95%) socioeconomic factors, which affect the satisfaction level. If the respondent is in low-income group and does not have a car, his satisfaction level is higher. Probably, he does not have any other alternative and can not compare the transit service with car. For non-transit users, flexibility of work starting time is the most significant factor with 95% significance level and also gender is significant with 90% significance level. If the respondent has no flexibility on starting work time, he is most likely to use his car. Male drivers consider transit as alternative more than female drivers do. Travel time is significant for non-transit users. Probably for long trips, non-transit users are more likely to use transit because of high travel costs and uncomfortable driving for a long time under congested conditions. For transit users travel time is not considered as a significant variable.

Considered information types are compared in Table 3 with their significant service levels. For both transit and non-transit users, six information types were considered as significant. Five information types are same among transit and non-transit users. However, considered service levels are different in some of them. In addition, walking distance to/from the station is considered as significant among non-transit users. Number of transfers is considered as significant among transit users.

Table 3 Significant information types and service levels for transit and non-transit users

Transit users		Non-transit users	
Information Type	Service Level	Information Type	Service Level
Information about how often transit vehicles run	30 min.	Information about how often transit vehicles run	15 min.
Fare information	0.5 YTL	Fare information	50 YKR
Information about operating hours	6.00 am-12.00/ 6.00am-2.00 am/ 24 hours	Information about operating hours	6.00 am- 12.00 pm
Information about waiting times	20 min/ 30 min.	Information about waiting times	30 min.
Information about station locations	1 km away	Information about station locations	750 m away
Information about transfers, and transfer locations	2 transfer/ 3 transfers	Information about walking time to/from the station	5 min. / 10 min.

30 minutes waiting time affects significance level in a negative way for non-transit users and 15-minute waiting time in a positive way for non-transit users. 0.5 YTL is considered as cheap transit fare and increase the significance level for both transit and non-transit users. Operating hours is considered as a significant information type with three service levels for transit users and with one service level for non-transit users. 20 and 30 minutes waiting time decrease the satisfaction levels of transit users. Only 30 minutes waiting time is considered as significant for non-transit users and decreases the satisfaction level. Also, far distances between the station and house of the respondent effect the satisfaction in a negative way. Number of transfers was considered as significant information with two service levels and both decrease the satisfaction level for transit users. In addition, walking time to/from the station was considered as an important information type with two levels for non-transit users and decreases the satisfaction level from the transit service.

5. Conclusions

This study investigates the important transit information types and their service levels in Izmir City, Turkey. In-person interviews were conducted to collect data from 645 respondents. 76% of the respondents were classified as transit users. Because of the income level and high gas prices, in big cities most of the residents use transit as their commute mode. Transit service information has an important role to increase the comfort level of the current users. In addition, transit service information attracts non-transit users to use transit as an alternative commute mode. 26.6% of the non-transit users declared that they would consider transit if more information was available.

Result of estimated two models showed that mostly considered significant information types are same among transit and non-transit users. However, responses for various service levels are different among transit and non-transit users. In addition, transit and non-transit users considered one different information type as significant. For transit service providers, it is important to consider the needs of different individual groups. Non-transit users' life standard is usually high because of high income. Thus, their expectation from transit service is different from others.

Socioeconomic characters also affect the satisfaction level of the users. Income is a significant variable for transit users and gender for non-transit users. Having a car and flexibility of work starting time are the other significant factors that affect the satisfaction level for transit and non-transit users, respectively.

People evaluate information as a valuable source more than before. Thus, to provide transit information to the current and potential users become a necessary part of providing transit service.

References

1) Mohamed A. Abdel-Aty, "Using ordered probit modeling to study the effects of ATIS on transit ridership", Transportation Research A, (9) 2001, 265-277.
2) Dubin J. and Rivers R., STT Users Guide Version 2.0, Pasadena CA, 1988.
3) Greene W**.,** Econometric Analysis, Fourth Edition, Prentice-Hall, New Jersey, 2000.