VALUATION OF MOUNT MERAPI NATIONAL PARK: A TRAVEL COST ANALYSIS

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Abstract

This study estimates recreational value of Taman Nasional Gunung Merapi (TNGM – Mount Merapi National Park) in Kaliurang, Yogyakarta with a travel cost method. Since the visitors are not the frequent ones, the paper estimates the visitor's utility using a categorical regression technique. Applying in-depth interview on visitors from August 1st until August 15th 2009, the results suggest that the utility function for recreation at volcano national park is better estimated using the negative binomial distribution model. It also finds that the economic value of recreation at volcano national park is Rp 222,000, and that the total consumer surplus for recreation national park is Rp 31.2 billion.

Keywords: Travel cost valuation, binomial regression model, recreation national park valuation
JEL classification numbers: D12, L83

INTRODUCTION

So far, papers assessing the benefits of natural forest attraction, which uses travel cost method, assume that the number of tourist visits follows a normal distribution. The statistics in our study suggests that the visitors visit natural forest attraction once or twice a year (Table 1). Consequently the assumption of normal distribution cannot be maintained in estimating the value of the benefits from visiting natural forest attraction. In addition to travel cost analysis approach, the distance from visitor's hometown to the tourist destination and the time spent by visitors are of critical assessments to the accuracy of the proxy to value natural forest attraction. With the availability of digital maps provided by Google, mileage and time required by visitors can be measured more accurately. These precision measurements of distance and time enables to provide more precise measurement to the values of time and money spent by visitors as a consequence of making a selection of visit forest attraction.

Table 1: Distribution of Respondents Number Visit

Arrivals	Distribution of Respondents Number	
	Amount	Percent
First time	167	51.7
Second time	90	27.9
Third time	15	4.6
Fourth time	7	2.2
Fifth time	8	2.5
Beyond fifth time	36	11.1

Source: Data estimation.

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Table 2: Number of Visitors, Mount Merapi National Park, September 2008-August 2009

Date	Tlogo Nirmolo			Tlogo Muncar		Gardu Pandang		Summary
	Domestic Tourist	Foreign Tourist	Stu-dents	Domestic Tourist	Foreign Tourist	Domestic Tourist	Foreign Tourist	
September 2008	1456	46		5609	138			7249
October 2008	4369	28	400	18944	115			23856
November 2008	864	19		7921	43			8847
December 2008	1186	55		8765	155			10161
January 2009	405	21	500	10335	196			11457
February 2009	924	26		6301	123			7374
March 2009	1266	51		7383	127			8827
April 2009	1068	41		6024	156			7289
May 2009	1220	26		8047	196	2441	146	12076
June 2009	1303	45		7922	182	4404	226	14082
July 2009	1346	66		6968	313	9234	631	18558
August 2009 *)	468	34		1051	79	3386	385	5403

Source: TNGM, 2009, adapted.

The improvement in the calculation of the travel cost will be used to assess the benefits visiting the natural forests in the sights of Mount Merapi National Park (Taman Nasional Gunung Merapi - TNGM). This natural forest attraction object is located at Sleman district and has been known as Kaliurang, which has been visited by many domestic and international tourists (Table 2).[2] During September 2008 to August 2009, the number of visitors is 140,252 people.

The objectives as well as benefits of this research can be explained as follows. Valuation of natural forest attractions aims at determining the estimated economic value of Kaliurang natural attractions in TNGM. By knowing the economic value of Kaliurang natural attractions in TNGM, local government and TNGM managers can offer or invite inventors and communities for the benefits of economic value development of TNGM.

The research hypothesis can be explained as follows. Negative binomial regression model, as has been mentioned, is the appropriate technique to determine the benefit values of Kaliurang natural attractions in TNGM. The benefit value, as indicated by the consumer surplus per visitor, is positive. This positive surplus means that Kaliurang natural attractions in TNGM have provide benefit values to the visitors.

Some papers have investigated the topic, along with various possible tools for analysis. Iamtrakul et al. (2005) construct an approach to valuate public park services to highlight the dominant functions of public parks from users' point of view. Particularly, they investigate recreation behaviour of park users in Saga city, Japan. Their result shows a useful issue that plays a significant role in generating valuable economic information for local government policymakers to apply suitable management plans in maintaining quality of public park service in association with the preference of community to achieve the goal of life city.

Babulo et al. (2006) investigate methods for valuation of the goods and services of enclosure in Ethiopia. They find that the economic value of closed areas could be grouped into two broad headings, namely the use and non-use values.

Chaudhry and Tewari (2006) develop a general model depicting the rela-

[2] Since year 2004, Kaliurang tourism object and the area have been named as Mount Merapi National Park by SK Menhut No: SK-134/MENHUT-II/2004 signed 4 May 2004.

tion of the ratio of consumer surplus estimated in TCM and CVM with corruption perception index in the case of tourists from various countries with different world rankings in so far as their parallel economy and level of corruption are concerned. They are motivated by the fact that in a developing country such as India the contingent valuation method (CVM) cannot always provide a correct valuation of recreational use benefits of an environmental resource given the huge size of the parallel economy involving different categories of middle to upper income group families which have the capacity to move as tourists.

Boyd (2007) attempts to value a recreational visit to surf beaches within the local urban setting of Mooloolaba beach, Sunshine Coast, Queensland using a truncated negative binomial individual travel cost model. He considers income, on-site and off-site travel expenditure and time, party size, and employment status to explain visits. He finds that the passive-use values of beaches are higher than those of national parks or forests.

Heberling and Templeton (2009) estimate an individual travel cost model for Great Sand Dunes National Park and Preserve (GSD) in Colorado. They consider travel cost and income to estimate the model. They find a negative binomial model corrected for truncation and endogenous stratification fit the data the best.

Techniques and applications of assessing the economic value of forest resources can be seen from the methodology used to obtain the data. Based on the methodology, the variety of asset valuation techniques of natural resources and the environment are divided into three methods, namely revealed preference method, stated preference method, and benefit transfer method (Table 3).

Table 3: Assessment Methodology of Forest Resources and Environment

Methodology	*Approach*	*Applications*	*Data requirements*	*Limitations*
Revealed preference methods				
Production function (also known as 'change in productivity')	Trace impact of change in ecosystem services on produced goods	Any impact that affects produced goods	Change in service; impact on production; net value of produced goods	Data on change in service and consequent impact on production often lacking
Cost of illness, human capital	Trace impact of change in ecosystem services on morbidity and mortality	Any impact that affects health (e.g. air or water pollution)	Change in service; impact on health (dose-response functions); cost of illness or value of life	Dose-response functions linking environmental conditions to health often lacking; underestimates, as omits preferences for health; value of life cannot be estimated easily
Replacement cost (and variants, such as relocation cost)	Use cost of replacing the lost good or service	Any loss of goods or services	Extent of loss of goods or services, cost of replacing them	Tends to over-estimate actual value; should be used with caution
Travel cost (TCM)	Derive demand curve from data on actual travel costs	Recreation	Survey to collect monetary and time costs of travel to destination, distance traveled	Limited to recreational benefits; hard to use when trips are to multiple destinations
Hedonic pricing	Extract effect of environmental factors on price of goods that include those factors	Air quality, scenic beauty, cultural benefits	Prices and characteristics of goods	Requires vast quantities of data; very sensitive to specification
Stated preference methods				
Contingent valuation (CV)	Ask respondents directly their WTP for a specified service	Any service	Survey that presents scenario and elicits WTP for specified service	Many potential sources of bias in responses; guidelines exist for reliable application
Choice modeling	Ask respondents to choose their preferred option from a set of alternatives with particular attributes	Any service	Survey of respondents	Similar to CV; analysis of the data generated is complex
Other methods				
Benefits transfer	Use results obtained in one context in a different context	Any for which suitable comparison studies are available	Valuation exercises at another, similar site	Can be very inaccurate, as many factors vary even when contexts seem 'similar'; should be used with caution

Source: Pagiola et al. (2004).

METHODS

The methodology of valuation using revealed preference method is used when data is observed based on the people's behaviour in reality. On the methodology using stated preference, the data obtained from surveys on the consequences of choices or responses by people to the hypothesis questions environmental changes will occur.[3] Those three methods have their own approaches, applications, data and limitations, so that they can complement each other when doing the valuation of natural resources and environment as a whole.[4] Thus, in general, the valuation of natural tourism park (natural tourism recreation service) applies two approaches, namely the travel cost method and the contingent valuation method, while the hedonic price approach is more widely used for valuation of land price and public facilities at the recreation park.

This paper conducts the valuation of recreational benefits of natural forest Kaliurang in TNGM using travel cost method (TCM). The tourist attraction proxy value is the cost required to achieve and enjoy the tourist attraction itself. In this TCM approach, the individual performs two types of expenses, cash expenditure and value of time.[5] Cash expenditure is required to pay fuels, ticket fee, accommodation, and to buy foods. Value of time is the valuation of time used to enjoy sights and adore the tourism object, starts from the places of stay until back to origin place before go to tourism object. The time used in this model is an opportunity cost for the individual being unable to perform other activities while the individual decides to visit a tourism attraction. The individual utility function with two constraints is written in equation (1).[6] (For further discussion, see Haab and McConnell (2002), and Melichar (2007)).

$$\max_{v,x} U = U(x, v, q, z) \quad (1)$$

subject to

$$wT = x + [p_0 + w(t_t + t_s)]v = x + p_v v$$
$$\text{which } p_v = p_0 + w(t_t + t_s).$$

Maximizing the result from equation (1) to the number of visits for recreation is the numbers of recreation visit demand function, namely:

$$v = f(p_v, q, y, z), \quad (2)$$

where
v is the number of visits within a certain period,
p is price or cost of visit,
q is environment quality,
Y is income,
Z is socio-demographic characteristics.

Equation (2) can be transformed into an econometric equation that can be estimated to get the coefficients of the factors that affect demand for recreation requests in national parks. To estimate the model, equation (2) rewritten as follows

[3] Benefit transfer method is the valuation method to compare two or more assessments of the benefits from similar natural resources and environment.

[4] For more detail, see Haab and McConnell (2002, pp. 137-189), Bockstael and Freeman (2005), in Mäler and Vincent, (2005, pp. 517-570), Phaneuf and Smith (2005), Mäler and Vincent (2005, pp. 671-762), and Shiferaw et al. (2005, pp. 19-52).

[5] TCM idea is contributed by Harold Hotelling (1931), proposed in assessment of National Park Service in America, and later developed and formalized by Clawson and Knetsch, 1966, although TCM is still considered to be less comprehensive and less flexible in assessment compared to CVM. Assessment using TCM is more focused on achieving assessing cost to the desired location (Rashev, 2003, pp. 18).

[6] Note that x is consumption of private goods, v is numbers of trips into tourist attraction, q is the environment quality as a tourist attraction, z is the characteristic of visitors, w is wage rate, t_t is time travel to the tourist attraction, t_s is time to enjoy tourist attraction, T is the amount of time used for the work and leisure time, p_v is price/cost of money to a tourist attraction, and p_0 is price or cost of money spent to enjoy tourist attraction.

$$SUM\_VISIT_i = \beta_0 + \beta_1 T\_COST_i + \beta_2 EXPEND_i + \beta_3 AGE_i + \beta_4 EDUC_i + \beta_5 NUM\_G_i + \beta_6 EC\_ACT_i + \beta_7 EC\_AME_i + \beta_8 EC\_UNI_i + \varepsilon_i \quad (3)$$

$$i = 1,\ldots,n$$

where *SUM_VISIT* is the number of visits of individual *i* at the sight, *T_COST* are travel costs and time to and from the sight of individual *i*, *EXPEND* are income or expenditure per month of individual *i*.

Variables for demographic characteristic of the respondents are as follows. *EDUC* is the highest educational level of individual *i*, *AGE* is the age category of individual *i*, *NUM_G* is the number of group who had been invited by individual *i*.

The variables to measure the characteristics of perception of the environment are as follows. *EC_ACT* is a variable for the activities of individual *i* on the sight, *EC_AME* is a variable for the valuation of individual *i* for convenience of public facilities, and *EC_UNI* is a variable for unique perception of the sight for individual *i*.

Equation (3) will be tested using a negative binomial regression model (*NBRM*). This is because visitors tend to come to a tourist attraction once or twice in a year and are heteroscedastic. The negative binomial regression modelwill be :

$$\theta_i = exp(\beta_0 + \beta_1 T\_COST_i + \beta_2 EXPEND + \beta_3 AGE_i + \beta_4 EDUC_i + \beta_5 NUM\_G_i + \beta_6 EC\_ACT_i + \beta_7 EC\_AME_i + \beta_8 EC\_UNI_i + \varepsilon_i)\delta_i, \quad (4)$$

where

δ_i is $\exp(\varepsilon_i)$,

ε_i is error terms,

β_0 is a constant coefficient estimation,

β_1 is the estimated travel cost of individual *i* coefficient,

β_2 is the estimated monthly income of individual *i* coefficient,

β_3 is the estimated highest education level of individual *i* coefficient,

β_4 is the estimated age category of individual *i* coefficient,

β_5 is the estimated number of groups of individual*i* coefficient,

β_6 is the estimated activities of individual *i* in the sight coefficient,

β_7 is the estimated valuation of individual *i* for convenience of public facilities coefficient,

β_8 is the estimated unique perception of the sight for individual *i* coefficient.

The value of benefits per individual, which is the average valuation of Kaliurang attraction in Mount Merapi National Park, is obtained by calculating the consumer surplus with the following formula $CS(p_v, q_0) = -\frac{1}{\beta_1} v_0$, where the value β_1 is obtained from the regression NBRM model, v_0 is the estimated v on a certain level of environment quality $(q = 0)$, a certain social characteristic $(z = 0)$, value p_v, and $v_0 = \beta_0 + \beta_p p_v + \cdots + \beta_y y$ (for more detail, please see Haab and McConnell, 2002, p. 161; Alberini and Longo, 2005, pp. 4).

Quantitative Data Collection

Data used in the research of benefit valuation of TNGM natural forest is secondary and primary data. The secondary data are obtained from Mount Merapi National Park Office archives and websites to give a general description and the determinations of number of respondents. The primary data is obtained from direct interview data (with list of questions) to the visitors of TNGM which are 19 years old and above, to estimate the benefit values of Kaliurang natural forest attraction. The direct interview survey with visitors were conducted on 1st to 15th August 2009.[7] The number of re-

spondents that can be processed are 323 people.

RESULTS DISCUSSION

To get Kaliurang natural attraction valuation, the paper estimates negative binomial regression models using three variants, namely regression using all data of respondent visitors, visitors with many purposes, and visitors with single purpose to visit natural forest TNGM (Table 4).

Negative Binomial Regression Model Test

Prior to this interpretation, the regression is tested using three states of testing (Cameron and Trivedi, 1998, pp. 44-45 and Winkelmann, 2008, pp. 113). Applying the Wald test with *z* distribution, the negative binomial regression model, which uses many purposes respondent data, does not pass the test because all the independent variables are not significant. Independent variables on negative binomial regression model, which uses all respondents and single purpose respondent visitors, are significant. Travel cost variable, expenditure per month of respondents, tour activities, and the number of groups who have been invited are significant with confidence level 5 percent, while the estimated coefficient of the variable presence of vegetation cultivation and variable presence of respondents to the path or road of TNGM environment are significant to 10 percent confident level. Thus, the price of natural forest attraction (which is approached by travel cost) can be used to explain what respondents demand to visit TNGM natural attraction.

Table 4: Negative Binomial Regression Results Recreation Demand Mount Merapi National Park in Kaliurang[8]

	All respondent visitors		Multi purposes respondent visitors		Single purpose respondent Visitors	
Variable	Coefficient		Coefficient		Coefficient	
C	0.683319	*	0.772970	*	0.641958	*
T_COST	-4.69E-06	**	-3.72E-06		-9.99E-06	**
EXPEND	0.094211	**	0.070292		0.12881	**
EC_LTOUR	0.176659	*	0.039359		0.297606	*
EC_VEGE	-0.251467	*	-0.232510	***	-0.34314	*
EC_HTRACK	0.165773	*	-0.003185		0.336254	*
NUM_G	-0.009386	**	-0.007701		-0.0134	**
Adjusted R^2	0.073817		0.045585		0.090722	
LR index (Pseudo R^2)	0.865501		0.869986		0.862992	
Number of respondents (*n*)	323		155		168	

Notes: Entries in *, **, and *** are significant at 1%, 5%, and 10%, respectively.
Source: Data estimation.

[7] With the estimated per year visitors numbers of 140,247 people and at 5-10% confidence level, the number of sample visitors is between 271 to 384 respondents. These respondents are from Telaga Muncar, Telaga Nirmolo, Kali Kuning, and Gardu Pandang.

[8] Education Level and Age Category do not pass Wald test (with *z* distribution), thus eliminated from model.

On testing the independent variables simultaneously, the *LR* value ($T_{LR} = -2[\mathcal{L}(\hat{\theta}_r) - \mathcal{L}\hat{\theta}_u]$) reaches 7,017,707 for respondents with multiple purposes, and 3657.434 for respondents with single purpose, which means very significant to reject H_0. This means that these independent variables simultaneously explain the demand for the visit numbers of respondents in TNGM.

The third test is the goodness of fit test (see Cameron and Windmeijer, 1996, and Winkelmann, 2008, pp. 118-220). In the *LR* index for the detection of Pseudo R^2 is high, namely 0,864380. Pseudo R^2 suggests that free variables can explain the average visit average numbers of respondents in TNGM. Then Pseudo R^2 value is consistent with the value of LR, and means that the regression is able to estimate demand for natural forest recreation TNGM in Kaliurang.

Valuation Interpretation Natural Forest Attraction

From the regression results presented in Table 4, this research has been able to answer the hypothesis that the negative binomial regression model can be used to estimate the price or value of natural forest attraction TNGM, as indicated by travel cost coefficient (as price of recreation services) is negative and significant at 5% confidence level.[9]

Negative travel cost shows that for each increase in travel cost, TNGM visitors in Kaliurang decreases the average number of visits, in which every 1% increase of travel cost (in units of million Rupiah) will decrease the average numbers of visit as many as 9.82 percent.[10] Compared to respondents that the main visit to TNGM, the decrease in the average number of visits is bigger, namely 22.18 percent. This implies that travel cost increases decreases the visitor numbers.

Value of benefits per individual, which is the average values of natural recreation Kaliurang in TNGM, is obtained by calculating the consumer surplus with formula: $CS(p_v, q_0) = -\frac{1}{\beta_1} v_0$, where value β_1 is obtained from the result of NBRM regression model, v_0 is the estimated average the number of visits on the level of income, demographic characteristic visitors, and perception characteristic visitors to a particular environment (see Haab and McConnell, 2002, pp. 161 and Alberini and Longo, 2005, pp.4).

Consumer surplus (per visitor), as indicated by the average visits divided by travel cost coefficient, is positive. The positive value means that natural forest attraction of Kaliurang in Mount Merapi National Park provides benefit value for the individuals who visit TNGM Kaliurang. The benefit values of Kaliurang TNGM are as follows. To all visitors:

$\frac{2.092879}{4.69\times10^{-6}}$ is Rp 466.000 per person per visit.

If the visitors of TNGM are 140.585 people, then economic value of TNGM natural attraction in Kaliurang is Rp 62.7 Billion. For visitors with single purpose, the economic value is

$\frac{2.220238}{9.999\times10^{-6}}$ is Rp 222.000 per person per visit.

If the visitors of TNGM are 140.585 people, the economic value of TNGM natural attraction in Kaliurang is Rp 31.2 Billion.

The difference indicates that the TCM approach to economic valuation needs to separate the visitors who have primary purpose to visit recreation object that is valued and visitors who have multi-

[9] Except the travel cost coefficient on negative binomial model regression, which uses data from multi purposes visitors, is not significant.

[10] Calculated from $\partial E[y|x]/\partial x = -\beta_1 E[y|x]$.

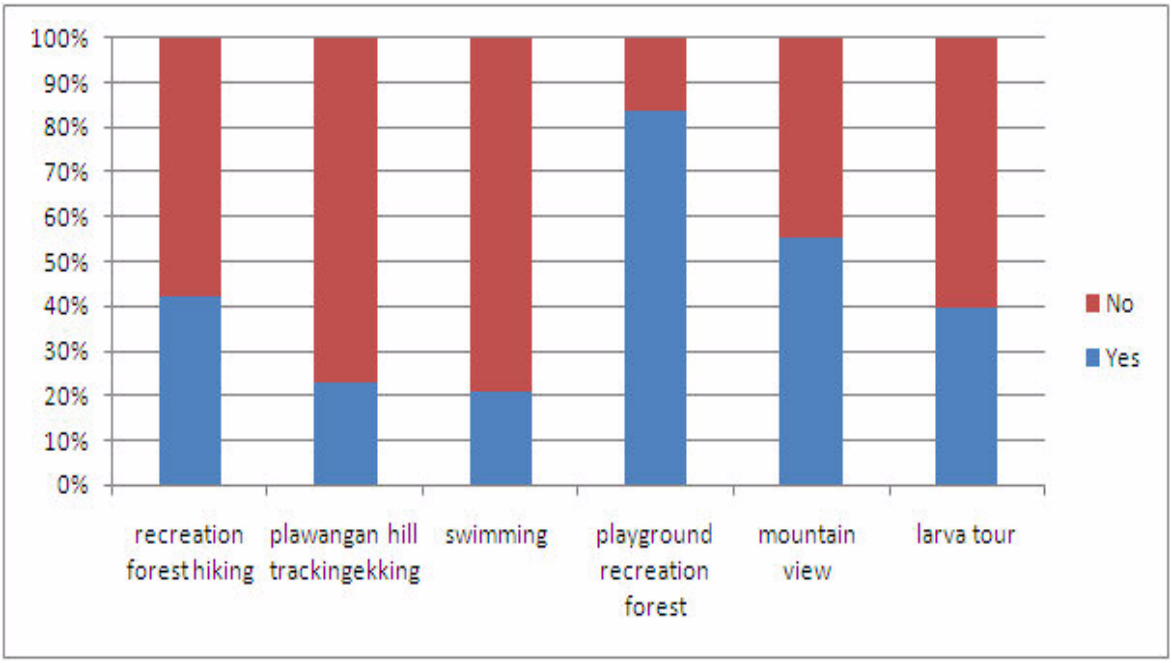
visit of recreation objects. Without the separation, the valuation on recreation objects will be over-valued. Travel cost (consists of time cost and money cost) spent by visitors (as proxy of economic value or recreation services price) not just for economic value of TNGM recreation in Kaliurang but might also be economic value of another objects. It is reinforced by regression coefficients on regression model, which uses data from multi purposes visitors (visit many tourist attraction beside TNGM natural forest attraction), is not significant.

The findings could also be interpreted that when visitors are willing to pay the prices higher, then the visitors will also ask for higher utilities. The utilities, where are gained in TNGM natural forest attraction, not yet commensurate with the value or cost that are paid, so that visitors chain the visit in natural forest attraction with another attractions. Based on the results of survey, 48% visitors did not visit TNGM only (Table 5). Visit in TNGM is one attraction of a series tourism attraction to be visited by 48% visitors.

Table 5: Priority Distribution/Recreation Destination Respondents

Recreation Destination	Amount	Percent
Main destination TNGM	168	52,01
Agrowisata Turi	3	0,93
Malioboro/Kraton	18	5,57
Borobudur	22	6,81
Prambanan	3	0,93
Kya Langgeng	16	4,95
Kali Kuning	7	2,17
Training/Seminar	4	1,24
Beach	23	7,12
Visit relatives/friends	14	4,33
Tour around Yogyakarta City	6	1,86
Transit place to another city	4	1,24
Not mention anything	35	10,84
Total	323	100,00

Source: Data estimation.



Source: Data estimation.

Figure 1: Percentage of Respondents Activities in TNGM Location

The condition is reinforced by the dominance of visitors with passive recreation activities (Figure 1). Visitors, who do not have many choices of recreation activities, would prefer passive recreation activities rather than active recreation activities, such as hiking and swimming, which not many do it anymore. Visitors with passive recreation activity have characteristics which are a couple and have thin wallet. The condition becomes different when visitors can perform many active recreation activities in Kaliurang recreation attraction, so the visitors will need longer time to stay and enjoy the recreation services which are offered. By longer time the visitors stay in recreation attraction, the economic values become higher than previous. Higher the economic values of TNGM recreation in Kaliurang will provide another incentive for inventors and public to participate in the development of natural tourism TNGM in Kaliurang.

CONCLUSIONS

The economic valuation generated by this research did not reflect the total economic value of TNGM. Another benefit of the existence of TNGM may have far greater value than the benefit of natural attraction itself, like the benefits of flood prevention, water resource and irrigation around Mount Merapi, and other benefits that can be generated from the existence of TNGM. Obeying the total value of TNGM, this research found the following results. First, consumer surplus per visitor was positive, which meant that Kaliurang natural forest attraction in TNGM provided benefit value for individuals with a single purpose, which was equal to Rp 222,000 per individual per visit. If TNGM visitors were 140,585 people, then the economic value of TNGM natural attraction was Rp 31.2 billion per year. Second, assessment on or valuation of natural forest attractions which uses travel cost analysis needed to strictly distinguish single purpose visitors and multi purposes visitors. Without separating the purposes, the conducted valuation would be overvalued.

Based on the aforementioned findings, the paper provided a couple of suggestions. First, TNGM managers and local government initiated or provided stimulus which improved the equipment or facilities of activities that can be used again, such as hiking path and it divided into several levels from beginner or children to advanced, looking for new water resources to relive swimming pool and also fishing facility, and special path for adventure with a mountain bike. Second, for the development of research and further natural forest attraction, TCM method with categorical regression model was practical to estimate the economic value of National Park recreation. The result of economic value of National Park recreation could be a reference for managers and local governments to balance between natural forest preservation with additional income for local governments and societies.

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