Activity-Travel Analysis of Women in a Patriarchal Society with Strong Gender Norms

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Abstract:

In this paper, we investigate activity-travel pattern of Iranian women, where typical patriarchal views and specific social and cultural norms may alter the patterns from those in western societies. We pay special attention to the role of marital and employment status of them on their activity-travel patterns. To this extent, we develop a joint mode and daily activity pattern (DAP) discrete choice model, which is a mixed nested Logit. The upper tier of the proposed model embodies women's DAP choices, and the lower tier belongs to the mode choices. We try to show how different factors in a traditional society like Iran affect or restrict women's type and structure of activity-travel patterns.

Keywords: Women; Activity patterns; Discrete choice models; Travel behavior; Gender differences.

1 INTRODUCTION

Women's activity-travel behavior differs substantially from men's in a variety of contexts. It has considerable policy implications in different aspectsRosenbloom [1]. Understanding dissimilarities in travel and activity patterns between men and women appears to be more important when evaluating the effects of transportation policies on different categories of citizens.

The different pattern of behavior of women in developing countries highlights the need for significant efforts in conducting studies to adapt the travel demand analysis. We here aim at identifying and quantifying the main determinants of Iranian women's travel demand patterns. We present a model that considers the demand for non-work-related activities and choice of a combination of modes of transport. We do not regard the exact sequences of activity types and modes of transport. We also focus on Iranian women without comparison with men.

In Iran, traditionally and legally, women do not have equal economic and social rights as men. These differences also emerge in transportation systems. Women are less secure in their urban trips, especially at night: they have their own separate public transportation (women-only metro cars and women-only bus services). They are also prohibited from cycling in the city. Also, women in Iran have less incentive to get into the labor market and the difference in wage with men is larger as compared to women in developed countries. Differences in beliefs, perceived and commanded social norms, and resulting lifestyles of Iranian women yield many differences in their activity-travel patterns.

This paper aims to propose a discrete choice modeling framework, especially through considering the marital and employment status of Iranian women on their activity-travel patterns. A joint model as a two-level mixed nested Logit is modelled. The upper nest takes the women's daily trip structure choices, and the lower nest takes the mode choice.

The rest of this paper is structured as follows. Section 2 belongs to literature review. In Section 3, we present the databank. Section 4 covers the discrete choice modelling. In Section 5, we provide a precise discussion on the estimation results. Finally, Section 6 closes the paper by offering conclusions.

2 LITERATURE REVIEW

There are many papers in the literature that investigate women daily activity and travel choices. Many papers indicate, women tend to commute shorter distances and travel less than men, especially with respect to business and work-related travels [2-6]. Women are likely to make more grocery trips than men [7] and make fewer stops in their commute trip chaining [8]. Likewise, they appear to be less sensitive to travel time than men [9].

One of the important criteria affecting women's out-of-home activities is employment [10]. Family structure is another key criterion shaping women's activity-travel patterns. Contrary to men, the number of dependent children holds a significant influence on the time allocated to out-of-home activities by women [2]. Zhong, Wu [11] showed that men tend to spend more time for out-of-home activities, such as work, school, social, and out-of-town; whereas women contribute more to domestic work, including shopping, eating, and religious activity. In line with this fact, Gossen and Purvis [12] showed that housewives with children travel more than non-working men. McGuckin and Nakamoto [13] showed that, in dual income households, women are more likely than men to drop off or pick up children.

From above, it may be inferred intuitively that the size of the family can also affect women's out-of-home activities [2, 4, 10]. Furthermore, it was drawn that the size of family is also associated with women shorter commuting times [2].

Age of women is another contributing factor to the number of women's daily trips [2]. Wage rates also significantly affect (married) women's commute times [14]. Income and occupation are also the two main determinants affecting women's commute time [15].

Family car availability (i.e. duration of car use over a week) differs among sex types, especially for the households with fewer cars than drivers [16]. Furthermore, Mohammadian [17] showed that gender difference is a significant factor in automobile type choice. He found that women prefer better safety features, but men prefer more power and performance. Finally, Simićević, Milosavljević [18] showed that women are less car dependent and more sensitive to parking pricing, therefore, more willing to replace a car journey with public transport.

It is observed that women are more likely to account for safety and security issues in their travel mode choices [19, 20]. For instance, their fear of sexual harassment on transit affects negatively the way they use public transportation [21], which has led to women-only transportation facilities [22]. Consequently, it may be anticipated that the use of public transportation between genders is different; however, contradictory results have been reported, while Gould and Zhou [23] have found that women ride buses more than men in California, Prashker et al. [6] and Patterson, Ewing [9] have demonstrated reverse in suburban Montreal. Due to security issues, Clifton and Livi [19] showed that women alter their walking behavior to conform to safer environments. Along with security, research showed that women have tendency to reliability [20].

3 DATABANK

This study uses data drawn from 2008 weekday household travel surveys in three different cities of Iran: Arak, Mashhad, and Urmia, and all the data in this paper are consistent with this year.

Arak is a medium-size city located in the central west of Iran with more than 500,000 inhabitants. It is one of the industrialized cities in Iran and most of the inhabitants work in factories and industries. The second city is Mashhad. It is located in the north-east of Iran and is the second largest city in Iran with a population of approximately 2.6 million inhabitants. It is recognized as a holy city with more than 32 million of pilgrims coming for pilgrimage of a Shia Imam annually. Last, Urmia is a medium-size city located in the north-west of Iran. It has approximately 613,000 inhabitants in 2008. It is characterized as a multicultural city.

The activity-travel databases of these three cities had been employed previously by Arman, Kalantari [24].

In this paper, we focus on women aged more than 18. Table 1 part a reports the descriptive statistics of the three samples. In this table the notations **E**, **U**, **M**, and **S** denote, respectively, "**E**mployed", "**U**nemployed", "**M**arried", and "**S**ingle" woman.

Table 1 part b points to the statistics of the percentage of family *activity-travel tasks* carried out by women. An *activity-travel task* is one that must be carried out to meet the needs of family members. It is important to note that, we do not consider personal or non-mandatory tasks in this table.

In defining activity-travel tasks here, we focus only on (i) children's care and escort, (ii) shopping for family, and (iii) other duties. Trips for receiving the services offered to household members by public or private administrations and accompanying spouse are included in "Other duties".

The statistics show that more than 65% of activity-travel tasks associated with children care and escort in families (e.g. getting kids to school, classes, recreation, and sport) are done by working mothers in all three cities.

Unemployed married (UM) women have the highest participation rates in activities associated with children's care and family shopping activities. On the contrary, unemployed

and single (US) women almost never participate in family activities. This is not surprising as, first, they have no children (the number of single women with children, e.g. widows, in the sample was so small that we excluded them from the analysis) and, second, they do not accompany or help their relatives along their trips.

Table 1. Sample Properties and Household Task Allocation

Part A: Properties of the three samples

City	Sample size (people)	Number of households in the sample	Gender distribution (%)		Unemployment rates (%)		Share of each women category (%)			
			Female	Male	Female	Male	EM	UM	ES	US
Mashhad	39947	11073	49.7	50.3	38.4	10.2	29.39	31.16	31.68	7.77
Arak	28254	8335	49.2	50.8	39.1	9.8	29.18	32.06	30.51	8.25
Urmia	22212	6202	49.5	50.5	40.2	12.4	28.34	32.27	30.21	9.18

Part B: Percentage of family activity-travel tasks carried out by women

City	Children care and escort (%)				Shopping for family (%)				Other duties (%)			
	EM	UM	ES	US	EM	UM	ES	US	EM	UM	ES	US
Mashhad	66.83	79.12	0	0.75	59.76	72.69	4.76	0.08	23.52	41.38	1.94	0.04
Arak	65.61	77.55	0	0.55	59.18	72.73	4.71	0.06	23.16	42.24	2.36	0.03
Urmia	66.36	78.72	0	0.51	58.16	71.94	4.88	0.06	24.68	41.02	2.25	0.03

Table 2 part a reports statistics on distribution of employed women regarding to work time (part time vs. full time), flexibility of work schedule (fixed vs. flexible) and marital status (single vs. married) for employed women. In addition, Table 2 part b reports the distribution by occupation status of women.

Table 2. Women Employment Status

Part A: Distribution of employed women by work status, type of work schedule, marital status

City	Single women (S)				Married women (M)			
	Working Time		Working Hours		Working Time		Working Hours	
	Full-time	Part-time	Fixed	Flexible	Full-time	Part-time	Fixed	Flexible
Mashhad	31.43	68.57	84.5	15.5	57.49	42.51	86.1	13.9
Arak	31.55	68.45	83.9	16.1	56.71	43.29	85.4	14.6
Urmia	27.22	72.78	81.1	18.9	55.55	44.45	83.6	16.4

Part B: Employment status of women by job title

City	**i.** White/Blue-collar workers except for items **ii** and **iv**		**ii.** Research, education, and training careers		**iii.** Sales and retail jobs		**iv.** Emergency service occupations and medical and health professions		**v.** Housewives (homemakers) and unemployed women	
	Married	Single	Married	Single	Married	Single	Married	Single	Married	Single
Mashhad	32.7	29.5	9.9	33.4	9.2	10.2	2.6	3.3	45.6	23.6
Arak	32	29.7	9.5	33.6	9.7	10.5	2.6	3.5	46.2	22.7
Urmia	32.2	26.4	8.1	32.7	12.5	14.1	2.5	3.3	44.7	23.5

4 MODEL

Our model takes the form of a mixed nested Logit (MNL) model (see, e.g. [25]). The nesting structure models determines the reciprocal dependency between choice of a daily activity pattern and the choice of a mode of transportation through an additional inter-alternative correlation and unobserved taste variation across decision-makers by including error components and random parameters in the utility functions. Our approach accounts for the presence of inter-alternative correlation in the unobserved utility terms and allows for a random distribution of tastes across decision-makers [26].

4.1. Choice sets

We develop a MNL model with the two tiers: (i) the top tier captures the traveler's *daily activity pattern* (DAP) choices and (ii) the lower tier accounts for the traveler's *mode choice* behavior. A DAP is a combination of trip purposes and their frequencies.

To model women's daily mode and DAP choices, we eliminate work trips from women's daily trip chain because we want to analyze the effect of employment on women's daily activity-travels. A work trip considered as an explanatory variable that is added to the utility function of the DAP choice model. Trip purposes are classed as *shopping trips* (labeled with S), *children-related trips* (labeled with C) like getting children to school or taking them to the doctor, *leisure trips and pilgrimages* (labeled with L), and *other trips* (labeled with O).

All the observed DAPs are sorted based on their frequency and those having at least 5% chance of observation are included in the women's DAP choice set. These DAPs encompass 89% of all the observations and the remaining are omitted from the analysis. There are 39926 observations used in the estimation of the model.

The DAP choice set is composed of 9 alternatives:

(i) DAP1: S(1)C(1)O(1)
(ii) DAP2: S(2)L(1)
(iii) DAP3: S(1)C(1)L(1)
(iv) DAP4: S(1)O(1)
(v) DAP5: S(1)L(1)
(vi) DAP6: L(1)C(1)
(vii) DAP7: S(2)
(viii) DAP8: L(2)
(ix) DAP9: C(1)O(1)

As already stated, the numbers in the parentheses refer to the number of trips while letters refer to the trip types. For example, DAP2: S(2)L(1) refers to combination of two shopping (S) and one leisure (L) trips in a day.

The observed travel behaviors reveals that the mode choice set is made of three individual and four combined modes of transportation. The individual modes are:

- Private car,
- Share taxi, and
- Bus;

and the combined modes are:

- Walk+private car,
- Walk+share taxi,
- Walk+regular bus, and
- Bus+share taxi.

There are no express bus services, high-frequency all-day services, or bus rapid transit services existed at the time the travel surveys were conducted in these cities.

Another important note is that we account for walking as an access way to other modes of transportation, and we distinguish it from walking as the only mode of transport.

4.2. Joint Model Structure

Decisions of women on activity-travel choices and their travel modes are made simultaneously. It is necessary to construct a mathematical structure that reflects such correlated decision making processes [27].

Basically, our joint DAP and mode choice model is a two-tiers MNL model, in which the upper tier takes the women's DAP choices, and the lower tier takes their mode choice behavior.

Our model structure is sequentially presented, although its estimation is made at once by maximum likelihood simulated technique.

A woman n is confronted with I modes of transport. She would gain a level of utility from each alternative. The utility that she receives from selecting mode i is u_{ni}, $i = 1,\ldots,I$. Similarly, there are K DAPs and the woman would receive a level of utility, w_{nk}, as a result of selecting DAP k.

We apply a non-fixed-choice set model. There are availability conditions that cause choice sets to be different from one individual to another. Stated more precisely, for example, mode choice set for women without a driving license or without a personal/household car is restricted to non-car modes of transportation. On the other hand, "private car" or "walk+private car" modes pertain to the choice set of women with driving license and personal/household car. There are also restrictions in the DAP choice set formation.

The joint model system is presented in Equations (1) to (6) in the following sections. The utility function of the mode choice model is presented in Equation (1). Equation (3) presents the utility function of the DAP choice model.

Mode choice alternatives are indexed by i (i=1,…,I), the DAP alternatives by k (k=1,…,K), women by n (n=1,…,N), decision attributes of the mode choice model by m (m=1,…,M), decision attributes of the DAP choice model by l (l=1,…,L), and women's household attributes by h (h=1,…,H).

4.3. Mode choice model

The transportation mode choice part of the modelling system is a MNL with random parameters and error components according to Figure 1.

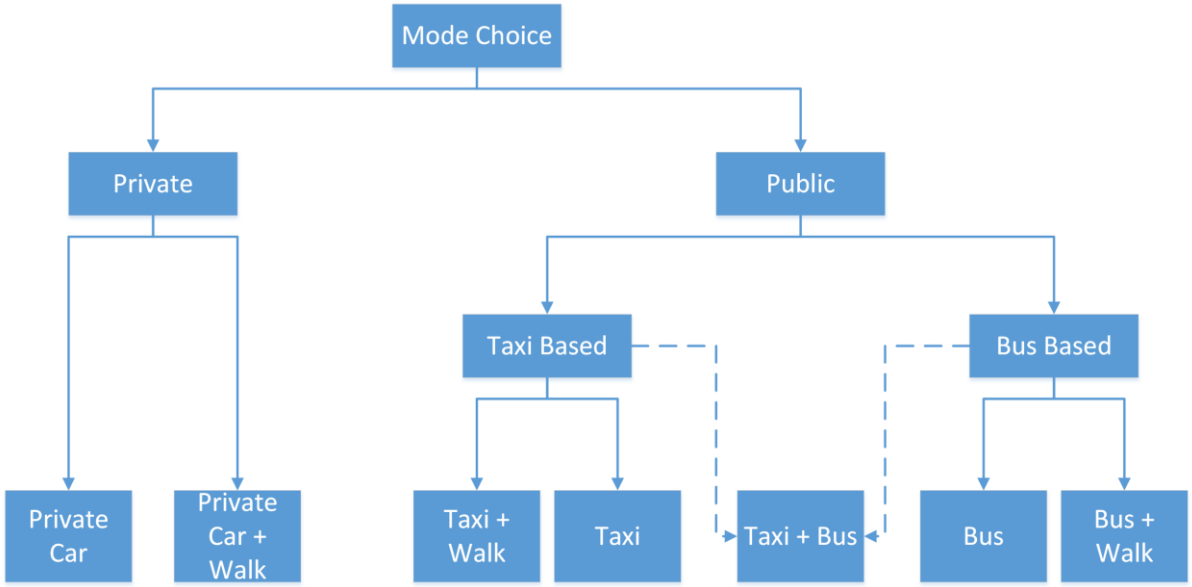

Figure. 1 Model Structure

The associated utility function is defined as follows:

$$u_{ni} = \left(\alpha_i^T + \gamma_n^T\right) x_{ni} + \rho_i r_n + \lambda_i \delta_n + \theta_i \eta_n + c_i + \zeta_m + \varepsilon_{ni} \quad (1)$$

where

u_{ni} The utility that woman n obtains from transportation mode i;

x_{ni} M×1 Column vector set of attributes is associated with woman n and mode i;

α_i M×1 Column vector of the mean effects of the elements of x_{ni} on women's utility for choosing mode i. The superscript T points to the transpose of the vector;

γ_n M×1 Column vectors whose m^{th} element denotes the unobserved factor specific to woman n. γ_n capture unobserved causes of influence of the corresponding m^{th} element of the vector set of attributes, x_{ni}. Each element of this vector has the log-normal distribution: $\gamma_{mn} \sim \ln N\left(0, \varsigma_m^2\right)$ where ς_m^2 is estimated;

r_n Dummy variable equal to 1 if any parking is available at the destination of woman n, who has traveled with private car, and zero otherwise;

ρ_i Corresponding mixed coefficient;

δ_n Dummy variable equal to 1 if a work trip done by woman n today and equal to zero otherwise;

λ_i Corresponding mixed coefficient;

η_n Common factors influencing woman n's utility for choosing any combination of modes and DAPs;

θ_i Corresponding mixed coefficient;

c_i Model constant;

ζ_m This component attempts to capture the correlation between modes of transportation. Subscript m denotes a different category of modes. We consider the vector of error components $\boldsymbol{\zeta} = \left\{\zeta_1, \zeta_2, \zeta_3, \zeta_4\right\}$, where ζ_1 captures the correlation between "private car" and "walk+private car", ζ_2 captures the correlation between "share taxi" and "walk+ share taxi", ζ_3 is for the correlation between "regular bus" and "walk+regular bus", and finally, ζ_4 denotes the correlation among "share taxi", bus and "bus+share taxi". We did not consider the unobserved correlation for other combinations;

ε_{ni} Idiosyncratic random error which is independently, identically distributed (iid) extreme value type I across women.

The probability of choosing transportation mode i by woman n is derived from:

$$P_{ni}^{u} = \frac{e^{u_{ni}}}{\sum_{j=1}^{I} e^{u_{nj}}} \tag{2}$$

4.4. DAP choice model

Women's DAP choice part of the modelling system also takes MNL formulation, as presented below:

$$\begin{aligned} w_{nk} &= w'_{nk} + \varphi_k \left(\ln \sum\nolimits_j e^{u_{nj}}\right) + \omega_k \eta_n \\ w'_{nk} &= \left(\beta_k^T + \nu_n^T\right) z_{nk} + d_k + \xi_{nk} \end{aligned} \tag{3}$$

where

w_{nk} The utility that woman n obtains from DAP k;

z_{nk} L×1 Column vector sets of variables related to DAP k;

β_k L×1 Column vector of the mean effects of z_{nk} 's elements on women's DAP choice utility;

v_n L×1 Column vectors whose l^{th} element denotes unobserved factor specific to woman n, which captures unobserved causes of influence of the corresponding lth element of the vector set of attributes, z_{nk}. Each element of this vector has the following normal distribution: $v_{ln} \sim N\left(0, \psi_l^2\right)$ where ψ_l^2 is estimated;

$\ln \sum_j e^{u_{nj}}$ Logsum of the utilities (u_{nj}s) associated with all transportation modes. It is used as a measure of accessibility to show the influence of the overall accessibility of woman n to transportation modes on her DAP choices;

φ_k Mixed coefficient representing the effect of the overall accessibility to transportation modes on the utility of choosing DAP k;

η_n Common factors influencing woman n's utility for choosing any combination of modes and DAPs;

ω_k Corresponding mixing parameter;

d_k Model constant; and

ξ_{nk} Idiosyncratic random error that is distributed iid extreme value type I across women.

Now, the conditional probability of choosing DAP k by woman n is derived from:

$$P_{nk}^{w} = \frac{e^{w_{nk}}}{\sum_{q=1}^{K} e^{w_{nq}}} = \frac{e^{w'_{nk} + \varphi\left(\ln \sum_j e^{u_{nj}}\right) + \omega\eta_n}}{\sum_{q=1}^{K} e^{w'_{nq} + \varphi\left(\ln \sum_j e^{u_{nj}}\right) + \omega\eta_n}} \tag{4}$$

or

$$P_{nk}^{w} = \frac{e^{\left(w'_{nk} + \omega\eta_n\right)} \times \left(\sum_j e^{u_{nj}}\right)^{\varphi}}{\sum_{q=1}^{K}\left(e^{\left(w'_{nq} + \omega\eta_n\right)} \times \left(\sum_j e^{u_{nj}}\right)^{\varphi}\right)} \tag{5}$$

The utility functions of travel mode and DAP choice models are considered to be estimated jointly and they are supposed to be interdependent. The dependency is created in two ways:

1. Using a common component in the models (η).
2. Putting the outcome of the lower level choice model (mode choice) into the utility function of the upper level choice model (DAP choice).

4.5. The common component (η_n)

The presence of the common component across two tiers of the mode, allows a joint modeling framework. The common component in Equation 1 and 3 has the following form:

$$\eta_n = \phi \times e^{\left(\vartheta^T y_n + f\right)} \tag{6}$$

where

y_n H×1 Column vector sets of variables related to woman n's household attributes;

ϑ H×1 Column vector of coefficients;

f A constant;

ϕ A vector of random coefficients that is distributed bivariate normal with parameters μ and Σ, where μ the 2-dimensional is mean vector and Σ represents the 2×2 covariance matrix.

The common component of the modeling system allows the utility function of mode choice (Equations 1 and 2) and DAP choice (Equations 3 and 5) models to vary across women through capturing the women's household attributes by y_n (see Equation 6).

The effect of women's household socioeconomic characteristics is captured by the joint component of the model system containing an H×1 column vector set of variables related to woman n's household attributes (y_n). Based on the marital status of each woman, these attributes are only related to parental household (for single women) or spouse household (for married women), so the women's marital status effects are captured by this joint component.

Such a joint component was firstly used as a working assumption in an article by Pinjari, Eluru [27]. We employ it here because of the following reasons:

1. Using same socioeconomic variables in two models that are estimated jointly with one likelihood function may result in the multicollinearity of predictors. The joint component used to relax it.
2. Using a joint component is an alternative approach for bringing more socioeconomic variables in the models.
3. It also relaxes the quasi collinearity among the predictive variables.

4.6. Model Estimation

The input variables of the models are x_{ni}, δ_n, z_{nk}, and y_n, the set of random terms is $E=\{\phi, \varepsilon_{ni}, \xi_{nk}\}$, the set of vertical stacks unobserved factors is $\Lambda=\{\gamma_n, \nu_n\}$, and the parameters that must be estimated are:

Γ The vector of all constant parameters (non-random coefficients) in the utility functions, i.e. $\Gamma=\{\alpha_i, \rho_i, \lambda_t, \theta_i, c_i, \beta_k, \varphi_k, \omega_k, d_k, \vartheta, f\}$

Θ The vectors that vertically stack standard errors ς_m and ψ_l, i.e. $\Theta=\{\varsigma_m, \psi_l\}$

Like before, suppose n as the index of women. The probability of woman n choosing the mode that she was actually observed to choose is formulated as:

$$\prod_{i=1}^{I}\left(P_{ni}^{u}\right)^{\Delta_{ni}} \tag{7}$$

where Δ_{ni} is a dummy taking the value 1 if mode i is chosen by woman n and 0 otherwise.

In the same manner, the probability of choosing the DAP by woman n that she was actually observed to choose is formulated as

$$\prod_{k=1}^{K}\left(P_{nk}^{w}\right)^{\Delta_{nk}} \tag{8}$$

where Δ_{nk} is a dummy which takes the value 1 if DAP k is chosen by woman n and 0 otherwise. The conditional likelihood function of choosing modes and DAPs by woman n based on her observed choices is

$$L_n(\Gamma,\Lambda)=\prod_{k=1}^{K}\left(\left(P_{nk}^{w}\right)^{\Delta_{nk}}\times\prod_{i=1}^{I}\left(P_{ni}^{u}\right)^{\Delta_{ni}}\right) \tag{9}$$

where P_{ni}^{u} and P_{nk}^{w} are derived from Equations 2 and 5, respectively. Then, the unconditional choice probabilities are

$$P_{nk,ni} = \int_{\Lambda} L_n(\Gamma, \Lambda) f\left(\Lambda \middle| \Theta\right) d\Lambda \quad (10)$$

The simulation approach using randomized and scrambled Halton sequences is applied to approximate the multidimensional integral in Equation 10 and calculate $\check{P}_{nk,ni}$ as the unbiased estimator of $P_{nk,ni}$. Assuming that each woman's choice is independent of the decisions of other women, we insert $\check{P}_{nk,ni}$s into the log-likelihood function to give simulated log likelihood as follows:

$$SLL = \sum_{n=1}^{N} \ln \check{P}_{nk,ni} \quad (11)$$

The resulting simulated log likelihood function (SLL) is used in the maximum likelihood estimation.

5 RESULTS

5.1. Mode choice model estimation

Mode choice model estimation results are presented in Tables 3. Table 3 reports the estimated parameters in part a and estimated vertically stack standard errors in part b. The correlation between modes in the mixed nested structure of the mode choice model are:

- $\zeta_{(\text{Private})} = 0.681$
- $\zeta_{(\text{Taxi-based})} = 0.719$
- $\zeta_{(\text{Bus-based})} = 0.706$
- $\zeta_{(\text{Taxi,Bus,Taxi+Bus})} = 0.595$

High correlation between two individual modes, namely "regular bus" and "share taxi" with the combined mode "bus+share taxi", shows that the nesting structure has been defined correctly.

The absolute values of t-statistics are given in parentheses. For this analysis, to calculate the *out of pocket cost*, monetary values are converted from Iranian Rials to US Dollar ($) based on the exchange rates in 2008. The ticket fares paid by women are considered as the daily out of pocket cost (DOPC) of travelling by bus system; moreover, the cash fare paid to the taxi drivers is the DOPC of taking taxis.

The reference mode of transportation is alternative 1 ("private car"). The intercept term is fixed to zero for identification purpose.

For the woman having a private car, depending on her car type and manufacturing year, the DOPC is computed based on the average daily fuel consumption, average daily vehicle repair cost, and average daily fees and taxes, which are normally calculated by dividing annual amounts to the number of days in a year.

From Table 3, it is worth noting that the most significant variable in the mode choice utility function is the *effect of common component* that represents *spouse or parents' characteristics* on woman's mode choice. A comparison of the coefficients shows that regardless of the *out-of-pocket cost* variable which has the highest-coefficient in the utility function, *employment status of woman* is one of the variables that strongly influences a woman's decision of mode choice.

It can be observed that, women's employment is directly related to their use of family cars. That is, the higher the rate of employment among women, the higher the rate of car usage by them. Perhaps it is because of the higher state of economic independence of employed women leading to a shift from traditional household style to the new one.

Among all the variables in the utility functions, *out-of-pocket cost* is the most effective one. Besides, *availability of parking space at the destination* accounts for the utility function of "private car" and "walk+private car" modes of transportation. As can be seen, this variable is highly significant in the model.

High values of the *t*-statistic for the coefficient estimated for the joint model components (in Table 3) imply that the proposed joint model structure is a proper structure for modeling in this context.

The effect of women's household socioeconomic characteristics on both mode and DAP choices is reflected through a joint component in the model system (η_n). The related coefficient in the mode choice utility function (θ) is estimated as provided in Table 3. Based on the marital status of each woman, various types of household attributes are brought into the model. The household type in this study could be one of the "parental", "sibling", "kin-headed", "individual", or "conjugal" households. By doing so, the effects of women's marital status are captured using the joint component of the women's DAP and mode choice models. The coefficient of the joint component is significantly high which confirms that the household attributes are influencing factors on women's mode choice behavior.

Table 3. Estimated Results of Mode Choice Model

Part A: Estimated parameters $(\alpha_i, \rho_i, \lambda_i, \theta_i, c_i)$ and corresponding *t*-statistic (in parentheses) of the mode choice model (StDev of mixed coefficients $(\rho_i, \lambda_i, \theta_i)$ are reported in bracket)

Coefficients of components in the utility function of the model choice model	Modes of travel						
	1.Private car	2.Regular bus	3. Share taxi	4.Walk+ private car	5.Walk+ regular bus	6.Walk+ share taxi	7. Bus + share taxi
Travel time (hours)	-1.55 (-5.88)	-3.82 (-5.14)	-1.99 (-6.11)	-1.42 (-5.33)	-3.87 (-4.69)	-2.12 (-6.01)	-2.64 (-6.16)
Access and egress time (hours)	–	-1.46 (-2.97)	-0.69 (-3.77)	–	-1.14 (-2.78)	-0.53 (-3.55)	-1.01 (-3.14)
Waiting time (hours)	–	-1.93 (-3.67)	-0.81 (-3.13)	–	-1.98 (-3.52)	-0.74 (-3.91)	-1.53 (-3.52)
Out-of-pocket cost ($)	-5.43 (-7.19)	-9.63 (-6.89)	-5.74 (-7.33)	-4.93 (-6.61)	-9.61 (-7.17)	-6.08 (-6.42)	-7.22 (-7.07)
Availability of parking space at the destination (a dummy variable (ρ)) *	3.11 (7.55) [0.09] (13.02)	–	–	2.66 (6.41) [0.37] (5.14)	–	–	–
Employment status of woman (coefficient of the employment dummy variable (λ_i)) *	4.31 (17.88) [0.69] (9.05)	2.31 (19.74) [0.11] (11.14)	3.26 (19.55) [0.41] (6.41)	3.95 (18.42) [0.62] (10.55)	2.16 (18.77) [0.08] (7.96)	3.04 (18.87) [0.38] (13.41)	2.79 (20.04) [0.27] (11.27)
Effect of common component on mode choice (spouse or parents' characteristics) (θ_i) *	2.16 (23.77) [0.31] (4.16)	2.67 (22.88) [0.28] (6.64)	2.42 (21.66) [0.33] (3.55)	2.25 (20.44) [0.19] (9.17)	2.81 (24.19) [0.24] (7.67)	2.52 (20.77) [0.32] (3.89)	2.55 (23.17) [0.39] (5.91)
Model constant (c_i)	0.0 (–)	1.77 (2.69)	1.23 (2.84)	0.83 (3.14)	2.01 (2.59)	1.09 (2.93)	1.61 (2.75)

Part B: Estimated error component in mixed Logit structure (ς_i) and corresponding *t*-statistic (in parentheses) of the mode choice model

Coefficients of components in the utility function of the mode choice model	Modes of travel						
	1.Private car	2.Regular bus	3. Share taxi	4.Walk+ private car	5.Walk+ regular bus	6.Walk+ share taxi	7. Bus + share taxi
Travel time (hours)*	0.22 (17.55)	0.71 (12.23)	0.33 (13.03)	0.27 (8.16)	0.79 (15.91)	0.35 (7.42)	0.32 (9.67)
Access and egress time (hours) *	–	0.58 (3.66)	0.52 (5.19)	–	0.56 (4.55)	0.49 (11.07)	0.56 (7.43)
Waiting time (hours) *	–	0.46 (8.11)	0.38 (4.59)	–	0.47 (6.12)	0.40 (3.16)	0.45 (4.51)
Out-of-pocket cost ($)*	1.17 (7.13)	0.12 (5.93)	0.19 (12.41)	1.04 (9.05)	0.09 (8.11)	0.18 (4.17)	0.14 (5.02)

Notes: (i) The values in parenthesis under the estimated parameters are t-statistics and values in bracket are StDev of the coefficients, correspondingly the value in parenthesis after values in the bracket are estimated t-test correspond to StDev values. All the coefficients are statistically significant at the 5% level of significance; (ii) Normal distribution supposed as mixed feature of these variables in the Mode choice model; (iii) Negative Log-Normal distribution supposed as mixed feature of these variables in the Mode choice model.

5.2. DAP choice model estimation

Tables 4 and 5 present the estimated coefficients of utility functions of the DAP choice model. The common component is found to be the most meaningful variable, based on both values of the estimated coefficient and *t*-statistic.

As shown in Table 4, women's *age* is one of the factors on women's DAP choice behavior. For the first three DAPs, which consist of three activities, the value of the coefficient of *age* decreases with the increasing magnitude of this variable. This coefficient becomes even negative for elderly women. In contrast, other DAPs (DAP4 to DAP9) which comprise only two activities seem more suitable for elderly women considering of the fact that through choosing these DAPs, elderly women may not meet a busy daily schedule. Moreover, DAP7, which consists of only two shopping activities, is in their favor.

For young women, DAP8, which consists of two leisure activities, seems more preferred among other DAPs. However, DAP9 with one children-related activity is the most preferred DAP for middle-aged women, as it is more probable that they are involved in child-rearing duties.

The next category of explanatory variables in the DAP choice model is related to women's employment status. For the first three DAPs, which consist of three activities in a day, the estimated coefficient of occupation type is positive for both *unemployed* and *housewife* women and negative for all other occupation types. That is to say, unemployed single (US) or unemployed married (UM) women tend to make more trips than employed ones, as also expected intuitively. The estimated coefficient for *emergency service occupations and medical and health professions* is negative for all of the DAPs. It means that these women are not interested in taking part in any shopping (or leisure) activities due to their physically strained and stressful jobs. DAP9 would be their preferred option if they have no choice but to make a trip in addition to the work trip. The same is true for all other career women. On the contrary, housewives prefer, to a greater extent, to be involved in daily activity-travel patterns like DAP7 which consists of two shopping activities. Moreover, for unemployed single women, two leisure activities, namely DAP8, seem more interesting than others.

Another significant variable is *daily working time.* As shown in Table 8, the higher the daily work hours, the less the tendency of women to have busier activity schedules, i.e. DAP1, DAP2, and DAP3.

Work shift, is also one of the influencing factors on women's daily DAP choice behavior. In our study, only jobs with consistent shifts are brought into the modelling framework and the jobs with rotating shifts were omitted since they have very low number of observations in the sample. The jobs are categorized into:

- *Morning occupations*
- *Midday occupations*
- *Evening or overnight occupations*

When the work shift is changed from morning to midday or from midday to evening-and-overnight, it causes the women to downplay the possibility of choosing the first three DAPs.

One of the most influencing factors on women's DAP choices is the presence of a work trip in a day. The results reveal that a woman with a work trip in a day does not tend to participate in more than two activities in the same day. That is why the estimated coefficients of *having a work trip today* variable are negative for those DAPs including three activities per day. Furthermore, women with a work trip in a day are more encouraged to take part in two shopping activities and choose DAP7 on the same day than women without a work trip.

The highest values of the estimated coefficients of *mode choice effect* variable are found for the first three DAPs. It means that the DAPs with more trips are more affected by mode choice decisions. In addition, the estimated coefficients for these DAPs with a shopping activity-travel are higher than other ones.

High values of the estimated coefficient of the joint component (ω_i) and the related *t*-statistic reveals that women's DAP choice decisions are highly influenced by their household characteristics.

Table 4. Estimated parameters $(\beta_k, \varphi_k, \omega_k, d_k, \vartheta, f)$ and corresponding *t*-statistic (in parentheses) of the mode choice model (StDev of mixed coefficients $(\rho_i, \lambda_i, \theta_i)$ are reported in bracket)

Variable category	Variable	Daily activity patterns (DAP)								
		DAP1	DAP2	DAP3	DAP4	DAP5	DAP6	DAP7	DAP8	DAP9
Demographic variables	Age									
	- Young (Up to 35 years old)	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)
	- Middle-aged (36-59 years old)	0.0 (-)	-1.21 (-3.89)	-0.82 (-3.55)	-0.89 (-3.66)	-1.61 (-3.92)	1.23 (4.66)	-0.22 (-4.18)	-2.26 (-5.16)	1.55 (4.47)
	- Elderly (60 years old and more)	0.0 (-)	-3.19 (-2.99)	-3.02 (-3.62)	0.77 (4.12)	-0.77 (-4.91)	-0.44 (-3.88)	1.04 (3.87)	-1.33 (-3.84)	0.51 (3.36)
	Education									
	- Up to high school diploma	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)
	- Bachelor's degree	0.0 (-)	-0.15 (-1.91)*	0.08 (1.22)**	-0.33 (-1.16)**	-0.10 (-1.47)**	-0.12 (-1.85)*	-0.05 (-1.88)*	-0.41 (-1.41)**	0.17 (1.26)**
	- Master's degree or PhD	0.0 (-)	-0.11 (-1.80)*	0.12 (1.64)*	-0.41 (-1.91)*	-0.46 (-1.11)**	-0.57 (-1.32)**	-0.44 (-1.47)**	-0.42 (-1.55)**	0.13 (0.42)**
Transportation variable	Having a work (business) trip today?	0.0 (-)	0.59 (7.12)	-0.88 (-7.12)	1.11 (6.16)	1.01 (7.19)	1.25 (5.59)	2.26 (5.11)	0.62 (8.81)	0.85 (7.73)
Employment status										
	Occupation type:	0.0 (-)	-1.29 (-4.48)	-1.13 (-2.24)	1.65 (3.19)	1.23 (5.15)	1.44 (4.16)	1.91 (3.93)	0.66 (5.17)	2.57 (4.48)
	i. White/Blue-collar workers except for items ii and iv, below	0.0 (-)	-1.24 (-4.12)	-1.09 (-3.88)	1.71 (5.12)	1.31 (3.47)	1.57 (3.01)	2.12 (4.99)	0.85 (3.64)	2.74 (4.16)
	ii. Research, education, and training careers	0.0 (-)	0.31 (4.19)	0.14 (2.49)	1.11 (4.86)	1.85 (4.47)	2.31 (3.97)	1.44 (2.55)	1.34 (4.91)	3.41 (3.55)
	iii. Sales and retail jobs									
	iv. Emergency service occupations and medical and health professions	0.0 (-)	-1.77 (-4.16)	-1.61 (-3.91)	-1.01 (-4.14)	-0.80 (-2.94)	-0.65 (-3.17)	-1.07 (-4.12)	-1.11 (-3.16)	-0.41 (-3.95)
	v. Housewife (homemaker)	0.0 (-)	2.66 (4.11)	2.52 (3.62)	2.84 (4.16)	3.23 (3.88)	3.44 (3.92)	3.57 (3.77)	3.35 (4.24)	3.30 (4.01)
	vi. Unemployed	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)

Notes: The values in parenthesis under the estimated parameters are t-statistics. All the coefficients are statistically significant at the 5% level of significance unless otherwise indicated:. One asterisk (*) (which does not exist in this table) indicates that the coefficient is not significant at the 5% level, and two asterisks (**) indicate that the coefficient in not significant even at the 15% level of significance.

Table 4. (continued)

Variable category	Variable	Daily activity patterns (DAP)								
		DAP1	DAP2	DAP3	DAP4	DAP5	DAP6	DAP7	DAP8	DAP9
Employment status (continued)	Daily working time - Less than 6 hours	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)
	- 6 to 9 hours	0.0 (-)	-0.31 (-6.11)	-0.22 (-5.17)	0.79 (4.91)	1.12 (4.77)	1.02 (4.45)	1.83 (4.69)	0.52 (4.19)	0.84 (4.52)
	- More than 9 hours	0.0 (-)	-0.96 (-5.19)	-0.81 (-4.99)	0.81 (4.11)	0.51 (4.77)	0.96 (4.18)	0.89 (3.97)	-0.47 (-4.04)	1.07 (3.65)
	Work shift - Morning	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)
	- Midday	0.0 (-)	-0.44 (-3.11)	-0.35 (-3.19)	0.55 (3.22)	-0.13 (-2.25)	1.31 (3.18)	0.92 (3.55)	0.71 (3.47)	1.19 (3.62)
	- Evening or overnight	0.0 (-)	-0.68 (-3.67)	-0.61 (-3.82)	-0.13 (-2.11)	-0.33 (-2.56)	-0.26 (-3.69)	0.83 (3.15)	-0.51 (-3.19)	0.98 (3.41)
	The workplace is located in the CBD?	0.0 (-)	1.14 (7.63)	-1.53 (-8.43)	0.88 (6.53)	0.16 (7.12)	-3.55 (-5.94)	0.47 (7.14)	-4.55 (4.35)	0.32 (3.33)
Mode choice effect (φ_k)		4.08 (13.07)	5.22 (9.44)	4.37 (12.28)	1.77 (10.02)	1.81 (12.95)	1.23 (9.21)	3.16 (13.33)	1.22 (14.55)	0.89 (10.65)
Common component										
	Effect of common component on mode choice (Household characteristics) (ω_k)	0.0 (-)	1.26 (17.77)	1.39 (20.77)	0.61 (19.42)	2.22 (16.66)	2.45 (22.01)	1.55 (17.82)	1.33 (19.36)	2.77 (20.16)
Model constant (d_k)		0.0 (-)	2.55 (3.25)	1.99 (2.82)	1.33 (2.73)	2.47 (3.13)	1.11 (2.44)	2.19 (2.91)	0.94 (2.67)	1.88 (3.05)

Notes: (i) The values in parenthesis under the estimated parameters are t-statistics. All the coefficients are statistically significant at the 5% level of significance; (ii) Normal distribution supposed as mixed feature of all the variables in the DAP choice model.

Table 5. Estimated error component in mixed Logit structure (ψ_l) and corresponding *t*-statistic (in parentheses) of the mode choice model

Variable category	Variable	Daily activity patterns (DAP)								
		DAP1	DAP2	DAP3	DAP4	DAP5	DAP6	DAP7	DAP8	DAP9
Demographic variables	Age									
	- Young (Up to 35 years old)	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)
	- Middle-aged (36-59 years old)	0.0 (-)	0.19 (6.16)	0.22 (4.18)	0.11 (11.02)	0.36 (5.15)	0.28 (3.79)	0.13 (9.12)	0.41 (7.09)	0.24 (10.44)
	- Elderly (60 years old and more)	0.0 (-)	0.15 (5.67)	0.34 (3.43)	0.15 (7.71)	0.24 (6.92)	0.14 (8.42)	0.34 (12.66)	0.36 (4.55)	0.12 (9.17)
	Education									
	- Up to high school diploma	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)
	- Bachelor's degree	0.0 (-)	0.23 (0.56)**	0.44 (0.04)**	0.19 (2.27)	0.28 (2.03)	0.19 (1.29)**	0.38 (1.47)**	0.18 (1.12)**	0.22 (0.52)**
	- Master's degree or PhD	0.0 (-)	0.29 (2.16)	0.39 (1.31)**	0.26 (0.88)**	0.17 (0.47)**	0.29 (0.66)**	0.05 (0.73)**	0.16 (0.58)**	0.54 (0.14)**
Transportation variable	Having a work (business) trip today?	0.0 (-)	0.12 (5.59)	0.26 (14.03)	0.25 (7.17)	0.34 (4.44)	0.32 (22.08)	0.46 (9.17)	0.24 (6.65)	0.22 (7.33)
Employment status										
	Occupation type:									
	i. White/Blue-collar workers except for items ii and iv, below	0.0 (-)	0.11 (5.56)	0.15 (4.88)	0.37 (13.11)	0.35 (4.47)	0.41 (5.19)	0.44 (9.62)	0.19 (3.31)	0.66 (4.77)
	ii. Research, education, and training careers	0.0 (-)	0.15 (2.39)	0.39 (12.88)	0.49 (4.87)	0.56 (9.43)	0.45 (8.11)	0.29 (5.55)	0.31 (5.91)	0.59 (7.84)
	iii. Sales and retail jobs	0.0 (-)	0.09 (7.56)	0.07 (5.13)	0.33 (8.01)	0.44 (3.79)	0.52 (2.55)	0.51 (4.01)	0.04 (17.45)	0.17 (2.77)
	iv. Emergency service occupations and medical and health professions	0.0 (-)	0.36 (4.29)	0.44 (3.77)	0.29 (8.41)	0.32 (9.19)	0.24 (5.16)	0.31 (11.01)	0.27 (13.09)	0.11 (4.14)
	v. Housewife (homemaker)	0.0 (-)	0.47 (7.17)	0.51 (5.56)	0.32 (3.13)	0.27 (2.77)	0.51 (5.59)	0.41 (8.91)	0.44 (16.66)	0.62 (13.01)
	vi. Unemployed	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)	0.0 (-)

Notes: The values in parenthesis under the estimated parameters are t-statistics. All the coefficients are statistically significant at the 5% level of significance unless otherwise indicated: One asterisk (*) indicates that the coefficient is not significant at the 5% level, and two asterisks (**) indicate that the coefficient in not significant even at the 15% level of significance.

Table 5. (continued)

Variable category	Variable	Daily activity patterns (DAP)								
		DAP1	DAP2	DAP3	DAP4	DAP5	DAP6	DAP7	DAP8	DAP9
Employment status (continued)	Daily working time									
	- Less than 6 hours	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)
	- 6 to 9 hours	0.0	0.02	0.07	0.04	0.09	0.11	0.02	0.11	0.07
		(-)	(14.55)	(8.74)	(6.65)	(6.19)	(3.12)	(8.81)	(7.42)	(9.19)
	- More than 9 hours	0.0	0.05	0.04	0.12	0.08	0.04	0.13	0.06	0.09
		(-)	(4.43)	(3.62)	(11.52)	(3.67)	(2.89)	(9.53)	(8.14)	(3.31)
	Work shift									
	- Morning	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)
	- Midday	0.0	0.16	0.19	0.14	0.08	0.06	0.15	0.14	0.13
		(-)	(9.55)	(4.62)	(5.99)	(3.75)	(2.11)	(6.85)	(4.73)	(5.91)
	- Evening or overnight	0.0	0.18	0.16	0.10	0.12	0.01	0.18	0.13]	0.17
		(-)	(4.88)	(2.47)	(7.55)	(9.92)	(3.16)	(7.44)	(14.50)	(6.62)
	The workplace is located in the CBD?	0.0	0.43	0.27	0.02	0.05	0.49	0.15	1.02	0.06
		(-)	(3.14)	(22.18)	(13.88)	(5.91)	(4.66)	(3.21)	(4.14)	(7.09)

Notes: (i) The values in parenthesis under the estimated parameters are t-statistics. All the coefficients are statistically significant at the 5% level of significance; (ii) Normal distribution supposed as mixed feature of all the variables in the DAP choice model.

5.3. Estimation of the joint component

Table 6 summarizes the estimation results of the joint component of the model. There are different types of households surveyed in this study. Only parental and conjugal households are brought in the modelling estimation presented in Table 6. Moreover, the joint component reflects women's household attributes.

For a single woman living with her parents, the most important variables are *parents' educational level* and *age gap between the single woman and her parents*. Although traditional values may strongly influence cultural and social norms in a developing country like Iran, which restricts female activities outside the home, parents' educational level may alter traditional norms and could be highly influential on girls' lifestyle. For a married woman living in a conjugal household, *spouse's educational level*, *having a less than 12-year-old child*, and household *car ownership* are the most important variables.

One of the main findings from Table 6 is that in the patriarchal religious societies like Iran, the traditional perceptions of gender roles, which may even create barriers for woman's daily activities, are significantly constrained by providing learning opportunities for people at school, college, or universities (e.g. see the *coefficients* of *father's education level*, *mother's education level*, or *spouse's education level*).

We estimated 86 parameters of the mode choice model with 4 correlation parameters. In addition, we estimated 265 parameters for the DAP choice models and 31 parameters of the joint component. For these estimations $LL(0)$ and $LL(\beta)$ are equal to -7539.522 and -4734.465 respectively. Consequently *Likelihood ratio (L*), Rho-Square* (ρ^2) *and Craig and Uhler's* R^2 for our model are equal to 5610.1, 0.372 and 0.417 respectively.

Table 6. Estimated parameters and corresponding *t*-statistic of the joint component of the model

Variable category	Variable	Coefficient	*t*-statistic
Parental household socioeconomic variables (for a single woman living with her parents)	- Household size	-1.17	-3.04
	- Number of employed adults in the family	1.44	3.58
	- Car ownership	0.51	2.22
	- Is the home located in the CBD	0.31	1.65*
	- Is the father employed?	1.11	3.77
	- Is the mother employed?	1.85	4.16
	Siblings		
	- Having a little brother?	-0.41	0.43**
	- Having a little sister?	-0.68	0.55**
	Father's educational level		
	- Up to high school diploma	-1.08	-6.11
	- Bachelor's degree	1.29	6.55
	- Master's degree or PhD	2.37	6.46
	Mother's education level		
	- Up to high school diploma	-0.88	-4.62
	- Bachelor's degree	1.51	5.94
	- Master's degree or PhD	2.88	4.37
	Age gap between the single women and her parents (on average)		
	- Less than 20 years	1.22	6.32
	- 20-30 years	0.55	7.15
	- More than 30 years	-0.94	-5.93
Conjugal household socioeconomic variables (for married women)	- Household size	-1.87	-3.27
	- Car ownership	2.77	6.01
	- Is the home located in the CBD?	0.94	0.69**
	Spouse's occupation type		
	-White/Blue-collar workers except for 2nd and 4th items, below	1.17	2.47
	- Research, education, and training careers	1.73	3.12
	- Sales and retail jobs	0.55	3.55
	- Emergency service occupations and medical and health professions	-0.74	-3.19
	- Unemployed	-1.52	-4.17
	Spouse's education level		
	- Up to high school diploma	-1.42	-6.37
	- Bachelor's degree	1.55	7.45
	- Master's degree or PhD	2.94	6.66
	Having a less than 12 years old child		
	- Boy	-2.89	-9.99
	- Girl	-3.75	-9.43
Model constant	(*f*)	0.83	3.19

Notes: All the coefficients are statistically significant at the 5% level of significance unless otherwise indicated: One asterisk (*) indicates that the coefficient is not significant at the 5% level, and two asterisks (**) indicate that the coefficient is not significant even at the 15% level of significance.

6. CONCLUTION

It is important to study separately women's trip-making behavior as many potentially influencing factors of travel behavior are tied to gender differences. Investigating women's behavior enables us to grasp the conceptual underpinnings of women's travel demand reactions to transportation system policies and to pinpoint, more accurately, the strategies alleviating the so-called gender equity dilemma in the transportation system, where mostly the developing societies across the nations face.

This study is one of the few studies supplied with appropriate data and attempted to examine the travel behavior of women in Iran. Our main achievements are as follows:

- From a sociological perspective, parents' educational level could lessen the strength of traditional/religious norms and values and could provide more freedom for women in social activities, personal, and familial life. The same also holds true for married women (i.e. spouses' educational level supports the freedom of women).
- Having a child, especially a less than 12 years old, considerably affects women's transportation behavior and activity patterns outside the home.
- Women's employment directly affects their use of family cars for non-work-related activities.
- The existence of a work trip in a day is one of the most influencing factors on women's daily activity structure and lessens the participation of women in other activities on the same day.
- The physically strained and stressful jobs or jobs with long working hours reduce the tendency of women in voluntary activities or entertainment.
- Being unemployed or a housewife increases the number of non-work activities of women, which varies depending on whether they are married or single. For singles, the number of daily leisure activities increases while for married women, the number of shopping activities increases.
- Women's household socioeconomic characteristics significantly affect women's activity-trip making behavior.

These findings stress the need for incorporating such gender-related observations into the transportation demand models like car-ownership models, cooperative activity-based models, mode choice models, departure time choice models, etc.

7. REFERENCES

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