İstanbul Commerce University Journal of Science, 21(42), Fall 2022, 344-352.

İSTANBUL TİCARET ÜNİVERSİTESİ
FEN BİLİMLERİ DERGİSİ

Istanbul Commerce University Journal of Science

http://dergipark.org.tr/ticaretfbd

Research Article / Araştırma Makalesi

EXPENDITURE ANALYSIS OF PLANNED SPECIAL EVENT PARTICIPANTS: BINARY LOGIT MODEL

PLANLANAN ÖZEL ETKİNLİK KATILIMCILARININ HARCAMA ANALİZİ: İKİLİ LOGİT MODELİ

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https://doi.org/10.55071/ticaretfbd.1130438

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Received / Geliş Tarihi
14.06.2022

Accepted / Kabul Tarihi
17.10.2022

Abstract

Planned special event (PSE) increases the travel demand and derives interim activities that individuals spend their time and money. In this study, it is aimed to determine the factors affecting the money expenditures of PSE participants in interim activities that they participated before the special event by using the Binary Logit Model. A face-to-face survey study started in December 2018 and ended in May 2019, and football is selected as the PSE. As a result, 357 valid questionnaires were obtained before 6 league games and included in the modeling study. This study showed that PSE participation is not the same with daily routine activity participation for example age, income level, frequency of participation in games are not statistically significant. However, when fans come to the games with someone, they gather at locations within walking distance of PSE venues and attend an event where they spend money.

Keywords: Binary logit model, money expenditure, planned special events, survey study, travel behavior.

Öz

Planlı özel etkinlikler (PÖE), seyahat talebini geçici olarak artırmakla birlikte katılımcıların hem zaman hem de para harcadıkları yeni aktiviteler de üretmektedir. Bu çalışmada, PÖE katılımcılarının özel etkinlik öncesi katıldıkları ara (türetilmiş) etkinliklerdeki para harcamalarını etkileyen faktörlerin İkili Logit Model kullanılarak belirlenmesi amaçlanmaktadır. Aralık 2018'de başlayan ve Mayıs 2019'da sona eren yüz yüze olarak gerçekleştirilen anket çalışması sonucunda 6 lig maçı öncesi 357 geçerli anket elde edilmiş ve modelleme çalışmasına dahil edilmiştir. Bu çalışma, PÖE katılımının günlük rutin aktivite katılımı ile farklı olduğunu, örneğin yaş, gelir düzeyi, oyunlara katılım sıklığı gibi önemli değişkenlerin istatistiksel olarak anlamlı olmadığını göstermiştir. Model sonucuna göre bireyler ticaret-yoğun yerleri tercih etmekte, özellikle bu gibi etkinliklere yalnız gelmediği takdirde daha fazla para harcama eğilimi göstermektedir. Katılımcıların toplandıkları alanlar stadyumun en yakın noktaları değil ancka yürüme mesafesindeki diğer alanlar olarak belirlenmiştir.

Anahtar Kelimeler: Anket çalışması, harcama analizi, ikili logit model, planlı özel etkinlikler, yolcu davranışı.

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1. INTRODUCTION

Planned special events (PSE) are those that occur at a known location at a defined time and generate a significant quantity of travel demand. PSEs usually draw individuals from all over the world, with a variety of cultures and backgrounds, into the host community, where they may engage with other communities and cultures (Cook et al., 2010). As a result of increases in travel demand or losses in the capacity of road segments, PSE has an influence on the transportation network with its known location and scheduled time (Latoski et al., 2003) such as concerts, rallies, sports competitions, etc. The main purpose of participating to an event is to be satisfied, to increase their quality of life, and run away from the daily stress (Ergin, 2021).

PSEs have both positive and negative effects. The primary of its negative effects is its effect on the transportation network. Due to the transportation demand it creates, it causes traffic congestions due to the fact that many participants are attracted to a certain area and many people leave the venue at the same time after the event. In USA, PSE related travel delays account for 93 to 187 million lost hours annually and the cost of congestion is estimated to be between $1.7 and $3.4 billion (Skolnik et al., 2008). Environmental effects such as gas and noise emissions caused by traffic jams should not be ignored. However, a well-managed PSE can also deliver huge economic and fiscal gains without harming the environment. Mobility relates to the ease with which one can go about, whereas dependability refers to the consistency with which one can move. In addition, mobility and travel time reliability are strongly connected to the number of participants, pace of event arrival and departure, venue location, and highway capacity (Ergin, 2021).

PSE increases the travel demand (Ergin & Tezcan, 2022) and derives interim activities that individuals spend their time and money. Moreover, individuals prefer to arrive the vicinity of the venues some time before the main event starts. PSE participants usually arrive a few minutes before the event begins (Leilei et al., 2012). However, according to Ergin and Tezcan (2022), it was discovered that on average, supporters arrive at the stadium 188 minutes before the game begins. Individuals generally spend their time in order to wait the starting time of the main event. On the other hand, individuals often afford to pay a ticket fee to attend the PSE. In addition, participants tend to spend money due to basic needs or personal demands before, during and after the event. Kwiatkowski (2016) divides the money flow into two categories that comes from local and non-locals in his study. It is not the case that each individual participating in the PSE will spend or choose an activity to spend their money. In this study, it is aimed to determine the factors affecting the money expenditures of PSE participants in interim activities that they participated before the special event by using the Binary Logit Model. In the next stage of the study, the Binary Logit Model is briefly mentioned, and then survey methodology and the study area is described. In the 4th part of the study, the data is introduced and its analysis is presented. In the continuation, the model results are given in detail, and finally, evaluation and recommendations are presented under the conclusion part. In addition, football is chosen as PSE in this study.

2.MODELING METHOD: BINARY LOGIT MODEL

When there are two options in the choice set, the binary logit model is utilized. The binomial logit model is the most often used probabilistic decision model between two choices (Ergin, 2021). In this study, Binary Logit Model is used due to mathematical simplicity of the approach. Logit models are based on the notion of random utility. The user selects a setting that maximizes her or his usefulness. The utility is derived from the definition of the options and/or the persons'

socio-economic characteristics (Lancaster, 1966). The utility function is a function that defines the utility of persons. This function is often a linear function with the Equation 1:

$$U = V + \varepsilon \quad (1)$$

where U stands for utility, V for the deterministic component, which reflects observable factors like age, trip duration, travel cost, income, and so on, and the ε represents the model's error. The error has an influence on the user's utility and contains unobservable characteristics.

The probability that alternative 1 will be chosen in binary logit model, where the preference set consists of alternatives 1 and 2, is computed using the Equation 2:

$$P_1 = \frac{e^{V_1}}{e^{V_1} + e^{V_2}} \quad (2)$$

where P_1 is the probability that an individual would select alternative 1, e^{Vi} denotes the exponential function, and V_1 and V_2 are the deterministic components of alternative 1 and 2, respectively (Horowitz et al., 1986). The sum of probabilities of both alternatives equals to 1.

Binary logit model has been used in many transportation preference model studies. For example, a binary logistic model was used by Abuhamoud et al. (2011) to investigate the factors impacting auto/government bus use and estimate the likelihood of switching from a private car to a government bus. On the other hand, the mode splits for cereal grains movement by truck and rail in the United States are estimated using a binary logit model developed by Shen and Wang (2012). Moreover, Ergin and Tezcan (2021) also used binary logit model in order to analyze perception of public transport users in terms of the willingness to pay for safety, crowdedness, stress, and fatigue factors. As a result of comparison between binary logit model and linear regression model, it is revealed that the logit model excels the linear regression model in terms of average absolute percentage changes.

3. STUDY AREA

According to TurkStat (2022), population of Istanbul is 15,840,900 in 2021. In addition to its great population, Istanbul attracts a large number of domestic and foreign tourists due to its historical and cultural heritage and strength economy. The transport system of the city serves around 20 million people daily. Besiktas is one of the most preferred districts of Istanbul for daily activities with its location and dense commercial areas. As a result of being dense commercial area, accessibility of the study area is also strong. Vodafone Park Stadium, which is located in Besiktas and is the subject of the study, is located here. There are 2 ferry piers, tram line, metro line and many bus stops within walking distance of the stadium. It also has a very strong connection to the main arteries by road. All in all, Besiktas and stadium is strongly connected to the transportation system (Figure 1).

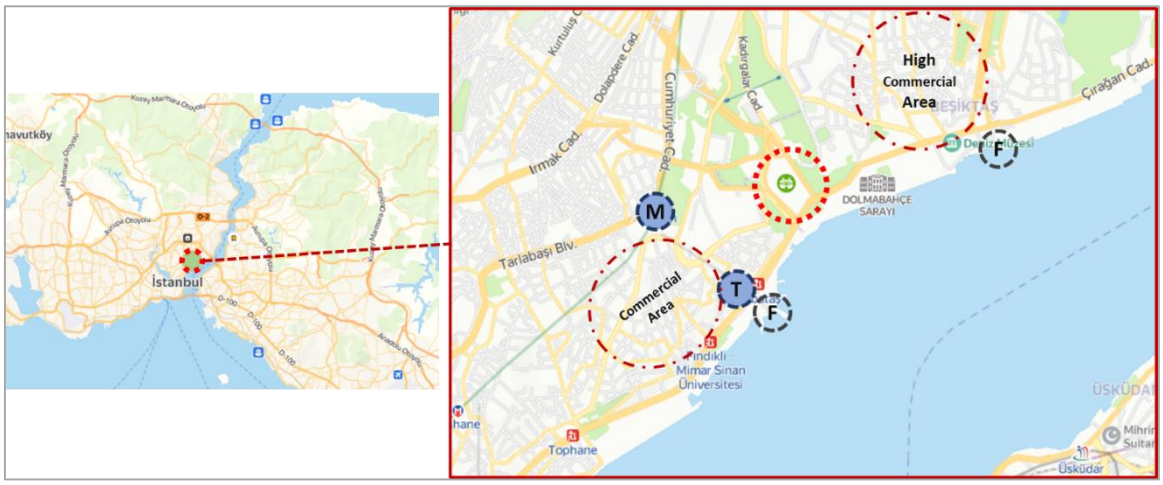

Figure 1. Besiktas Vodafone Park Stadium Location

Vodafone Park Stadium is used by Besiktas Football Club (BJK) which is one of the most popular football teams in Turkiye in terms of the number of the fans and historically based on league success in Turkiye. Moreover, the residential population of Besiktas is 178,938 (TurkStat, 2022).

4. SURVEY ANALYSIS AND DATA

The transportation and money expenditure behaviors of the fans during football games were tried to be analyzed with a survey study. The study started in December 2018 and ended in May 2019. In this context, the socio-economic characteristics of the fans, their interest in football games, the frequency of participation in football games, the fandom degree, the type of activities they participated in before-during-after PSE, activity durations, activity costs, transportation mode choices, travel time and costs, etc. They were asked about all their activities in the day of the participation to the PSE. The questionnaires were conducted with the spectators entering the stadium who arrived at the immediate vicinity of the venue and surveys were started approximately 3 hours before the game starts. Some road connections are closed when there is a PSE in the stadium, and in others the lanes are narrowed to provide safe walking and waiting space for participants. The surveys were conducted face-to-face where the participants waited for the starting time of the PSE in the safe area, and the selected places of the survey points were close to the gates in order to catch all kinds of participants. Face-to-face surveys took an average of 8 minutes. In order to avoid biases or inaccuracies in the data obtained, only ordinary league games held once every two weeks were included in the study, but derby, Turkish Cup and European Cup games were excluded in the study. In the survey study, the behaviors of people who live far away from walking distance rather than local participants were examined. For this reason, the factors affecting the pre-PSE expenditures of the spectators who travel with motor vehicles are emphasized. In this context, 357 valid questionnaires were obtained before 6 league games and included in the modeling study. The descriptive statistics of the surveys are given in Table 1.

Table 1. Descriptive Statistics of The Surveys

Criteria (N=357)	Categories	N	Percentage	Criteria (N=357)	Categories	N	Percentage
Age groups	0-24	82	23%	Ticket cost	0-90	124	35%
	25-30	87	24%		91-149	118	33%
	31-37	95	27%		150 +	115	32%
	38+	93	26%	Seasonal ticket	No	251	70%
Gender	Woman	21	6%		Yes	106	30%
	Man	336	94%	How often do you participate in games in a year?	0 - 4	124	35%
Residential status	Out-of-town	70	20%		5 - 8	88	25%
	Istanbul	287	80%		9 - 13	41	11%
Income groups	0-3000	141	39%		14 +	104	29%
	3001-5000	103	29%	Mode choice	Bus	87	24%
	5000+	113	32%		Ferry	110	31%
Private car ownership	No	188	53%		Private Vehicle	81	23%
	Yes	169	47%		Rail	79	22%
Companion	Alone	81	23%	Destination	High density commercial area	175	49%
	With someone	276	77%		Low density commercial area	126	35%
					ctadium	56	16%

According to the survey conducted for Besiktas and the details of which are given in the Table 1, the average age of the participants is 32.18. Also, 6% of the participants are women, and 20% of the spectators, including those coming from abroad, attend the PSEs from out-of-Istanbul. The average income level is around 4,183 Turkish Liras (TRY) (according to 2019). While 47% of the participants own a private vehicle, approximately 77% of the participants attend the event with at least one friend or acquaintance. Of course, as a result of being out of scope of this study, the social network of the participants was neglected. The average ticket price is 127 TRY and 30% of the attendees have seasonal tickets. While 29% of the fans participated in all the games, 35% stated that they participated in one time or only a few games (less than 5 in a year). Accessibility of the stadium or the surrounding area is very easy by public transport. For this reason, there is a balanced distribution among the modes of transport. The most preferred mode was Ferry with 31%. As expected, people prefer high density commercial areas as the destination of their motorized trips. Since there is no sufficient commercial use in the immediate vicinity of the stadium, the preference rate of the stadium as destination by fans is at the level of 16%.

5. MODEL RESULTS

Effect coding is used for the proposed Binary Logit Model and some of the continuous variables are categorized according to percentiles such as income, participation the games in a year and destination choice (Table 2). Age, ticket cost and selected transportation modes were also categorized and included into the model, however, since there was no improvement in the model, they were removed from the model and included continuously. The reference variable category is selected with regard to lowest observed one. Other variables are also effect coded.

Table 2. Categorization and Coding of The Selected Variables

Variable	Classification	No. of obs.	Abbreviation	BASE
Income Groups	0-3000	141	linc	
	3001-5000	103	minc	BASE
	5000+	113	hinc	
Destination	High Density Commercial Area	175	hcom	
	Low Density Commercial Area	126	lcom	
	Stadium	56	scom	BASE
Participation	0-4	124	part1	
	5-9	88	part2	
	10-14	41	part3	BASE
	14+	104	part4	

The other variables used in the model are transportation modes, private car ownership, day of the week, gender, residential status, having a companion, having seasonal ticket, last activity duration which is used as continuous, and classified destinations in terms of number of commercial units in the destination zone. The variables used in the proposed model are explained in the Table 3:

Table 3. Coding of The Non-Categorized Variables

Variable	Explanation	Coding
ww	"with whom" represents whether a companion is there or not,	Alone: -1, Having a companion: 1
lad	Last activity duration (minutes)	Continuous
pt	Public transport	If pt is chosen:1, if not: -1
st	Seasonal ticket	If the individual has seasonal ticket:1, if not: -1
age	Age	Continuous
gen	Gender	Female:-1, Male:1
ticket	Ticket cost	Continuous

Moreover, Apollo package developed by Hess and Palma (2019) in R software was used in the modelling.

Utility function of the money expenditure binary logit model is given below:

$$\boldsymbol{U_{NON}} = ASC_{NON} + ww_{NON} \times ww_{NON} + lad_{NON} \times lad_{NON} + hcom_{NON} \times hcom_{NON} + lcom_{NON} \times lcom_{NON} + pt_{NON} \times pt_{NON} + st_{NON} \times st_{NON} + age_{NON} \times age_{NON} + part1_{NON} \times part1_{NON} + part2_{NON} \times part2_{NON} + part4_{NON} \times part4_{NON} + gen_{NON} \times gen_{NON} + ticket_{NON} \times ticket_{NON} + linc_{NON} \times linc_{NON} + hinc_{NON} \times hinc_{NON}$$

$$\boldsymbol{U_{MONEY}} = ASC_{MONEY}$$

The adjusted Rho-square of 0.3949 does not present any problems in the overall goodness-of-fit. It means that the variables used in the model are effective in the monetary expenditures of individuals in their PSE participation (Table 4).

Table 4. Model Results

LL(start)		-247.45	
LL(final)		-134.28	
Rho-square (C)		0.4557	
Adj.Rho-square (C)		0.3949	
AIC		298.56	
BIC		356.72	
Variables	**Estimate**	**Std.err.**	**t-ratio(0)**
ASC_{NON}	**1.7375*** **	0.8153	2.1312
ASC_{MONEY}	*0.0000*	*NA*	*NA*
pt_{NON}	0.3305	0.2376	1.3909
gen_{NON}	-0.2089	0.3410	-0.6126
ww_{NON}	**-0.3929***	0.2078	-1.8903
st_{NON}	0.2433	0.2444	0.9954
lad_{NON}	**-0.0246*** **	0.0029	-8.4878
$hcom_{NON}$	**-1.2863*** **	0.2413	-5.3301
$lcom_{NON}$	0.3816	0.2800	1.3626
$part1_{NON}$	0.1493	0.2814	0.5307
$part2_{NON}$	0.1899	0.2975	0.6384
$part4_{NON}$	-0.2325	0.3438	-0.6762
$ticket_{NON}$	0.0015	0.0018	0.8152
age_{NON}	0.0139	0.0194	0.7155
$linc_{NON}$	0.1484	0.2486	0.5970
$hinc_{NON}$	-0.2069	0.2637	-0.7849
***, **, * ==> Significant at 1%, 5%, 10% level.			

The ASC_{NON} variable is statistically significant at 99% confidence interval. Using public transport, gender, having seasonal ticket, number of participation in a year, ticket price, age, and income level are not statistically significant. Only, attending with a companion, activity duration and the dense commercial destination are statistically significant at 10%, 99% and 99% respectively. Since the sign of the coefficient of *ww* is negative, spectators tend not to spend their money if they participate the PSE alone. Furthermore, as the last activity duration increases, they tend to choose saving their money which means spectators spend their time by attending the activities that do not require money for instance waiting. In other words, people who spend money on the activity tend to spend less time at the place where they attend the activity. Even other variables are not statistically significant, the signs of the coefficients are expected. On the other hand, they contribute the overall goodness-of-fit and increases the power of the model.

6. CONCLUSIONS

PSE activities should not be confused with daily and ordinary activities and should be considered separately. As seen in this study, it is very difficult to predict the behaviour of the spectators, especially in sports where the degree of fanaticism is high, such as football. For example, this study showed that age, income level, frequency of participation in games are not statistically significant. However, when fans come to the games with someone, they gather at locations within walking distance of PSE venues and attend an event where they spend money. For the further studies, accessibility of the venues might be included into modelling process as accessibility increases, commercial activity rises and no one is inclined to prefer a place that is hard to reach. For example, Ercan and Tuncer (2020) investigated one of the district of Istanbul,

Beylikduzu, and in general individuals, especially disabled people are not satisfied with the transportation network quality. The same situation should also be examined for Besiktas, as well.

All in all, in a PSE organization, local government and organizers should not only manage the traffic and trade demand in the stadium and the immediate vicinity of the stadium, but also the traffic and trade demand in the dense-commercial areas within walking distance of the PSE venue and analyse the economic impact of the PSEs in this broad framework.

Contribution of The Authors
The authors confirm that they equally contributed to this paper.

Conflict of Interest
The authors declare that there is no conflict of interest.

Statement of Research and Publication Ethics
Research and publication ethics were observed in the study.

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