The Shopping Trips for Traditional Markets in Makassar City: Trip Attraction and Frequency Analysis using Regression and Logit Model

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Abstract: The present paper develops a relationship model between number of visitors and number of kiosks on the traditional markets in Makassar, Indonesia, as well as the factors which significantly influenced individuals in obtaining their shopping travel frequency. The study surveys number of visitors and kiosks on the six traditional markets. Also we consider socio-demography variables of households, characteristics of the shopping trip to traditional market, and travel attributes such travel time and modes. The study adopts regression analysis and the multinomial logit model in order to construct the trip attraction and the trip frequency phenomena of the traditional markets. The number of accessories and household equipment kiosks influence significantly the trip attraction number. Further, the house condition, family size, income, spent money, and stay time at the market are the significant variables in influencing trip frequencies. The results provide a basic insight on further studies such travel mode choice model.

Key Words: Shopping trip, traditional market, trip attraction, trip frequency, regression, logit

1. INTRODUCTION

Nowadays, research on shopping trip found out more and more attention. There are some reasons for this condition, i.e. shopping trip contributes to increasingly large proportion to urban trips recently, especially on peak periods, the trip has more temporal flexibility of individual than work trips (Bhat and Steed, 2002), and provides more or less congestion and some kinds of environmental problem in centre business district of city (Ramli et al., 2010a, 2010b, 2010c, 2011a, 2011b, 2011c).

Through travel demand management (TDM) analysis, some primary aspects have become interests by many scholars in order to solve the problem, such as aspects in four steps model (i.e.: trip generation and attraction, trip distribution, trip assignment, and mode split), departure time choice, travel pattern, trip frequency, etc. Particularly in trip frequency, travelers on shopping trip may face many factors in order to consider their trip frequency to a shopping place (such mall or traditional markets), not only in term a certain or similar shopping place, but also in term shopping trip as purpose.

Trip frequency is an important aspect for understanding shopping trip behaviors. Some scholars have studied some related researches. They provide some insights for understanding shoppers' behavior by highlighting the relationship between shopping frequency and such

factors as shoppers' demographic characteristics, the possibility to combine shopping trip with other trip, and shopping motivations (Kim and Park, 1997; Bacon, 1995; Roy, 1994; Bhat, et al., 2004). Based on shopping frequency analysis, Chen et al. (2005) studied the relationship between shopping frequency and travel distance for daily shopping. Furthermore, he found that considering the different discrimination ability and different attitude people have even for the same condition such as the same transportation mode and the same travel distance.

Other important factor on trip frequency is accessibility. There are three components of the accessibility measure that representative from transport component (reflecting the generalized costs of travel), the spatial component (reflecting the possibility to perform the desired activities) and the individual component (reflecting the different preferences of individuals). The accessibility is represented by used are travel time, travel cost, travel distance, travel speed, average travel time cost, travel time for mandatory trips, number of mode transfers per trip per household and generalized costs of travel (Bierman, 2004).

Shopping frequency may be influenced by many factors such as the household's socio-economic characteristics, the free time available to shoppers and by the performance of travel mode and the built environment. It is impossible to conclude all factors in a model. Even if we can do so, the interdependence and interaction between those factors may make it is impossible to clarify how each specific factor affects the travelers' behavior (Sumi et al., 1990). In the previous studies, the authors (Pasra et al, 2011) have studied the travel factors that influenced the shopping trip frequency. The study included such kind of accessibility, mobility, land use of a shopping centre, and service quality of a shopping centre on a structural equation modeling (SEM) approach.

Concerning to continue the trip frequency analysis related to its influenced factors, this study attempts to grasp some exogenous variables in influencing individuals or households on the shopping trip frequency to traditional markets. The variables consist of three categories, i.e. the category of household characteristics, the category of the shopping activity characteristics, and the category of the shopping trip characteristics.

Related to the shopping trip behavior as mentioned above, another difference situation of daily shopping trip would be represented in this paper in particular trip to traditional market for daily shopping in Makassar, Indonesia. The trip is specified by two special characteristics, i.e., types of transport mode which available, and socio-economic condition of the travelers that dominated by community that located not so far from a traditional market. The travel mode of the trip is divided into two categories, the one is auto-car and or motorcycle/bike, namely of private car category, and the other is minibus, namely para-transit as public transport that available in almost cities in developing countries. The specific characteristics of the public transport are that the transit system does not have fix schedule and minibus stop for dwelling process of passenger. The condition indicates that travel time of the mode can be treated similar to travel time of private car. In further of the specific trip, the travelers of the trip are usually originated from residential areas that located near from a traditional market, whereas almost the travelers have similarly socio-economic condition.

In order to appreciate the above specific condition, this paper aims to develop a relationship model between number of visitors and number of kiosks on the traditional markets in Makassar, Indonesia, using linear regression, as well as to determine significant variables that influence the trip frequency of the travelers. In this study, the trip frequency is analyzed from individuals having similar origin place or similar residential area. The multinomial logit model approach is adopted in order to describe the trip frequency model.

The rest of this paper is organized as follows. This paper begins with an introduction that explain the background and a review of previous studies related to trip frequency on shopping

trip, trip attraction of traditional markets, and the objective of the paper. Then, we present the methodological approach such the multinomial logit model construction, the variables specification of the model, and data collection. Next, the paper provides a description data, and the model estimation results. Finally, the paper presents the conclusion of the study regarding the analysis results.

2. THE STUDY METHODS

2.1 Construct of the Multinomial Logit (MNL) Model

The multinomial logit model is a model approach that represent the relationship between the response (endogenous) variable (Y) that categorical and one or more exogenous variables (X) which not only categorical but also continual (Train, 2009). When the endogenous variable consists of more than two category, i.e. Y = 1 (success) and Y = 0 (otherwise), then multinomial logit model could be applied.

In this regard, the model assumes that the categories of the dependent variable result in Y follow the Bernoulli distribution. The probability function of the Y with parameter γ is stated as follows:

$$P(Y=y)=\gamma^{y}\left(1-\gamma\right)^{1-y} \tag{1}$$

Where y = 0, 1. Thus, the probabilities of each categories are P(Y=1) = γ and P(Y=0) = 1 – γ with E(y) = γ, for $0 \leq \gamma \leq 1$.

Generally, probability of the logistic regression that deal with n predictor variables could be formulated as follows (Ramli et al., 2010):

$$P\left(y\middle|x\right)=\frac{e^{-(\beta_0+\beta_1x_1+\beta_2x_2+\ldots+\beta_nx_n)}}{1+e^{-(\beta_0+\beta_1x_1+\beta_2x_2+\ldots+\beta_nx_n)}} \tag{2}$$

Where x_n is a vector of observed variables that represent relevant attributes to dependent variable, *Y*. β_n is parameter of x_n that should be estimated, and β_0 is a constant of the model.

This study uses the Multinomial Logit (MNL) model to grasp the relationships between trip frequency as response variable and some identified factors.

2.2 The Specification of the Model Variables

The specification of the exogenous variables taking account in this research consists of three categories, i.e., socio-demography of individual or household, the trip characteristics, and the characteristics of the shopping activity in the traditional market. Meanwhile, the endogenous variable, trip frequency consists of five attributes or attitudes, i.e. trip frequency 1 time until 5 times in a week. The socio-demography category involves house condition, family size, household head occupations, household incomes, car ownership, and motorcycle ownership variables. The trip characteristics include travel mode and travel time variables. The shopping activity characteristics only consider spent money and stay time at the traditional market. Table 1 shows the name, label and attributes or attitudes of the all variables of the model completely.

Table 1 The Model Variables and Their Attributes or Attitudes

Variable Name	Variable Label	Attribute/Attitude of Variable
1. Trip Frequency (time/week)	*Frequency*	1 time; 2 times; 3 times 4 times; 5 times
2. House Condition	*HouseCond1* *HouseCond2*	1 = Not yet renovated; 2 = Otherwise 1 = Has been renovated; 2 = Otherwise
3. Family size (person)	*FamilySize*	1 = 2 persons; 2 = 4 persons; 3 = 6 persons; 4 = 8 persons; 5 = 10 persons
4. Occupation of household head	*Occupation1* *Occupation2* *Occupation3* *Occupation4* *Occupation5*	1 = Civil Servant; 2 = Otherwise 1 = Private Employee; 2 = Otherwise 1 = Entrepreneurship; 2 = Otherwise 1 = Student; 2 = Otherwise 1 = Others; 2 = Otherwise
5. Income of household ($1x10^6$ IDR/month)	*Income*	≤ 0.5; 0.5 – 1.0; 1.0 – 1.5; 1.5 – 2.0; ≥ 2.0
6. Car ownership (unit)	*CarOwn*	0; 1; 2
7. Motorcycle ownership (unit)	*MCOwn*	0; 1; 2
8. Travel mode	*TravelMode1* *TravelMode2* *TravelMode3*	1 = Public Transport; 2 = Otherwise 1 = Private Car; 2 = Otherwise 1 = Motorcycle; 2 = Otherwise
9. Travel time (minutes)	*TravelTime*	< 15; 15 – 30; 30 – 45; 45 – 60; > 60
10. Spent money (IDR)	*SpentMoney*	≤ 10,000.-; 10,001 – 20,000; 20,001 – 30,000; 30,001 – 40,000; ≥ 40,001
11. Stay time (minutes)	*StayTime*	< 30; 30 – 60; 60 – 90; 90 – 120; > 120

2.3 The parameter estimation of the multinomial logit model

Estimation method of the parameter values of the model applies the maximum likelihood method. The procedure to estimate the maximum likelihood value involves development of a joint probability density function of the observed sample, called the likelihood function, through estimation of parameter values which maximize the likelihood function. In case there are T observation face j categories results, the likelihood function is defined as follows (Koppelman and Bhat, 2006):

$$L(\beta) = \prod_{\forall_t \in_T} \prod_{\forall_j \in_j} \left(P_{jt}(\beta)\right)^{\delta_{jt}} \tag{3}$$

Where δ_{jt} is chose indicator (=1 if j is happen by observation t and 0, otherwise) and P_{jt} is the probability when the observation t give event j. The solution in order to maximize the log-likelihood function is the second derivation of the function with respect to β.

2.4 Data Collection

The present study also conducts a primary survey in recording the number of visitors which arrive in the six famous traditional markets in Makassar City. The six traditional markets are namely Niaga Daya, Pannampu, Terong, Butung, Maricayya, and Pa'baeng-baeng traditional markets. The visitor number recording was conducted during two days, one day in weekday

and one day in weekend, from morning (06.00 am) until evening (18.00 pm) of each the traditional markets using video recorder equipments. In addition, the survey also covers the types and the number of the kiosks available in the markets. These data will be used in analyzing the relationship model between the number of visitors and the number of kiosks in order to describe the trip attraction phenomena of the traditional markets in the city.

In the other side, in order to grasp the influenced travel factor on shopping trips for traditional markets, this study also uses data from a survey for characteristics of daily shopping travel to a traditional market, in Makassar, Indonesia carried out by Transportation Engineering Laboratory of Hasanuddin University, as same used in Ramli et al (2010a). The respondents of the survey are travelers or individuals that conducted travel for daily household shopping from their house in Minasa Upa Residence, one of large residences area in southern part of Makassar City, Indonesia which consisted of 2,527 households, to a traditional market in the city, namely Pabaeng-baeng market. The residential area located not so far from the market. There are 345 individuals which represent the households in the residential area, as samples in the survey. They were selected using random sampling approach. The survey applied the home interview method based on a questionnaire sheet.

3. DATA DESCRIPTION

3.1 Operational characteristics of traditional markets in Makassar City

Regarding the primary survey was conducted in this study, the traditional markets in Makassar City, Indonesia have the shape of simple until modern building construction. The markets consist of tenant rooms or kiosks which opened by the merchantmen or the market management. Mostly activities on the traditional markets in the city are supplying the daily household logistics such as primary food, vegetable and fruit, convection, etc. From 16 traditional markets in the city, there some markets which supply export activities for vegetable and fruit on the Indonesia eastern region. Figure 1 visualizes the traditional markets conditions in Makassar City.

Figure 1 The traditional markets conditions in Makassar City

3.2 Types and number of kiosks in the traditional markets

The traditional markets in Makassar City have many kinds of the kiosks. In order to simply the kiosk types, we categories the tenant rooms into 7 types, i.e. primary foods kiosks, household equipment kiosks, convection kiosks, accessories kiosks, spread out area, service kiosks, and others kiosks. Table 2 shows the number of kiosks of the six traditional markets in the city which are survey in this study. The table presents that the number of kiosks varies among the traditional markets. The Niaga Daya traditional market has the highest number of kiosks, about 1,004 kiosks, however amount of them are unused kiosk category. Some of the markets have

number of kiosks around 200 kiosks such Pannampu, Maricayya, and Pa'baeng-baeng traditional markets. In the other side, Terong and Butung traditional markets have number of kiosks around 500 and 600 kiosks.

Table 2 Number of kiosks in traditional markets in Makassar City

Kiosk categories	Number of kiosk in the traditional markets					
	Niaga Daya	Pannampu	Terong	Butung	Maricayya	Pa'Baeng-baeng
Primary foods	430	155	321	-	92	79
Household Equipments	158	10	32	-	17	14
Convection	190	24	149	594	47	28
Accessories	50	5	21	15	11	6
Spread out area	-	-	-	-	-	-
Service	1	-	-	48	1	14
Others	-	-	-	-	27	74
Total	1004	214	558	657	213	215

3.3 Number of attraction of the traditional markets

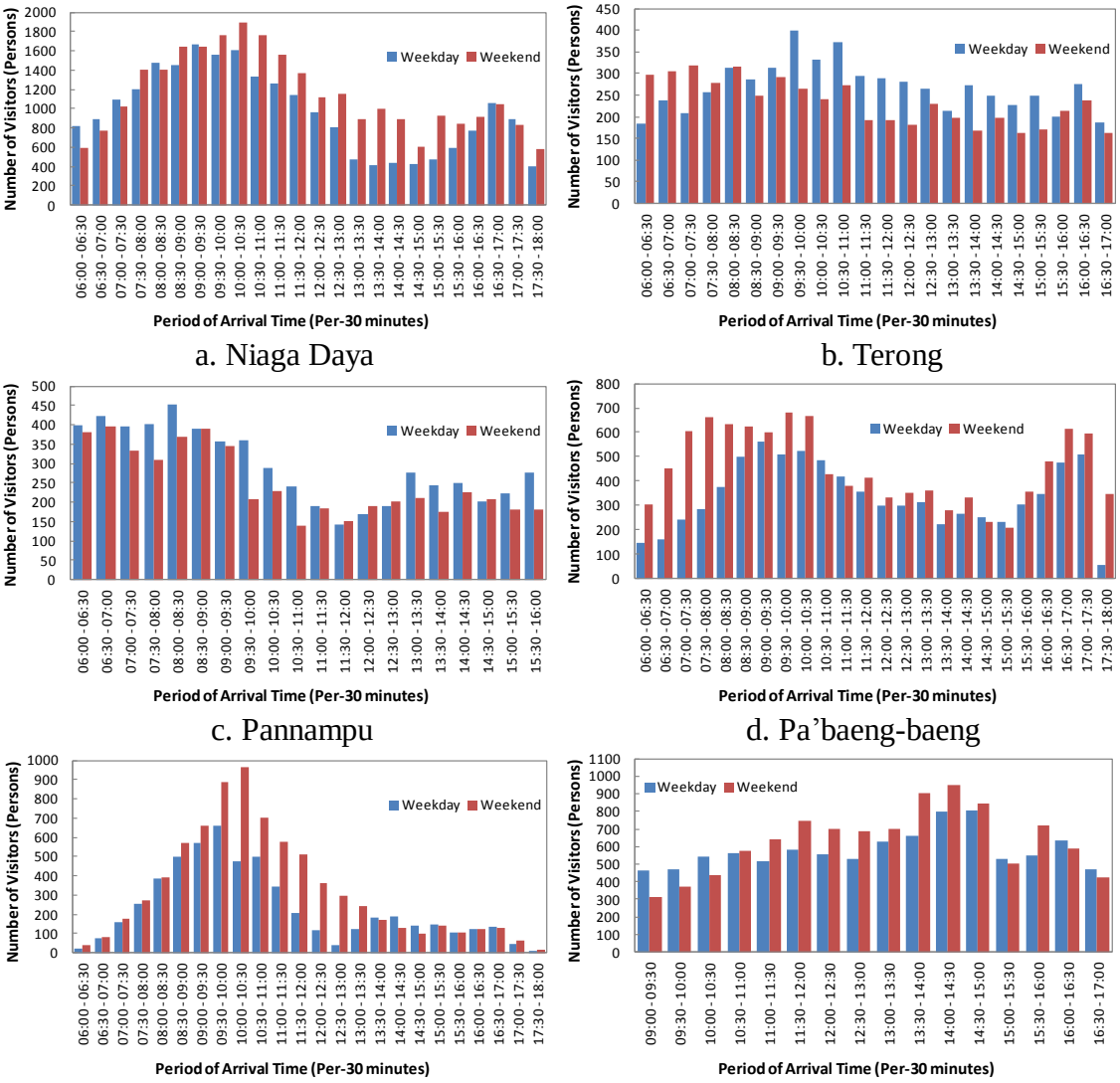
Regarding the primary survey on the number of visitor of each traditional market, we present the number of attraction on weekday and weekend for period arrival time in 30 minutes, in Figure 2. The figure shows that the maximum number of visitors among the six traditional markets achieves 1,600 visitors per 30 minutes, while the minimum number of visitors is 30 - 100 visitor in the 30 minutes. Further, Figure 2 also shows that the number of visitors of each traditional market has distribution patterns along in the morning until in the evening. In thi regard, the distribution pattern of the visitor number shows two peak distribution shapes, i.e. until peak distribution in the morning and peak distribution in the afternoon.

3.4 Data description for the MNL model development

Table 3 provides information about the values of maximum, minimum, mean, standard deviation, and variance of the variable data from the survey. The table shows that mostly variables have data which do not exactly match with a normal distribution. In this regard, a multinomial logit model is suitable to develop the trip frequency of the individuals. Therefore, all of the variables were included into continuous steps of MNL analysis.

Figure 3 describes the survey data summary including characteristics of the individuals, the shopping travel, and the shopping activity. Regarding Figure 1, almost house condition of respondents was renovated from their original house. The family size having 3 - 6 persons dominated the households in the residential area. Further, the occupations of household heads are majority as civil servant, while household income is 1 - 2 million rupiahs or > 2 million rupiahs. In addition, the vehicle ownership was dominated by own one motorcycle or one car. Also the travel times of the individuals from origin to destination (home to traditional market) were mostly in interval 15 – 30 minutes and interval 30 – 45 minutes.

Furthermore, Figure 3 also shows that travelers utilized private vehicle are larger than utilized mini bus or para-transit, namely of public transport in Makassar City. The amount of spent money at traditional market of the shoppers was ten thousand rupiahs until more than forty thousand rupiahs. The stay time at the market of the individuals was average in interval 50 – 90 minutes and 90 – 120 minutes. Meanwhile, the trip frequency to the market in a week was dominated by 2 times until 3 times in a week.



a. Niaga Daya b. Terong

c. Pannampu d. Pa'baeng-baeng

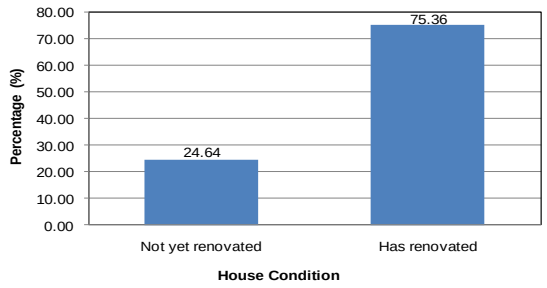
e. Maricayya f. Butung

Figure 2 **N**umber of attraction of the traditional markets in Makassar City

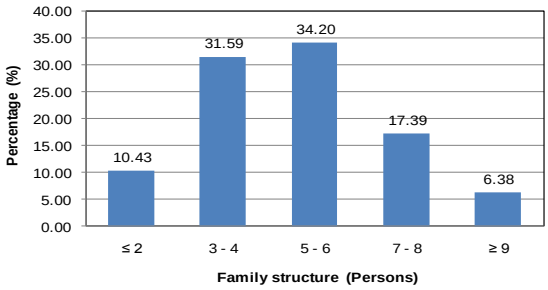
Table 3 Descriptions of Variable Data

Variable Title	Min.	Max.	Mean	Std. Dev.	Variance
Frequency	1.0	5.0	3.0	1.122	1.258
HouseCond1	1.0	2.0	1.8	0.432	0.186
HouseCond2	1.0	2.0	1.2	0.432	0.186
FamilySize	2.0	10.0	5.6	2.113	4.463
Occupation1	1.0	2.0	1.5	0.499	0.249
Occupation2	1.0	2.0	1.8	0.394	0.155
Occupation3	1.0	2.0	1.9	0.340	0.116
Occupation4	1.0	2.0	2.0	0.217	0.047
Occupation5	1.0	2.0	1.9	0.278	0.077
Income	0.5	2.5	1.8	0.541	0.293
CarOwn	0.0	2.0	0.6	0.637	0.406
MCOwn	0.0	2.0	0.7	0.623	0.388
TravelMode1	1.0	2.0	1.6	0.494	0.244
TravelMode2	1.0	2.0	1.7	0.449	0.201
TravelMode3	1.0	2.0	1.7	0.460	0.211
TravelTime	7.5	52.5	29.6	8.710	75.865
SpentMoney	15.0	45.0	28.7	11.418	130.381

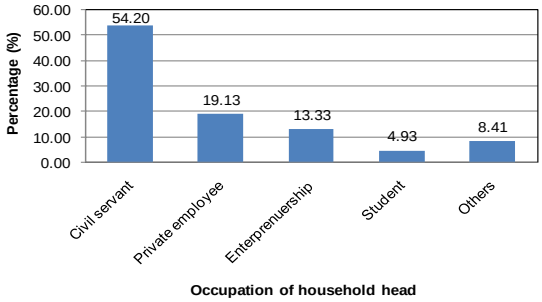
StayTime	15.0	135.0	84.1	29.430	866.102



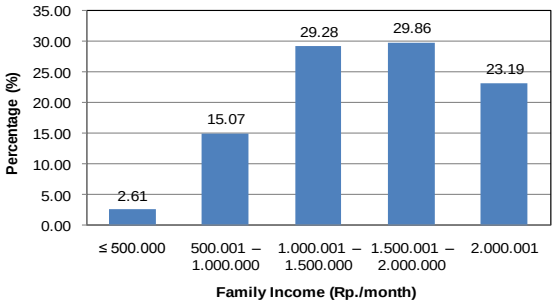
a. House condition



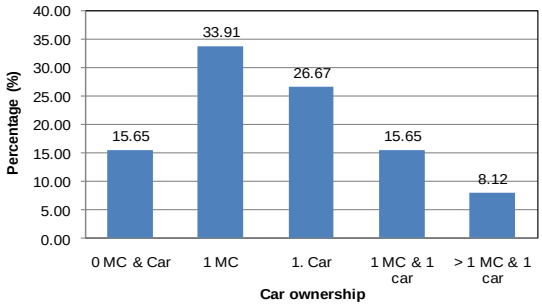
b. Family structure/size



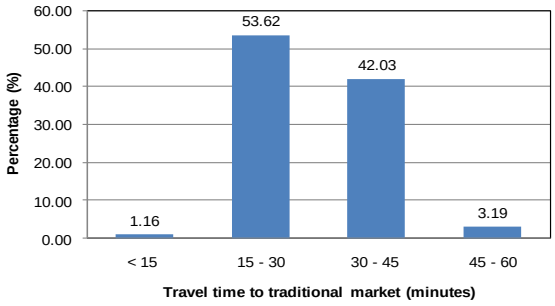
c. Occupation of household head



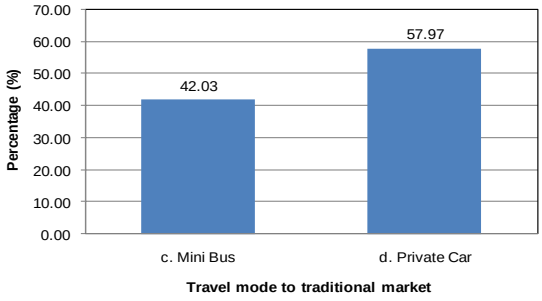
d. Family income



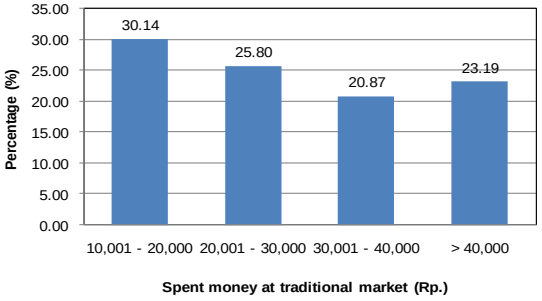
e. Car ownership



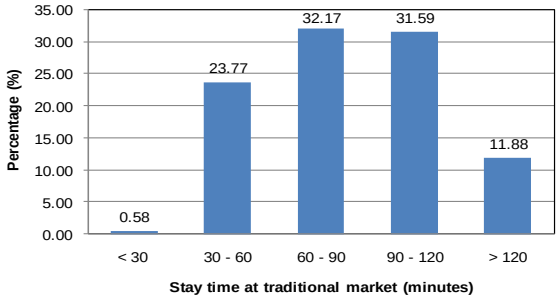
f. Travel time



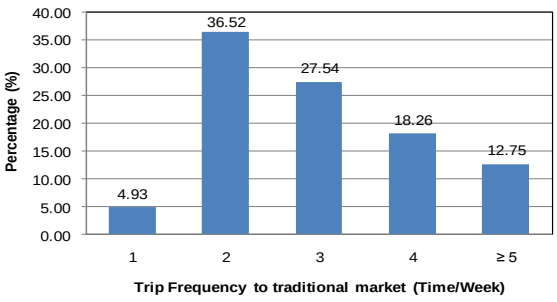
g. Travel mode



h. Spent money



i. Stay time



j. Trip frequency

Figure 3 Individuals attitude and attribute mode of trip to traditional market

4. TRIP ATTRACTION AND FREQUENCY ON TRADITIONAL MARKET

4.1 The relationship model between trip attraction number and number of kiosks

In order to grasp the trip attraction number of visitors on the traditional markets in Makassar City, we develop a relationship model between trip attraction number and number of kiosks (k) using the single linear regression model approach. The source data for the model are the primary recording survey of the visitor number and the number of kiosks for each kiosk categories. Table 4 provides the calibration results of the regression model for number of visitors on weekday (NVD) and number of visitors on weekend (NVE) models regarding the five kiosk categories. In this regard, we used the number of visitors of 15 minutes periods, and the constants of the models were set to equal zero. Meanwhile, the visualization of these models is presented in Figure 4.

Table 4 shows that mostly correlations of the kiosks categories have *r* values significantly, vary from 0.7 until 0.9. Only the convection category has *r* value around 0.6. In the other side, Figure 4 shows that the number of attraction of each traditional market increase in following the increasing of the number of kiosks. Overall, the number of accessories and household equipments kiosks are both more significant variables in influencing the increasing of the trip attraction on the traditional markets in Makassar City.

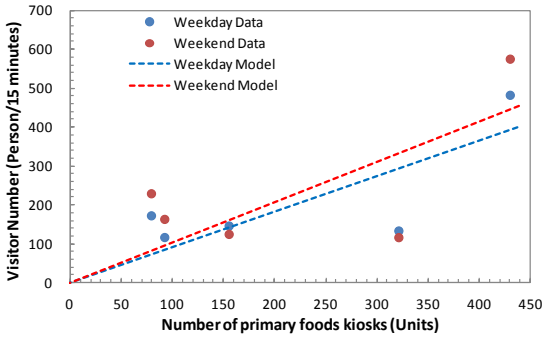
Table 4 Relationship between trip attraction and kiosk number

Kiosk Categories	**The corelation results**	
	Trend Equations	***r***
Primary foods	NVD = 0.8767k	0.7601
	NVE = 0.9764k	0.7340
Household Equipments	NVD = 3.1459k	0.9015
	NVE = 3.6790k	0.9710
Accessories	NVD = 9.3391k	0.9052
	NVE = 10.7470k	0.9308
Convection	NVD = 1.9579k	0.6306
	NVE = 2.2055k	0.6773
Total Kios	NVD = 0.4331k	0.8861
	NVE = 0.4910k	0.8766

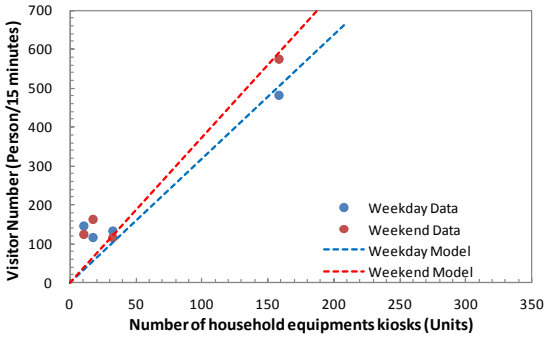
4.3 The calculation results of the parameters values of the MNL model

Table 5 provides the result calculation of the parameters values of the model, as well as some indicators values of significance and goodness of fit test for the model, particularly the likelihood ratio and the hit ratio, respectively.

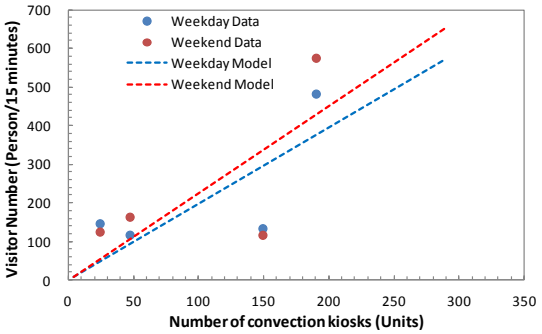
Overall, Table 5 shows that the trip frequency model for shopping travel on the traditional market has significant goodness of fit statistical tests. The likelihood ratio of the model such McFadden pseudo-ρ^2 has value 0.508, a very good value to assess that a logit model is significant (Koppelman and Bhat, 2006; Ramli et al., 2010)). As well as, the Cox and Snell pseudo-ρ^2 value and Nagelkerke pseudo-ρ^2 value are 0.770 and 0.815, respectively. In additional insight, Table 3 also shows that the hit ratio value, correct percentage between observed data and predicted model, is 68.7% indicating the model enough good to predict the trip frequency of the travel.



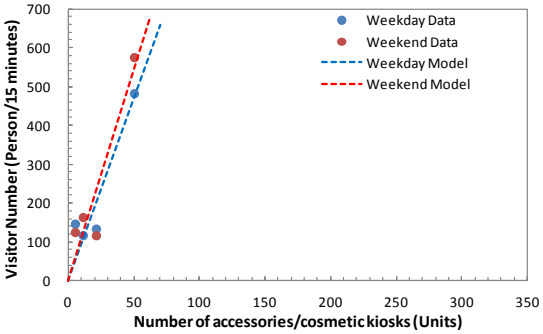
a. Primary foods kiosk



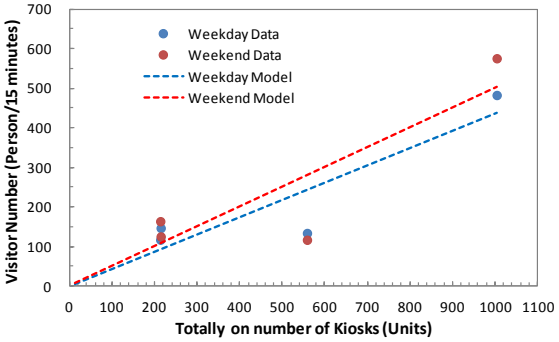
b. Household equipments kiosk



c. Convection kiosk



d. Accessories/Cosmetic Kiosk



e. Totally on number of kiosks

Figure 4 Relationship model between number of visitors and number of kiosks

Furthermore, as shown in Table 5, mostly categories of the endogenous variable on the trip frequency model had similar some exogenous variables in producing statistically significant parameters at level 95% (i.e.: family size, income, house condition-1, and spent money). However, in the utility function of the "frequency = 2" category, the house condition variable is insignificant variables. In addition, the categories of the "frequency = 4" and "frequency = 5" include the travel mode-1 as significant variable in their utility function. As well as, stay time variable are significant in the utility function of the "frequency = 2" and "frequency = 4" categories. However, in the "frequency = 4" category the variable only produced statistically significant level at 80%.

Generally, characteristics of household such family size, income, and house condition variables have become the significant variables that influence individuals or households in their trip frequency for shopping travel on the traditional market. As well as, characteristics of the shopping activity such spent money and stay time at the traditional market have significantly influenced the individuals or households. In many cases of shopping trip to traditional markets in developing countries, such in this study, individuals purpose to buy daily goods for their

households. In this regard, the more their spent money and stay time, the less their trip frequency in a week to traditional markets. These phenomena were indicated by the negative parameter values of both variables, as shown in Table 5.

Table 5 Result calculation of parameters values

Variabel	Frequency = 2		Frequency = 3		Frequency = 4		Frequency = 5	
	B	Sig.	B	Sig.	B	Sig.	B	Sig.
Constant	-3.447	0.725	-13.292	0.228	-15.415	0.291	**-57.315**	**0.000[1]**
HouseCond1	0.968	0.191	**5.047**	**0.000[1]**	**4.999**	**0.002[1]**	**3.396**	**0.033[1]**
HouseCond2	0[b]	.	0[b]	.	0[b]	.	0[b]	.
FamilySize	**0.721**	**0.012[1]**	**1.420**	**0.000[1]**	**2.016**	**0.000[1]**	**2.127**	**0.000[1]**
Occupation1	1.172	0.348	0.737	0.600	-0.231	0.900	0.756	0.694
Occupation2	0.145	0.910	-0.617	0.675	-2.166	0.257	-0.828	0.686
Occupation3	-0.589	0.699	-0.161	0.924	-0.664	0.755	0.303	0.894
Occupation4	0.604	0.704	0.876	0.643	0.056	0.983	0.509	0.855
Occupation5	0[b]	.	0[b]	.	0[b]	.	0[b]	.
Income	**2.339**	**0.024[1]**	**3.482**	**0.003[1]**	**5.124**	**0.000[1]**	**4.965**	**0.001[1]**
CarOwn	-1.298	0.154	-1.681	0.101	-0.740	0.512	-0.928	0.464
MCOwn	0.031	0.964	-0.049	0.951	0.048	0.957	0.755	0.438
TravelMode1	1.478	0.267	2.192	0.125	**3.269**	**0.038[1]**	**20.897**	**.**
TravelMode2	-0.321	0.868	-0.148	0.943	-0.053	0.980	-0.149	0.947
TravelMode3	0[b]	.	0[b]	.	0[b]	.	0[b]	.
TravelTime	0.040	0.393	0.014	0.794	0.054	0.382	0.109	0.104
SpentMoney	**-0.086**	**0.069[2]**	**-0.194**	**0.000[1]**	**-0.280**	**0.000[1]**	**-0.368**	**0.000[1]**
StayTime	**-0.032**	**0.011[1]**	-0.023	0.112	**-0.028**	**0.090[2]**	-0.003	0.880
Number of observation					345			
Likelihood ratio, ρ^2:								
- Cox and Snell					0.770			
- Nagelkerke					0.815			
- McFadden					0.508			
Hit Ratio (%)					68.7			

Note: [1] Significant at 95%, [2] Significant at 80%
[b] This parameter is set to zero because it is redundant
The reference category is 'trip frequency = 1'.

5. CONCLUSSION

The relationship between number of visitors and number of kiosks on the six traditional markets in Makassar City, Indonesia, as well as, some exogenous variables that influenced individuals of households in making trip repeatedly for a shopping trips on a traditional market in the city have been analyzed in this study.

Regarding the single linear regression analysis, the number of accessories/cosmetics and household equipments kiosks categories more significant influence the trip attraction number of the traditional markets. In the other side, through a multinomial logit model approach, the family size, income, and house condition variables of the household characteristics have become the significant variables in influencing individuals or households on their trip frequency to the traditional market. Also, the spent money and stay time variables of the shopping activity characteristics have significantly influenced the individuals or households.

Briefly, we expect that the analysis result of the model provides a basis for an extension analysis of shopping travel on traditional markets in Makassar in further studies such as the departure time choice model, the travel mode of the shopping trips, etc.

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