

## A Latent analysis on The Effect of Social Networks on Major Shopping Center Choice

Ramin Khavarzadeh<sup>1</sup>, Navid Kalantari<sup>2</sup>, Mina Pournaghi<sup>3</sup>, Neda Alirezaei<sup>4</sup>

1- PhD Candidate, Department of Statistics, Mathematical Faculty, Tarbiat Modares University.

2- Transportation Planning, PhD - Dept of Civil Engineering.

### Abstract

The effect of intra-household and intra-personal relationships has recently recognized to significantly influence many aspect of travel behavior. Previous research has considered the effect of these relationships on travel behaviors. However, research on the relationship of social networks and shopping destination choice has been scarce. This paper aims to study the effect of social networks on non-grocery shopping center destination choices. This study is based on a random sample survey. A Structural Equation Modeling (SEM) has been used to model Internet-Friendliness, Sociability and Family bonds as three latent variables that are related to the formation of social networks and shopping destination choice. The model results have confirmed the effect of these latent variables on the destination choice behavior of respondents.

**Keywords:** *Social Networks, Shopping center destination choice, sociability, internet-friendliness, family bonds.*

<sup>1</sup> Tarbiat Modares University, Tehran, Iran, Tel: +98(21) 82884424; Email: [r.khavarzade@modares.ac.ir](mailto:r.khavarzade@modares.ac.ir).

<sup>2</sup> Avand-e Tarh-o Andisheh Consulting Engineers, Tehran, Iran, Tel: +98(21) 77871287; Email: [kalantari@iust.ac.ir](mailto:kalantari@iust.ac.ir).

<sup>3</sup> Islamic azad university, Tehran, Iran, Tel: (98)9123867142; Email: [mina\\_pournaghi@yahoo.com](mailto:mina_pournaghi@yahoo.com).

<sup>4</sup> Shahid Beheshti University, Tehran, Iran, Email: [alirezaei@sharifdata.com](mailto:alirezaei@sharifdata.com).

## 1. INTRODUCTION

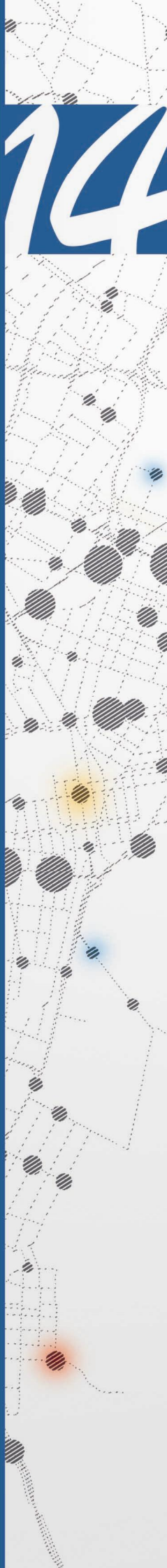
Recently the interaction among decision makers regarding their daily activities has been an interesting research field in travel behavior modeling. These studies have been mostly focused on intra-household relationships and joint trips. Compared with intra-household relations, research on the effect of social network on the daily activities, are scarce (2).

The effect of the joint decisions has been studied on different aspects of the travel behavior such as: mode choice, vehicle allocation, activity allocation and etc. One of the first studies that addressed the effect of social network on travel behavior was the study of Axhausen (3). This study has focused on leisure activities. It has been reported that observable changes in the spatial structures of the social networks has occurred in the past few years.

The effect of social networks and the interaction between decision makers on mode choice has been investigated by Dugundji and Walker (8). In this research these effects have been modeled by the use of a mix GEV model. Carrasco and Miller (6) studied the social activity-travel behavior. In this study they incorporated the influence of individuals' social context (their social networks) in terms of egocentric social networks, social activities, and social episodes. Individuals' personal attributes, social network composition, and information. Communication technology interactions with social network members have been noticed to be the most important aspect that influences the propensity to perform social activities.

Sharmeen and Ettema (12) studied the influence of urban form and accessibility of services on company choice. It was shown that better access to facilities leads to more joint activity participation, for social activities, shopping and sports/recreation. Using multilevel path analysis, Van den Berg et al. (5) studied the effects egos and ego-alter relationships on the frequency of social interaction by different communication modes. It was shown that contact frequencies of the different modes, especially face-to-face and telephone, can also be largely explained by the ego's personal characteristics, type of relationship and the distance between ego and alter.

Han et al (10) studied the influence of social networks on the formation of location choice sets. These effects have been considered to occur through information exchange, adaptations of spatial choice sets and formation of common aspiration levels. Van den Berg (4) studied the generation of social activities and travel demand for social purposes. Built environment, ICT-use and social networks were shown to play a significant role in the generation of social activity-travel.



Van den Berg has studied the social interactions in term of neighborhood -based contacts. It was shown that neighborhood-based contacts are influenced by personal and household characteristics, such as education, income, work status, ethnicity, household composition, and years at the current address. Meanwhile, social network size, the share of neighbors in the network or the frequency of interaction with neighbors, were not found to be affected by Neighborhood characteristics. Other aspects of social networks such as personal network dynamics (1), and social influence ((7), (11), (13)) have been also studied previously.

The review of previous studies reveals that, although different aspect of social network has been studied in terms of mode choice, leisure trips and social-activity trips, the studies related to the effect of social networks on destination choice has been scares in previous research. This paper aims to study the influence of social networks on shopping location choice. It has been hypothesized that the suggestion of friend and family members could affect the shopping center choice. This mechanism is assumed to be affected by the propensity to use internet and internet-base social networks, the sociability of individuals that are modeled as latent variables in this study. A Structural Equation Modeling (SEM) has been implemented to study the influence of the aforementioned latent personal characteristics on shopping center choice.

The rest of the paper in organized as follows. In the next section the data collection process has been explained. The modeling approach is presented in section three. The results and discussions are given in section four and finally section five concludes the paper.

## 2. DATA COLLECTION

The data has been collected from four different shopping centers in Tehran, Iran in 2014. The required sample size for 95% confidence and 0.05% error has been estimated to be 246 samples. Based on this estimate, the sample size of 300 shoppers was selected. The questionnaire consists of three parts: the questions about socioeconomic characteristics of the respondents, transportation related questions and some questions that have been used as a proxy for propensity to use internet, sociability and family bonds of the respondents. In order to check for the reliability of the questionnaire, Cronbach's Alpha has been used. Based on this test, the alpha value of 0.786 was obtained, which indicates that the reliability of the questionnaire is acceptable.

The shoppers were asked about their different shopping habits. Among these questions was the time they usually select for shopping. As could be seen in Figure 1, most shoppers prefer to go for shopping in the afternoon. It is worth

mentioning that, non-grocery shopping was only considered in this paper, and the time distribution of grocery shopping might differ from the ones given. The shopping frequency of the respondent is shown in Figure 2. As this figure shows nearly 30% of the shoppers could be known to be frequent shoppers (shopper that go to shopping at least once every week). To check for the influence of internet and web-base advertisements and social networks, the average daily internet usage of the respondents were asked. As could be seen in Figure 3, more than 70% of the respondents used internet for more than one hour per day. This shows that the shoppers are quite familiar with internet and social networks. Based on this survey, on average the shoppers were a member of 3 social networks. In spite of this level of internet usage, it could be seen in Figure 4 that nearly 3% of the respondents pay attention to internet advertisements in Iran.

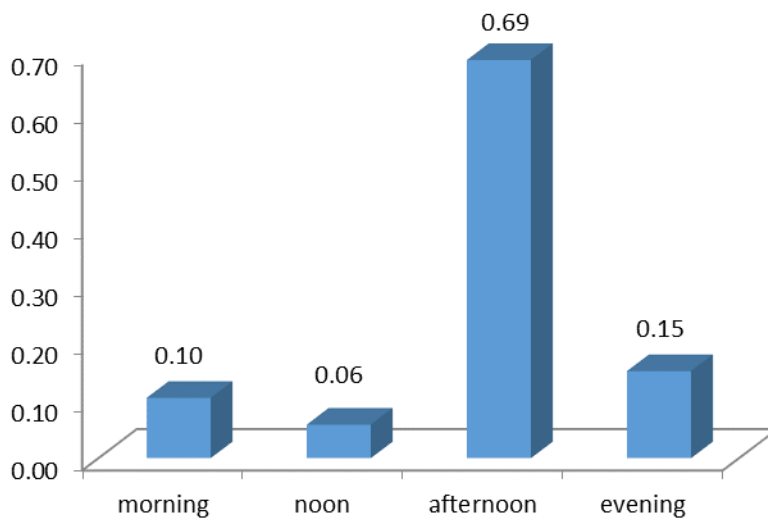


Figure 1: Time distribution of non-grocery shopping in the survey

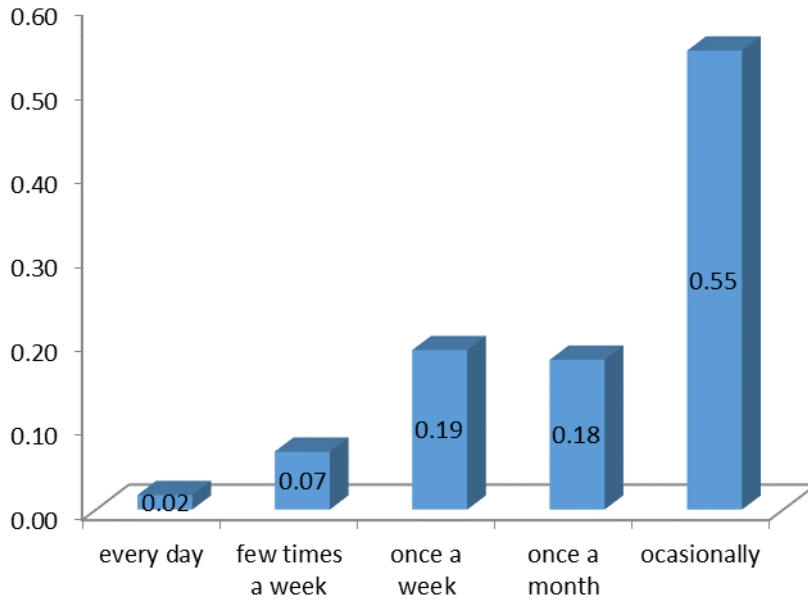


Figure 2: Shopping frequency among the respondents

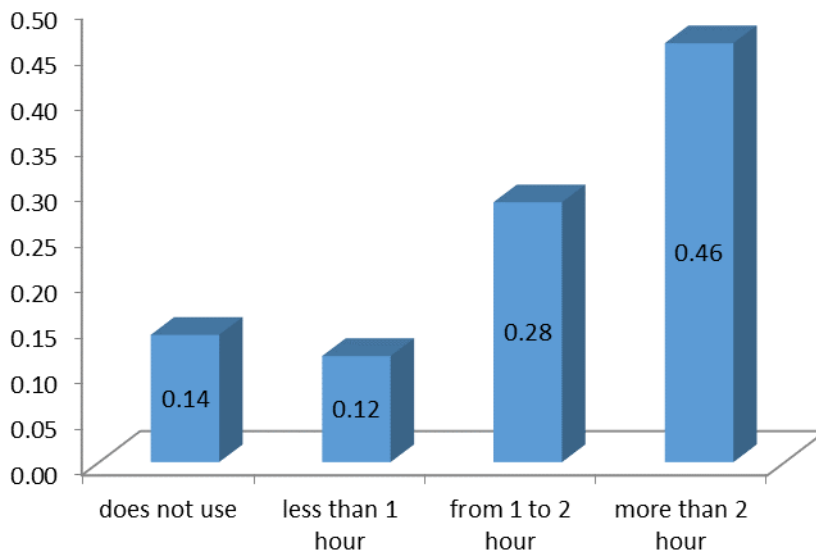


Figure 3: Average daily internet use distribution among respondents

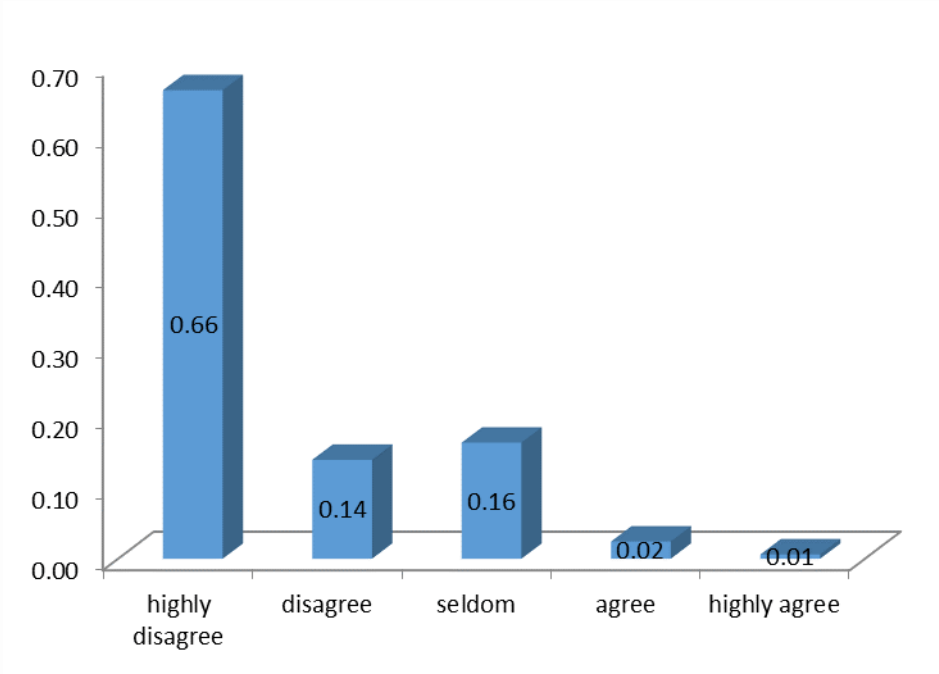


Figure 4: Attention to internet advertisements in the respondents

As given in Figure 5, 61% of the respondents said that their friends had on influence on their shopping center selection decision. Suggestions from family members had the second highest share (31%). This shows the role of friend on shopping center selection decisions.

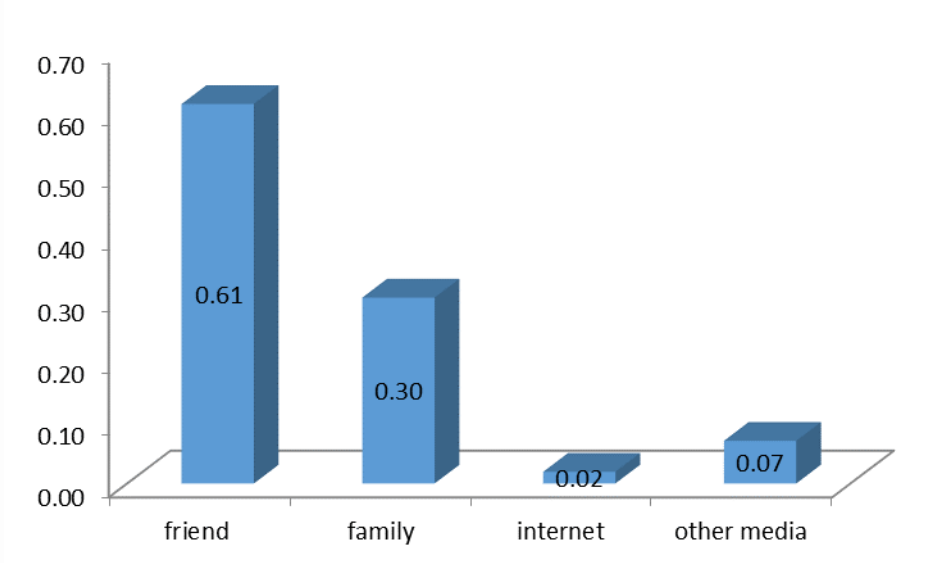


Figure 5: the distribution of influential factors on shopping center selection decision

### 3. METHODOLOGY

In this paper the effect of different latent variables on shopping center choice (shopping destination choice) has been estimated using a Structural Equation Modeling (SEM) by LISREL software. SEM is a statistical technique that is used for testing and estimating causal relations by a combination of statistical data and qualitative causal assumptions. Also called simultaneous equation models, SEMs are multivariate regression models. Unlike the more traditional linear models, the response variable in one regression equation in an SEM may appear as a predictor in another equation; indeed, variables in an SEM may influence one-another reciprocally. These structural equations are meant to represent causal relationships among the variables in the model. As this paper does not intend to give a comprehensive introduction to SEM, interested readers are referred to Multivariate Analysis (9) For more details on this subject.

The latent variables used in this study are Internet-Friendliness, Sociability, Family bonds, and Habit. The variable, Family bonds, is considered as a latent variable in order to estimate the level in with the suggestion of different family members influence the individual's shopping destination choice. The path diagram of the proposed structure is given in Figure 6. It is worth mentioning that, the term relation with classmates is used to describe the number of time a person meets his/her classmate. As many of the respondents are adults and do not go to school, this variable is used to somehow show the persistence of the respondent friendships.

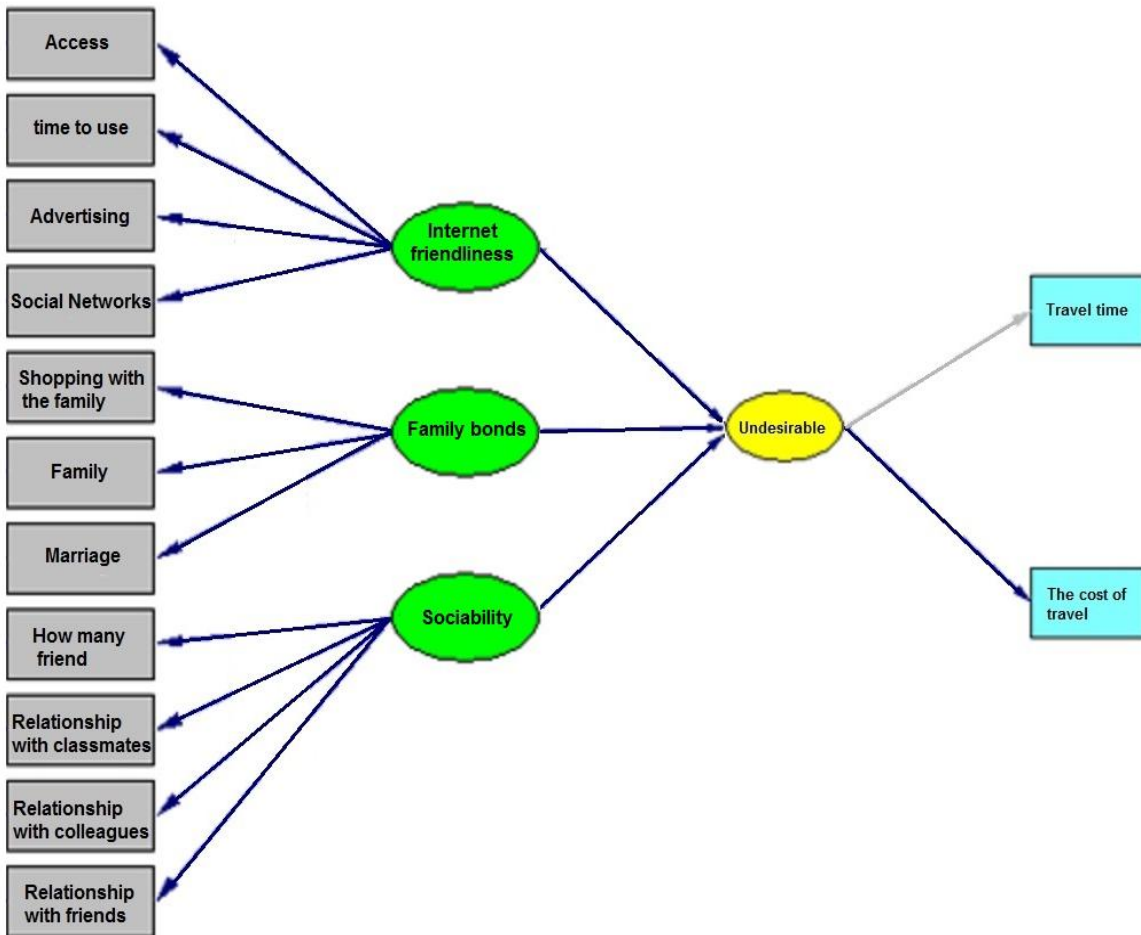
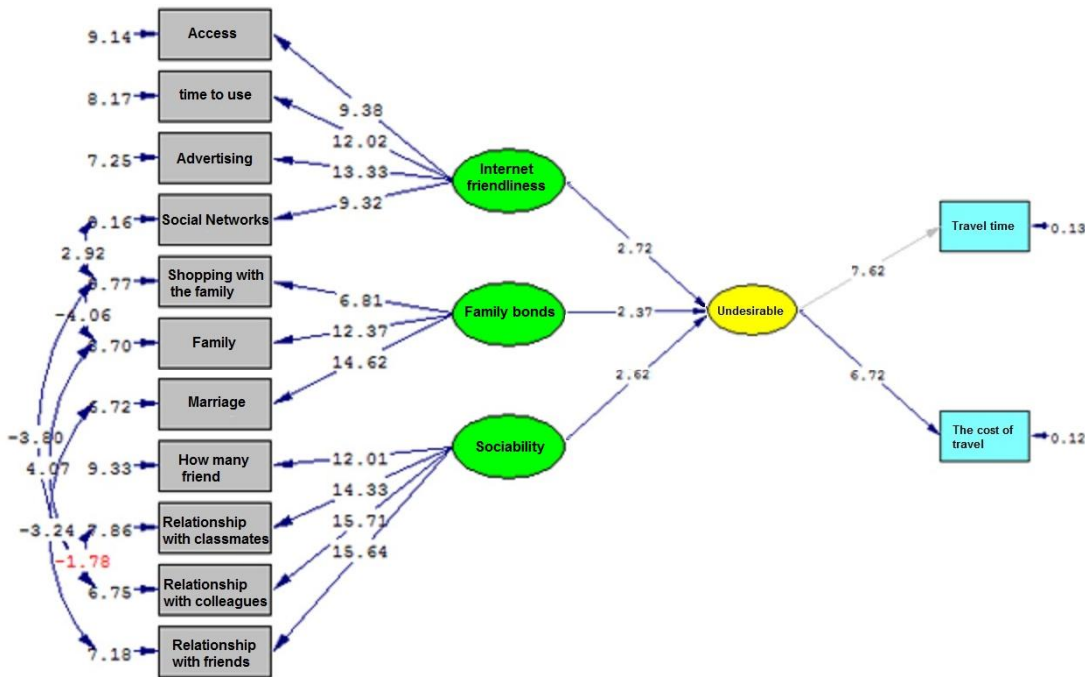


Figure 6: Path diagram of the proposed structure

#### 4. RESULT AND DISCUSSION

The model estimation results and fitness have been shown in Figure 7. As could be seen in this figure, the average daily amount of time that the respondents use internet and their interest to internet advertisements, are the most significant variables that affect personal internet-friendliness.





Chi-Square=67.53, P-value=0.00078, RMSEA=0.068

Figure 7: Results of the model estimation

The household size and marital status (married) highly influence the personal bonds to their family. The number of time at person meets their friends and relationship with colleagues (co-workers) are the most effective parameters on personal sociability. It could be seen that marital status (married) and the number of time a person meets their friends, negative affect each other, as marriage could reduce available time budget for meeting friends. As a result marriage could negatively affects personal sociability (in terms of relationship with friends) as it reduces the number of times a person meets his/her friends. Personal relationship with colleagues (co-workers) also reduces the number of times a person goes shopping with their friends. As could be seen all three latent variables defined in this paper are less significant than travel time and cost. Within the latent variables sociability and internet-friendliness are more influential than family bonds. As could be seen all the relationships shown in the figure are significant, except for the association between, the persons' relation with colleagues (co-workers) and relation with classmates. The goodness of fit measure of the proposed path diagram is given in Table 1. As could be seen all the goodness of fit measures confirmed the accuracy of the proposed path diagram.

Table 1: Goodness of fit measures for the path diagram of the latent variables

|                  | Measure        |       |      |      |
|------------------|----------------|-------|------|------|
|                  | Chi-Squared/DF | RMSEA | NNFI | AGFI |
| Acceptable range | <4             | <0.08 | >0.9 | >0.9 |
| Model Fit        | 1.12           | 0.068 | 0.96 | 0.94 |

The coefficients of the model are given in Table 2. As could be seen the constant in the model is insignificant. Sociability has the highest coefficient in the model. Meanwhile, habit is the only variable that has a negative effect on the travel disutility, as called in this paper to represent the generalized cost (including time and monetary cost). This model shows the extent in which respondents are willing to pay (in terms of travel time and cost) for their shopping travel as a function of the latent variables considered in this paper. As a result, this model converts the effect of latent variables into a generalized cost variable that could be used in shopping destination choice models. We estimated the model based on the travel time and cost data observed in the survey. This model shows that as a person becomes more sociable, he/she would pay more for shopping trips (go to further shopping centers or pay more for the trip). Family bonds, Internet-friendliness and advertisements have also shown to have the same effect. As mentioned previously habit is the only latent variable that had a negative effect on willingness to pay.

TABLE 2: The coefficients of the model

| variables             | Unstandardized Coefficients |            | Standardized Coefficients | t      | Sig. |
|-----------------------|-----------------------------|------------|---------------------------|--------|------|
|                       | B                           | Std. Error | Beta                      |        |      |
| (Constant)            | -.051                       | .049       |                           | -1.036 | .302 |
| Internet-friendliness | .174                        | .058       | .187                      | 2.978  | .003 |
| Sociability           | .339                        | .056       | .394                      | 6.058  | .000 |
| Family bonds          | .165                        | .053       | .202                      | 3.101  | .002 |
| Advertisements        | .191                        | .052       | .229                      | 3.679  | .000 |
| Habit                 | -.145                       | .052       | -.179                     | -2.793 | .006 |

## 5. RESULTS

In this paper the effect of latent variables that are related to the effect social networks of shopping destination choice has been investigated. An SEM has been used to study the effect of these variables on shopping destination choice. Sociability (relationship with friends), family bonds and internet-friendliness are considered as latent variables in this study. These latent variable are captures though some proxy questions. This study has shown that these latent variables significantly influence personal non-grocery shopping destination choice. As the level of sociability, internet-friendliness, family bonds and advertisements increase the respondents were more inclined to pay more for their shopping trips. This higher willingness to pay shows the significant effect of latent variable considered in this paper. Meanwhile Habit has shown to negatively affect willingness to pay in this paper. This is one of the first studies that have shown the effect of these variables on shopping destination choice. The incorporation of these latent variables into activity base models could be an interesting ground for future research.

## 6. REFERENCES

1. Arentze, T. and Timmermans, H. (2008). "Social networks, social interactions, and activity-travel behavior: a framework for microsimulation," *Environment and Planning B: Planning and Design*, 35, 1012-1027.
2. Axhausen, K.W. (2005). "Social networks and travel: Some hypotheses," in *Social Aspects of Sustainable Transport: Transatlantic Perspectives*, eds. Donaghy, K.P., Poppelreuter, S. and Rudinger, G., Ashgate, Aldershot, pp. 90-108.
3. Axhausen, K.W. (2005). "Activity spaces, biographies, social networks and their welfare gains and externalities: Some hypotheses and empirical results," *Paper for the PROCESSUS Colloquium*, Toronto.
4. Berg, P.E.W. van den, (2012). "Social activity-travel patterns : the role of personal networks and communication technology," Eindhoven: Technische Universiteit Eindhoven. ((Co-)promot.: prof.dr. H.J.P. Timmermans & dr. T.A. Arentze).
5. Berg, P.E.W. van den, Arentze, T. and Timmermans, H. (2010). "A multilevel path analysis of contact frequency between social network members," *Journal of Geographical Systems*, 14, 1-17.
6. Carrasco, J.A. and Miller, E.J. (2009). "The social dimension in action: A multilevel, personal networks model of social activity frequency between individuals," *Transportation Research Part A: Policy and Practice*, 43 (1), 90-104.
7. Dugundji, E. and Gulya", S.L. (2008). "Sociodynamic discrete choice on networks in space: impacts of agent heterogeneity on emergent outcomes," *Environment and Planning B: Planning and Design*, 35, 1028-1054.
8. Dugundji, E. and Walker, J. (2005). "Discrete choice with social and spatial network interdependencies: an empirical example using mixed generalized extreme value models with field and panel effects," *Transportation Research Record*, 1921, 70-78.
9. Hair, J.F., Black, W.C., Babin, B.J., Anderson, R.E. and Tatham, R. (2006). *Multivariate Analysis (6th ed.)*, New Jersey: Pearson Education Inc.
10. Han, Q., Arentze, T., Timmermans, H., Janssenb, D. and Wets, G. (2011). "The effects of social networks on choice set dynamics: Results of numerical simulations using an agent-based approach," *Transportation Research Part A: Policy and Practice*, 45 (4), 310-322.
11. Pa"ez, A. (2008). "A discrete-choice approach to modelling social influence on individual decision making," *Environment and Planning B: Planning and Design*, 35, 1055-1069.

12. Sharmeen, F. and Ettema, D.F. (2010). "Whom to hang out with and where? Analysis of the influence of spatial setting on the choice of activity company," *Conference Paper : Proceedings of the 12th World Conference on Transport Research (WCTR)*, Lisbon, July 2010, pp. 1-18.
13. Struben, J. and Sterman, J.D. (2008). "Transition challenges for alternative fuel vehicle and transportation systems," *Environment and Planning B: Planning and Design*, 35, 1070-1097.