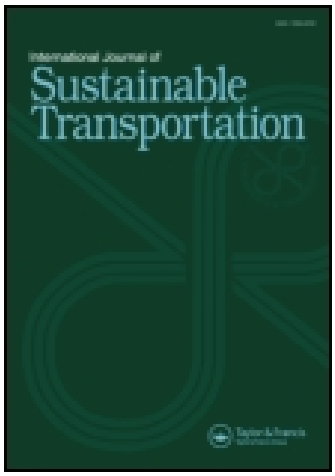

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Money Allocation to Out-of-Home Leisure Activities and the Organization of These Activities in Time and Space

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Monetary budgets influence activity participation and related travel as they demarcate limits on how people organize their activities in time and space. In this paper, we are interested in money allocation to out-of-home leisure activities and how this is affected by duration, sociodemographics, and time-location variables. Analyses were carried out by applying a seemingly unrelated regression model to a leisure activity data set. The analyses revealed that expenditures for out-of-home leisure activities are influenced by the variables mentioned above. Moreover, the results indicate that there is a substitution between expenditure of each activity.

Keywords: activity duration, activity-travel patterns, monetary expenditures, out-of-home leisure activity

1. Introduction

Activity-travel patterns shape urban settlements and vice versa. Understanding activity-travel patterns is therefore important to guide sustainable development. Since the mid-1990s, activity-based models have been developed to better represent the decision mechanisms of individuals and households. A distinctive feature of these models is their consideration of time expenditure on activities and travel for predicting activity-travel patterns in time and space.

In time-use studies of activity-travel behavior, it is assumed that spending time on activities brings utility. This utility can be explained with a concave function because utility increases with decreasing marginal utility. Moreover, time allocated to an activity is chosen to maximize the utility that is obtained, subject to the time constraint (Bhat and Misra 1999; Kitamura 1984). Therefore, these models can explain the influence of changes in urban structure and transportation by predicting the effects of these changes on activity participation and time allocation.

Activity participation is affected, however, not only by time constraints, but also by monetary constraints, because many activities require money, directly or indirectly. Moreover, growing scarce resources will likely increase the costs of conducting activities. Therefore, understanding the allocation of monetary budgets for different activities is important for shaping a better sustainable urban settlement.

The relation between time use and monetary expenditures is significant, especially for out-of-home leisure activities. For instance, if an individual spends more time on an activity, then this may increase monetary expenditure. There is also a trade-off between monetary expenditures and time use within activities. For example, if an individual has to spend more time on in-home activities, this decreases the time spent on out-of-home activities.

The study of monetary constraints in activity participation started in the mid-1960s. Becker (1965) proposed a microeconomic framework addressing the importance of monetary constraints in activity participation. In his microeconomic framework, income was added as a constraint. Later, De Serpa (1971) and Evans (1972) proposed improvements and modifications of this seminal model. According to microeconomic theories, utility is a function of time spent on different activities and the consumption of goods during these activities, which is associated with the cost of the activity. Therefore, participation in an activity for a given duration implies a particular cost. Constraints are derived from time and money budgets for conducting various activities so that trade-offs have to be made between these budgets. However, this model does not consider spatial aspects, such as travel time, travel costs, and price differentiation between locations.

These early theories create the foundation for several recent studies on the subject of time and money constraints (e.g., Arentze and Timmermans 2011; Jara-Diaz et al. 2008; Kockelman 2001; Konduri et al. 2011; Zhang 2009). Except Arentze and Timmermans (2011) and Zhang (2009), these frameworks for modeling activity resource allocation do not consider allocation of monetary budgets on an activity episode level, but describe the total time allocated to activity classes across episodes. Although Zhang (2009) considers the allocation of budgets on an activity episode level, his framework ignores spatial elements and activity participation. Consequently, these frameworks cannot incorporate conditions and choice facets such as location and timing that may vary across episodes of an activity and hence influence duration and expenditure choices as well. In particular, monetary expenditures are also

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affected in two ways by where an activity is conducted. First, by spending more time or money on traveling, one can reach a more attractive location where one can likely spend more time and money. Second, the location may influence time and money spent directly if locations differ in terms of price levels. In addition, time variables such as season and day of the week influence activity participation. For instance, people engage in fewer water recreation activities during winter and more going-out activities on weekends. Moreover, individuals from different sociodemographic backgrounds may have different activity patterns. To address these issues, Arentze and Timmermans (2011) developed a random utility maximization (RUM) dynamic activity-based framework for simultaneous modeling time and money budget constraints on an activity episode level. However, this model has not been validated empirically yet.

In this paper, we are interested in the money allocation for out-of-home leisure activities because the availability of out-of-home leisure activities is increasing rapidly, which causes more consumption of these activities and their related travel. Using seemingly unrelated regression analysis, the specific purpose of this paper is to estimate the effects of sociodemographics and time-location variables such as day of the week and location of activity on activity participation, taking into account the duration of out-of-home leisure activities. The specification of the analysis is derived from a utility-maximization model of activity participation under a monetary budget constraint. This paper reports estimation results based on a national continuous leisure time data set collected in 2008 in the Netherlands.

The paper is structured as follows. First, we introduce the methodology. Next, we present the data and estimation results. Finally, the paper concludes with a summary of results and a discussion of future research.

2. Methodology

Our utility function stems from the existing Cobb-Douglas production function (Cobb and Douglas 1928). The Cobb-Douglas functional form of production functions is widely used to represent the relationship between inputs and output. Moreover, it has also been used for activity time allocation models by Jara-Diaz et al. (2008) and Konduri et al. (2011). We can rewrite the function as a utility function that is derived from the attractiveness of time and location, time spent, and expenditure spent as in the following equation:

$$U_{ijp} = A_{ijp}(T_{ijp})^{\alpha_i}(E_{ijp})^{\beta_i} \tag{1}$$

where *i, j,* and *p* are the subscripts for activity type, activity episode, and person; U is the utility derived from conducting an activity; A_{ijp} is a utility factor derived from the attractiveness of the location of the activity, the start time of the activity, the season, and the day of the week; $\mathrm{T_{ijp}}$ is the duration; $\mathrm{E_{ijp}}$ is the money spent on the activity; and α_i and β_i are saturation parameters for duration and expenditure. The latter saturation parameters range between 0 and 1. When the value of α_i is smaller than one, the utility function displays diminishing returns with increasing duration of the activity episode, which is realistic for out-of-home leisure activities. Likewise, when the value of β_i is smaller than one, the utility function displays diminishing returns with increasing expenditure for the activity episode.

Expenditures for activities are constrained by the available monetary budget. Therefore, the marginal utility for expenditure is equal to a value that represents the budget constraint. For instance, if a marginal utility is high, this means that the budget constraint is tight because an individual with a low budget gets more satisfaction from conducting an activity. The marginal utility of expenditure is given by:

$$\partial U_{ijp}/\partial E_{ijp} = \beta_i A_{ijp}(T_{ijp})^{\alpha_i}(E_{ijp})^{\beta_i - 1} \tag{2}$$

We can write marginal utility of expenditure $\partial U_{ijp}/\partial E_{ijp}$ as a constant C, which represents scarcity of money for each person. Equation 2 can be solved for expenditure and transformed to a logarithmic form to obtain an additive function. This results in the following equation:

$$\ln(\mathrm{E_{ijp}}) = \frac{1}{\beta_\mathrm{i} - 1}\left(\ln(\mathrm{C_p}) - \ln(\beta_\mathrm{i}) - \ln(\mathrm{A_{ijp}}) - \alpha_\mathrm{i}\ln(\mathrm{T_{ijp}})\right) \tag{3}$$

For convenience, we define:

$$\mathrm{b_i} = \frac{1}{\beta_\mathrm{i} - 1} \tag{4}$$

It should be noted that b_i has a negative value because β_i ranges between zero and one. Then Equation 3 can be rewritten as follows:

$$\ln(E_{ijp}) = b_i \ln(C_p) - b_i \ln(\beta_i) - b_i \ln(A_{ijp}) - \alpha_i b_i \ln(T_{ijp}) \tag{5}$$

For ease of estimation, we seek a function of expenditure that is linear in parameters. If we assume for ease that the second term is approximately a constant:

$$\theta_i \approx b_i \ln(\beta_i) \tag{6}$$

then we can rewrite Equation 5 as follows:

$$\ln(E_{ijp}) = \theta_i + b_i \ln(C_p) - b_i \ln(A_{ijp}) - \alpha_i b_i \ln(T_{ijp}) \tag{7}$$

The first two terms on the right-hand side of the equation represent a budget effect and an attractiveness effect on expenditure, respectively. To obtain a linear model, we specify these components as a linear function of a set of explanatory variables, as follows:

$$\mathrm{b_i}\ln(\mathrm{C_p}) = \sum_\mathrm{k} \lambda_\mathrm{ki} \mathrm{X_{kip}} \tag{8}$$

$$\mathrm{b_i}\ln(\mathrm{A_{ijp}}) = \sum_\mathrm{m} \gamma_\mathrm{mi} \mathrm{Z_{mjp}} \tag{9}$$

$$\alpha_\mathrm{i}\mathrm{b_i} = \delta_\mathrm{i} \tag{10}$$

where X are person/household level indicators of available budgets of each person conducting an activity, Z are time and location level variables of attractiveness of the activity episode for each person, and λ_{ki} and γ_{mi} are parameters to be estimated. Person/household level indicators such as gender, age, etc., are

used for marginal utility of expenditure because the sociodemographic variables in the model enable us to estimate possible systematic effects of these person variables on the utility. The last component δ_i, represents the effect of duration of the activity type on expenditure. Finally, we get the following linear-in-parameters function for expenditure, which is a regression model of monetary allocation:

$$\ln(E_{ijp}) = \theta_i + \sum_k \lambda_{ki} X_{kip} - \sum_m \gamma_{mi} Z_{mjp} - \delta_i \ln(T_{ijp}) \quad (11)$$

Because the proposed model is a linear-in-parameters equation (11), we can apply a seemingly unrelated regression estimation (SURE) to test the impact of various sociodemographic, time-location variables and duration effects, in which the impact of those variables are estimated simultaneously on different activity expenditures. The model can be estimated equation-by-equation using the standard ordinary least squares (OLS) method. However, these estimates are not as efficient as the SURE method, which uses a feasible generalized least squares criterion with a specific form of the variance-covariance matrix (Zellner 1962). The SURE system assumes that the error terms are correlated across the equations and therefore the equations are related to each other. First, we assume that a utility is derived from an activity i, which consists of an error term. Therefore, we can use Equation 12 to have a system of simultaneous equations for each activity category.

$$\ln(E_{ijp}) = \theta_i + \sum_{ki} \lambda_{ki} X_{kip} - \sum_{mi} \gamma_{mi} Z_{mjp} - \delta_i \ln(T_{ijp}) + \varepsilon_{ijp} \quad (12)$$

This system can be estimated as a system of seemingly unrelated regressions, allowing the error terms ε_{ijp} to be correlated to represent mutual dependencies between activity types.

3. Data

The data used for the empirical analysis in the paper was obtained from the 2008/2009 Continuous Free Time Use (CVTO) data set. CVTO is a national-level survey conducted by the Dutch Board of Tourism and Conventions and Taylor Nelson Sofres-Netherlands Institute for Public Opinion (TNS-NIPO). It is representative of the Dutch population, conducted between May 2008 and May 2009. The data set includes information about expenditures for various kinds of activities (direct costs of activity), such as consumptions during the activity, entrance fee, money spent in the shops, etc., and the expenditure of travel for these activities. The data do not include subscription, contribution, and membership costs.

This survey collected information on leisure activity episodes that the individual participated in over the course of a week. Only the activities that were conducted for one hour or more are included in the data set. A wide range of activities were collected that can be clustered into 10 activities as follows:

- Outdoor recreation, such as walking for pleasure or recreation in parks, forests, or near the sea

Table 1. Sample characteristics

Variables	Frequency	Percent
Sociodemographic Variables		
Gender		
Male	4925	47.4
Female	5472	521.6
Age		
<18	1590	15.3
18–24	819	7.9
25–54	4974	47.8
55–64	1485	14.3
65–74	1057	10.2
>75	472	4.5
Social Class		
High	1863	17.9
Middle	5985	57.6
Low	2549	24.5
Household Composition		
Single	1761	17.0
Family with children	5514	53.0
Family without children	3122	30.0
Urban Density		
Strong	4940	47.5
Moderate	2488	23.9
Low	2969	28.6
Time & Location Variables		
Season		
Summer	2459	23.7
Other seasons	7938	76.3
Day of the Week		
Weekdays	5795	55.7
Weekends	4602	44.3
Start Time		
Morning	3675	35.3
Afternoon	4395	42.3
Evening and night	2327	22.4
Location		
City/village center	9411	90.5
City park	63	0.6
On or near water	234	2.3
Own neighborhood	88	0.8
Rural or recreational	494	4.8
Other areas	107	1.0
Activities		
Activity Purpose		
Outside recreation	1490	14.3
Water recreation	529	4.1
Visiting sport event	337	3.2
Wellness and beauty	261	2.5
Attraction visit	725	7.0
Event visit	432	4.2
Fun shopping	3078	29.6
Culture	495	4.8
Going out	1919	18.5
Other hobbies and courses	1131	10.9

- Water recreation and sports such as surfing, fishing, swimming
- Event visits such as exhibition, fairs, shows, festivals
- Fun shopping (doesn't include grocery shopping) such as shopping for pleasure in the shopping center, furniture mall visit, going to factory outlet
- Culture such as concert, musical, museum
- Visiting sports events such as going to watch a football game
- Attraction visit such as attraction parks, zoo
- Going out such as bar, café, disco visits, eating out
- Wellness and beauty
- Other hobbies and courses such as club activities, drawing, taking photographs, language courses

The episode-level information collected in the data set includes the kind of activity, start time, duration of the activity and travel, expenditure for the activity and travel, location of the activity, and travel distance to the activity. In addition, data on individual and household sociodemographics are collected.

Table 1 gives an overview of the key sample characteristics. The sample is fairly distributed across gender classes. 47.8% of the sample is between 25 and 54 years of age. 57.6% of the sample is from the middle social class. 53.0% of the households are families with children and the rest are single households and families without children. Almost half of the sample lives in strong urban density areas. When we look at time and location variables, activities conducted in summer represent 23.7% of the sample. 55.7% are out-of-home leisure activities conducted on weekdays, while 44.3% are conducted on weekends. 35.3% of the activities begin in the morning; 42.3% start in the afternoon, and 22.4% begin in the evening. Most activities are conducted in a city or village center. Fun shopping is the most frequently conducted activity with a percentage of 29.6%, followed by going out and outside recreation.

4. Empirical Analysis

4.1. Variable Specification

The data set has a panel structure because each respondent does more than one activity in a week and so has multiple responses. To eliminate the panel structure, we randomly sampled one activity of each person. Several types of variables were considered in the model specification. These included (1) total duration of the activity and travel; (2) individual and household sociodemographics (gender, age, social class, household composition, and urban density); (3) timing and location variables (day of the week and season of the year, beginning time of activity, location, distance to the activity); and (4) activity type that is conducted. The dependent variable is total expenditure on activity and travel. We used the natural logarithm of expenditure in the regression and therefore the activities that have no expenditure were excluded. Moreover, we also used the natural logarithm of duration in the regression. Expenditure, distance, and total duration variables are used as continuous variables in the regression, while the others were coded as dummy variables.

In the data set, most activities (90.5%) are conducted in a city/village center. Table 2 shows the observed frequencies of location types for each activity. Outside recreation and water recreation activities are observed in different location categories, while other activities are observed only in the city/village center. Therefore, location type will be used only in the models for outside recreation and water recreation activities.

4.2. Model Estimation Results

Tables 3.1 and 3.2 present the model estimation results. An empty cell in this table indicates that the variable does not have a statistically significant effect on the activity. The coefficients in the table indicate the effects of variables on expenditures for activities. A positive sign of an estimated coefficient indicates that either the budget is greater or that the attractiveness of the location or time of the activity is greater. This reflects the tendency that expenditure increases both if the budget is greater and the attractiveness is greater. It is noted, however, that with this regression analysis we cannot disentangle the budget effect and attraction effect on expenditure. Furthermore, the estimates capture an effect of β, which is a saturation effect. For instance, people with higher saturation, that is, who experience more strongly diminishing returns on expenditure, will spend less. Overall, the coefficients that are estimated cannot separate budget effects, attraction effects, and saturation effects.

If we look at the sociodemographic effects on activities, we see that being female has a positive effect on expenditures for wellness and beauty, event visits, and fun shopping activities, while it has a negative effect on expenditures for outside recreation, visiting a sports event, and going-out activities. People less than 18 years of age have a positive effect on expenditure for water recreation and attraction visit. However, people less than 18 years of age have a negative effect on fun shopping

Table 2. Observed leisure out-of-home activities according to the location types

	Outside recreation	Water recreation	Visiting sport event	Wellness and beauty	Attraction visit	Event visit	Fun shopping	Culture	Going out	Other hobbies and courses	Total
City/village center	580	453	337	261	725	432	3078	495	1919	1131	9411
City park	59	4	0	0	0	0	0	0	0	0	63
On or near water	186	48	0	0	0	0	0	0	0	0	234
Own neighborhood	83	5	0	0	0	0	0	0	0	0	88
Rural or recreational	484	10	0	0	0	0	0	0	0	0	494
Other areas	98	9	0	0	0	0	0	0	0	0	107
Total	1490	529	344	261	725	433	3078	495	1919	1166	10397

Table 3.1. Estimation results

Activities/Main effects		Outside recreation		Water recreation		Visiting sport event		Wellness and beauty		Attraction visit	
		B	Sig.	*B*	Sig.	*B*	Sig.	*B*	Sig.	*B*	Sig.
Constant		0.73	0.00			−0.19	0.00			−0.42	0.00
Gender	Female	−0.01	0.03			−0.02	0.00	0.02	0.00		
Age	<18			0.03	0.00					0.03	0.01
	25–54										
	55–64	0.04	0.01								
	65–74	0.04	0.01								
	75+										
Social Class	High					−0.01	0.04				
	Middle			−0.01	0.01						
Household	Single					−0.01	0.03	0.02	0.00	−0.02	0.05
	Family without children	0.02	0.01			−0.01	0.01			−0.02	0.02
Urban Density	Strong										
	Moderate			−0.01	0.04						
Season	Summer	0.03	0.00			−0.01	0.00			0.02	0.00
Day of the Week	Weekends	0.04	0.00	−0.02	0.00	0.03	0.00	−0.02	0.00	0.01	0.01
Beginning Time	Morning	0.03	0.00	0.02	0.00	−0.01	0.05			0.05	0.00
	Afternoon	0.04	0.00							0.02	0.02
Distance		0.0035	0.00							0.0006	0.00
Location	City park	0.12	0.00	−0.04	0.05	—	—	—	—	—	—
	On or near Water	0.29	0.00	0.10	0.00	—	—	—	—	—	—
	Own neighborhood	0.11	0.01			—	—	—	—	—	—
	Rural or recreational	0.25	0.00			—	—	—	—	—	—
	Other areas	0.17	0.00	−0.05	0.00	—	—	—	—	—	—
Duration		0.08	0.00			0.04	0.00			0.10	0.00
R-square		0.144		0.018		0.019		0.011		0.037	

and going-out activities. This is an expected result due to the limited monetary budget of this age category. Moreover, people between the ages of 25 and 54 tend to spend less on going-out activities compared to the base category. Furthermore, people between the ages of 55 and 64 tend to spend more on outside recreation and other hobbies, while they tend to spend less on fun shopping and going-out activities. It is also found that people between the ages of 65 and 74 have a positive effect on expenditure for outside recreation and other hobbies and they have a negative effect on expenditure for fun shopping and going-out activities. In addition to this, it is found that people over the age of 75 have a positive effect on expenditure for culture and other hobbies, while they have a negative effect on expenditure for fun shopping and going-out activities. These results indicate that the need for fun shopping and going-out activities decreases with aging.

People from high social classes tend to spend more on event visits, culture, and going-out activities, while they tend to spend less on visiting sports events and fun shopping activities. Moreover, the middle social class has a positive effect on expenditure for event visits and culture activities; however, it has a negative effect on water recreation and fun shopping activities. The results show that people spend more on event visits and culture activities with increasing social class, which is expected. Another result indicates that expenditure on fun shopping increases with increasing social class.

Furthermore, when we look at the household composition effects, it is found that single households tend to spend more on wellness and beauty and going-out activities. However, they tend to spend less on visiting sports events and attraction visit activities. It is also found that families without children have a positive effect on the expenditure for outside recreation, fun shopping, and going-out activities, while they have a negative effect on visiting sports events and attraction visits.

Strong urban density has a positive effect on expenditure for fun shopping and culture activities, while it has a negative effect on expenditure for event visits and other hobbies. Moderate urban density has a negative effect on expenditure for water recreation activities. This might be a result of a correlation between the type of water recreation activity (less expensive) and urban density (moderate) of the location where it is conducted.

With respect to the time variables, summer has a positive effect on expenditure for outside recreation, attraction visits, and going-out activities. This result is expected because those activities are conducted mostly when the weather is suitable. Moreover, summer has a negative effect on visiting sports event activities, which is also expected because sports events are not conducted during the summer as often as other seasons. In addition, summer also has a negative effect on expenditure on other hobbies. Furthermore, weekend has a positive effect on expenditure for outside recreation, visiting sports events, attraction visits, event visits, and going-out activities, while it has a negative effect on water recreation, wellness and beauty, fun shopping, and other hobbies. Conducting activities in the morning has a positive effect on expenditure for outside

Table 3.2. Estimation results

Activities/Main effects		Event visit		Fun shopping		Culture		Going out		Other hobbies	
		B	Sig.	*B*	Sig.	*B*	Sig.	*B*	Sig.	*B*	Sig.
Constant		−0.53	0.00	1.50	0.00	−0.36	0.00	−0.44	0.00		
Gender	Female	0.01	0.05	0.12	0.00			−0.03	0.00		
Age	<18			−0.23	0.00			−0.14	0.00		
	25–54							−0.07	0.00		
	55–64			−0.10	0.00			−0.07	0.00	0.03	0.03
	65–74			−0.14	0.00			−0.13	0.00	0.03	0.01
	75+			−0.10	0.01	0.05	0.00	−0.07	0.03	0.04	0.01
Social Class	High	0.02	0.03	−0.07	0.00	0.02	0.00	0.04	0.01		
	Middle	0.01	0.04	−0.06	0.00	0.02	0.00				
Household	Single							0.07	0.00		
	Family without children			0.05	0.01			0.03	0.01		
Urban Density	Strong	−0.01	0.02	0.03	0.03	0.02	0.00			−0.01	0.05
	Moderate										
Season	Summer							0.04	0.00	−0.01	0.04
Day of the Week	Weekends	0.02	0.00	−0.05	0.00			0.09	0.00	−0.02	0.00
Beginning Time	Morning	−0.02	0.01	0.38	0.00	−0.09	0.00	−0.32	0.00	−0.02	0.00
	Afternoon			0.37	0.00	−0.07	0.00	−0.19	0.00	−0.04	0.00
Distance		0.0012	0.00	−0.0010	0.00	0.0004	0.01	0.0021	0.00	0.0008	0.00
Location	City park	—	—	—	—	—	—	—	—	—	—
	On or near water	—	—	—	—	—	—	—	—	—	—
	Own neighborhood	—	—	—	—	—	—	—	—	—	—
	Rural or recreational	—	—	—	—	—	—	—	—	—	—
	Other areas	—	—	—	—	—	—	—	—	—	—
Duration		0.11	0.00	−0.20	0.00	0.09	0.00	0.09	0.00	0.03	0.00
R-square		0.043		0.075		0.032		0.075		0.014	

recreation, water recreation, attraction visits, and fun shopping, while it has a negative effect on event visits, culture, visiting sports events, going out, and other hobbies. Moreover, afternoon has a positive effect on expenditure on outside recreation, attraction visits, and fun shopping; however, it has a negative effect on culture, going out, and other hobbies. The likely explanation is that these activities are generally conducted in the evening instead of the morning or afternoon because culture, event visits, and courses generally take place in the evening. Moreover, going-out activities are mostly conducted in the evening.

Regarding location variables, the results indicate that outside recreation, attraction visits, event visits, culture, going out, and other hobbies have a positive effect on expenditure with increasing distance. However, distance has a negative effect on fun shopping activities, which could indicate that this activity is more attractive in closer locations or that people trade off between travel costs and money spent on shopping. Location-type variables are estimated only for outside recreation and water recreation activities. City parks have a positive effect on outside recreation activities, while they have a negative effect on water recreation activities. Moreover, on or near water variables have a positive effect on outside recreation and water recreation activities. Own neighborhood and rural and recreational areas both have a positive effect on outside recreation activity.

Table 4. Covariance matrix

	Outside recreation	Water recreation	Visiting sport event	Wellness and beauty	Attraction visit	Event visit	Fun shopping	Culture	Going out	Other hobbies
Outside Recreation	0.429	−0.012	−0.010	−0.008	−0.030	−0.030	−0.100	−0.020	−0.077	−0.017
Water Recreation		0.130	−0.002	−0.003	−0.007	−0.004	−0.039	−0.004	−0.017	−0.004
Visiting Sport Event			0.110	−0.002	−0.007	−0.007	−0.026	−0.006	−0.024	−0.004
Wellness and Beauty				0.203	−0.005	−0.005	−0.050	−0.007	−0.026	−0.006
Attraction Visit					0.290	−0.018	−0.070	−0.012	−0.043	−0.010
Event Visit						0.263	−0.049	−0.015	−0.051	−0.011
Fun Shopping							1.920	−0.046	−0.239	−0.048
Culture								0.284	−0.064	−0.012
Going Out									1.052	−0.041
Other Hobbies										0.285

Finally, the other areas variable has a positive effect on outside recreation, while it has a negative effect on the water recreation activities. All location variables have plausible and expected effects on outside recreation and water recreation activities.

Duration has a positive effect on expenditure for activities such as outside recreation, sports event visits, attraction visits, event visits, culture, going out, and other hobbies. This is the result of the relation between expenditure and duration for out-of-home leisure activities, which suggests that if more time is spent on an activity, then it is likely that more money will be spent on that activity. However, duration has a negative effect on fun shopping activity. This might reflect that fun shopping activity is a different type of activity in that expenditure is related to buying goods rather than nondurable consumptions. The effect suggests that more expensive purchases do not necessarily involve longer duration for activities.

A final finding about these estimates is the covariances between the error terms shown in Table 4. These can be interpreted to mean that a negative covariance implies that there is a substitution between expenditures of activities, while a positive covariance implies that expenditure on one activity results in expenditure on another activity (Ettema 2009). Table 4 shows that there is a substitution between all activities.

5. Conclusion

People conduct their activities under budget constraints that concern time and money. It is important to understand these constraints as they shape the set of feasible configurations of activity-travel patterns, which in turn affect the evolution and sustainability of urban environments. The aim of this paper is to contribute to this literature with an empirical study.

In this study, a linear-in-parameters regression model was derived from a utility-maximization model of activity participation under monetary budget constraints. Analyses were carried out by applying a seemingly unrelated regression model to a 2008/2009 leisure activity data set. The analyses revealed that expenditures for out-of-home leisure activities are influenced by the duration of the activity and travel. This result was assumed by our modeling framework. With increasing duration of the leisure activity and travel, the expenditures increase, except fun shopping activity, which shows that fun shopping is a different kind of activity than other out-of-home leisure activities. Moreover, sociodemographic variables and time-location variables influence expenditures. Another result is that there is a substitution of expenditure between the out-of-home leisure activities.

This study provides insights into the relationships between monetary expenditures and duration, activity types, sociodemographic variables, and time-location variables. In turn, these activity-travel patterns influence the sustainability of the built environment. Time and money constraints affect the intensity and kind of activity participation that individuals and households can realize in any space-time setting. Time and money budgets can restrict or even prohibit people's opportunities to become engaged in activities they prefer to do or even worse prevent them from engaging in these activities and therefore induce social exclusion. In this case, the urban environment, in combination with the transport environment, is not very sustainable from both an economic and social perspective. However, further work is needed to understand how the trade-offs between time and monetary budgets are made and how available income and fixed expenditures affect the expenditures on out-of-home leisure activities and travel. Therefore, dedicated data collection is needed to further research this problem.

In addition to the general relationships between activity-travel patterns and expenditures, findings of this study also emphasize the role of particular location variables in stimulating out-of-home leisure activities. In particular, it is found that city parks are important for outside recreation activities. Furthermore, distance to the activity location has an effect on expenditure. With increasing distance, the expenditure on most out-of-home leisure activities increases as well (the only exception is fun shopping). This indicates that individuals generally can find more attractive locations for leisure activities by traveling farther and this affects the amount of expenditure for the activities. This suggests that the distance and location of activities, factors that are related to monetary expenditures, can be affected by applying transport pricing policies for a more sustainable environment.

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