

**VALUING A HIGH ALTITUDE MOUNTAIN ECOSYSTEM AND
CREATING POLICY INSTRUMENTS FOR ECOTOURISM
DEVELOPMENT: A CASE STUDY OF
YULONG MOUNTAIN, CHINA**

Zhuoran Zhang

**A Dissertation Submitted in Partial
Fulfillment of the Requirements for the Degree of
Doctor of Philosophy (Economics)
School of Development Economics
National Institute of Development Administration
2015**

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Zhuoran Zhang

School of Development Economics

Associate Professor Udomsak Seenprachawong..... Major Advisor
(Udomsak Seenprachawong, Ph.D.)

Associate Professor A. Israngkura..... Co-Advisor
(Adis Israngkura, Ph.D.)

Assistant Professor Anan Wattanakuljarus..... Co-Advisor
(Anan Wattanakuljarus, Ph.D.)

The Examining Committee Approved This Dissertation Submitted in Partial
Fulfillment of the Requirements for the Degree of Doctor of Philosophy (Economics).

Assistant Professor: Penporn Janekarnkij..... Committee Chairperson
(Penporn Janekarnkij, Ph.D.)

Associate Professor A. Israngkura..... Committee
(Adis Israngkura, Ph.D.)

Assistant Professor Anan Wattanakuljarus..... Committee
(Anan Wattanakuljarus, Ph.D.)

Associate Professor Udomsak Seenprachawong..... Committee
(Udomsak Seenprachawong, Ph.D.)

Assistant Professor Nada Chunsom..... Dean
(Nada Chunsom, D.B.A.)

June 2016

ABSTRACT

Title of Dissertation	Valuing a High Altitude Mountain Ecosystem and Creating Policy Instruments for Ecotourism Development: A Case Study of Yulong Mountain, China
Author	Zhuoran Zhang
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This dissertation consists of three connected parts:

The first part is a research paper examines the tourism demand and assesses consumer surplus from visiting a unique tourist attraction site: glaciers in Mt. Yulong, Yunnan, China by using the Zonal Travel Cost Method (henceforth, ZTCM). I aim to uncover the use value of this particular site in tourism development. I divide domestic travelers into 20 groups based on the demographical and geographical characteristics of their place of residence. The empirical results show that the economic value of the glaciers in the tourism industry is more than 3 billion Chinese Yuan (CNY), roughly equivalent to 500 million dollars at the exchange rate of March 2016, which is approximately 10% of the local GDP. The high estimated value of the glaciers suggests that some conservation policy interventions are necessary.

The second research paper attempts to elicit the maximum willingness to pay by the travelers for the ecotourism development, which would conserve the glaciers and the ecosystem in Mt. Yulong. The survey was conducted in Mt. Yulong among the travelers during June to December 2015, and the focused group talk technique was applied. A total of 1,500 survey questionnaires were distributed and 889 returned with completed information. The estimated willingness to pay by each traveler's averages around 220 CNY, which is equivalent to 35 US Dollars at the exchange rate of March 2016. This amount was almost twice higher as the entrance fee to the site and

indicates that the travelers are highly concerned with the environmental quality during their traveling experiences and are in favor for the eco-friendlier tourism.

The third part of this dissertation is a discussion paper that aims to compare different techniques of intervention instruments based on the particular situations in Lijiang and Mt. Yulong. This paper combines researches and recommendations from the environmental scientists of Chinese Science Academy and the economic attributions uncovered from the previous two parts of this dissertation into consideration. Even though various market base instruments have their unique advantages and might all be achieving in the case of Mt. Yulong, the Payments for Ecosystem Service (henceforth, PES) package seems to be most effective in addressing the environmental conservation issues as well as enhancing the economic development.

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ABBREVIATIONS

Abbreviations

CNY

CS

CV

CVM

EV

GDP

MBI

MES

Mt.

OE

PES

TCM

USD

WTP

WTA

Equivalence

Chinese Yuan

Consumer Surplus

Compensating Variation

Contingent Valuation Method

Equivalent Variation

Gross Domestic Product

Market Base Instruments

Market for Ecosystem services

Mountain

Open-Ended

Payment for Ecosystem Services

Travel Cost Method

U.S. Dollar

Willingness to Pay

Willingness to Accept

CHAPTER 1

INTRODUCTION

1.1 Background

Tourism has recently grown to become a star sector in China. It generates millions of dollars for locals without consuming much of the resources. In Yunnan Province, tourism is one of the most profitable sectors, and it has helped an array of poor regions to raise their living standards. Nonetheless, the tourism sector has recently started to draw concerns from policymakers, scholars and concerned citizens, as the associated activities carried out at the tourist attraction sites raise many environmental issues, such as air and water pollution, and deforestation. The degradation of the main environmental asset is possible and such a development can result in a drastic decrease in tourist visitation and thereby tourist dollars.

The general public has since started to call for more sustainable development and, more importantly, implementation of feasible conservation plans, especially in tourism attraction sites with highly sensitive environmental assets. However, a central issue often raised by skeptics regarding the conservation of such environmental assets is: “Is it worth the money and effort, and will the implemented rules and policies to conserve the environment pay off in the long run?”

This dissertation attempts to gauge the economic value of a well-known tourism attraction site: Mt. Yulong (also known as the Jade Dragon Mountain) in Yunnan Province, China. This site is celebrated for its unique and precious environmental asset: glaciers. We employ the widely adopted Travel Cost Method and the economic value derived from such a method shall serve as a benchmark that allows us to examine whether or not this tourist attraction is crucial for the vigor of the local tourism sector and economy; I also apply the Contingent Valuation Method in order to elicit the travelers’ willingness to pay for the conservation of the glaciers

and the ecotourism development, in the hope to fully examine the consumer's welfare related to the glaciers. This study hopefully can provide some first-hand evidence that signifies the economic importance of the site and its glaciers. It is, thus, necessary for the local authority and policymakers to implement some urgent measures to conserve this sensitive but precious environmental asset.

1.2 Site of Study

Mountain ecosystem is one special type of the Terrestrial Ecosystem where:

Lands provide a scattered but diverse array of habitats in which a large range of plants and animals can be found. At higher altitudes harsh environmental conditions generally prevail, and a selection of treeless alpine vegetation, upon which the present account is focused, is supported. The montane forests commonly cover the lower slopes. At even lower levels mountain lands grade into other types of landform and vegetation - e.g., tropical or temperate forest, savanna, scrubland, desert, or tundra. (Smith, n.d.)

Such an ecosystem can typically be found in Andes, Himalaya and Siberia.

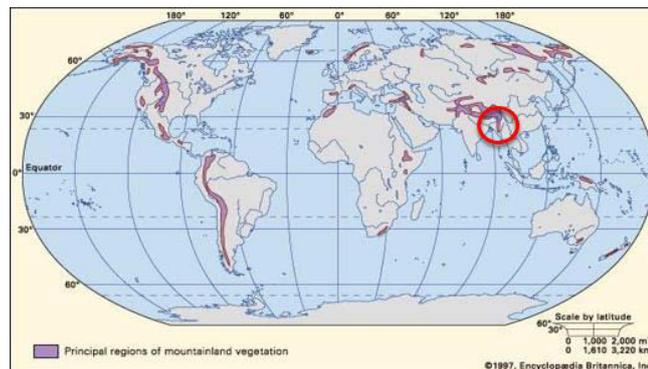


Figure 1.1 Mountain Ecosystems and Mt. Yulong

Source: Smith, n.d.

Yulong Mountain (Mt. Yulong henceforth) is also known as the Jade Dragon Mountains. It is located in the northern part of Yunnan Province, China (latitude $27^{\circ} 10'$ to $27^{\circ} 40'$, longitude $100^{\circ} 9'$ to $100^{\circ} 20'$), and it is one of China's southernmost mountain ranges, as shown in Figure 1.1. Mt. Yulong has glaciers that are the closest to the Equator in the entire northern atmosphere. It is the most remote mountain range reaching out from the Tibetan Plateau (Himalaya) and covered with Maritime glaciers. The climatic snowline of the Mt. Yulong is at approximately altitude 5000 meters, with a terrain snow line at around 4,000 meters. Its main peak has a developing hanging glacier, while cirque glaciers cover most of other peaks at altitude 4500 to 5000 meters. There are currently 19 glaciers covering a total area of more than 11.61 square kilometers. Most of the glaciers possess similar characteristic as those found in the Alps. (He and Zhang, 2004)

Combining the sub-tropical location and rapid change in altitude, Mt. Yulong has a fairly diverse range of ecosystems: (1) sub-tropical rain forests in the river valley; (2) temperate broad-leaves forests between altitude 2400 to 3200 meters; (3) the boreal coniferous at altitude 3200 to 4200 meters; (4) alpine scree with sparse vegetation covered between altitude 4300 to 5000 meters, and (5) permafrost and glaciers dominating the higher levels.

For thousand years, Mt. Yulong was the residence of a small number of tribal people living in tiny basins over the river valley, enjoying the fertile soil, mild climate and rich natural diversity. Only occasionally outsiders traveled to the region and were often marveled by the mountain's natural beauty.

The uniqueness of the ecosystem and spectacular scenery has given Mt. Yulong a new life in the late 20th century. Local residents and the provincial authority started to explore the huge tourism value within the glaciers and the mountains. Various tourism projects including airports, hotels, and roads were proposed and subsequently developed and completed. For example, the new cable tram, which allows travelers to reach the glaciers, was built in 1998.

With the completion of these tourism projects, the surrounding areas and local city, Lijiang, have since enjoyed a substantial economic expansion. As shown in Table 1.1, there were merely about 200,000 visitors in 1994. That figure soon

exploded to roughly 1.7 million in 2004 and 3.6 million in 2013. The importance of this sector on the local economy had also grown substantially.

Table 1.1 Economic Statistics of Lijiang

	1994	2004	2013
Total Number of Tourists Arrival	200,000	1.7 million	3.6 million
Real GDP (in USD)	50 million	250 million	4.49 billion
Tourist Revenue to GDP	28.40%	48.30%	61.40%
Number of Travelers Visiting Glacier to Total Number of Travelers	7.60%	41.20%	77.40%

Source: Statistical Office, Tourism Authority of Lijiang.

Note: Figures of 1994 were approximated by staff of the Statistical Office due to lack of data.

The tourist site on the glaciers is managed by a group of state owned enterprises, each entitled to run and manage a separate functions, such as the cable car, the site development and the environment conservation; all the enterprises are founded and directly supervised by the Committee of Tourism Development of Mt. Yulong, which was a subordination agent under the Tourism Authority of Yunnan, and the main responsibility of this committee is to create development plans and to regulate the economic activities related to Mt. Yulong and the glaciers.

Unfortunately, perhaps due to the economic activities that have been carried out at and around the mountains, ominous signs of environmental deterioration have emerged and started to draw concerns. Scientists from Chinese Academy of Sciences predicted that there would be only six glaciers left in 2015, compared to a total of 19 in 1994 (Ning et al. 2006). Table 1.2 reveals his other predictions about the fate of the mountain and its glaciers. It is apparent that the development of tourism brought about a huge amount of tourist revenue and speeded up the social and economic development. However, these tourism projects and activities have negative effects on the very most important environmental resource – the glaciers. Almost 30% of the glaciers (6 out of 19) have disappeared since 1994. The remaining 13 glaciers have also retreated by more than 200 meters on average. The total area covered by glaciers and permafrost has also shrunk by around 30% in size. At this speed, by year 2050, all

the glaciers are expected to recede to above 5,000 meters and half of the area currently covered by glaciers would have nothing but bare rocks. The glaciers would likely appear only at altitudes where it is inaccessible for human within 20 years, if nothing were done to conserve it.

Table 1.2 Environmental Statistics of Mt. Yulong

	1994	2012	2050*
Local Temperature (Annual Average)	12.6	14.2	16
Number of Existing Glaciers	19	13(14)	6
Areas Covered by the Glaciers	11.5km ²	8.5km ²	4.42km ²
Underground Water Line	65m	105m	N/A
Glacier Retreat (5 years Average)	10.13m	24.7m	N/A
Glacier lower edge Altitude	4,550m	4,771m	4,910.6m

Source: Li, 2014

Note: Figures in 2050 were predicted by He Yuanqing. He is a member of Chinese Academy of Sciences.

1.3 Research Questions and Objectives

The aim of this research is to prove a viable Market Based Instrument in order to achieve sustainable tourism development and reduce the damage cause by the tourism development to the sensitive environmental asset through examining the consumer surplus and compensating surplus of the glacier in tourism development. The research questions to be addressed in this dissertation are:

- 1) What would be the value of Mt. Yulong in tourism development?
- 2) What would be the appropriate Market Based Instrument for conserving the glaciers and the ecosystem?

The objectives of this dissertation are:

- 1) To evaluate the tourism consumer surplus of the Jade Dragon Mountain Glacier utilizing the Travel Cost Method.

2) To evaluate the consumer willingness to pay for the conservation of the glaciers regions through the Contingent Valuation Model.

3) To create and recommend a feasible policy instrument package for Lijiang to achieve the sustainable ecotourism development.

1.4 Conceptual Framework

The framework and design of dissertation is highlighted in Figure 1.2. In this dissertation, I would take three step to answer the research questions set above: the first step is to examine the use value of the glaciers by adopting the Travel Cost Method in order to determine whether it is valuable enough for our further investigation and conservation; the second step is to elicit the travelers' willingness to pay in the hope to uncover whether the travelers value the glaciers as an import component of their traveling experiences and whether they are willing to support its conservation financially; in the final section of this research, I will discuss various of conservation tools in the attempts to allocate the most suitable package for Lijiang and Mt. Yulong.

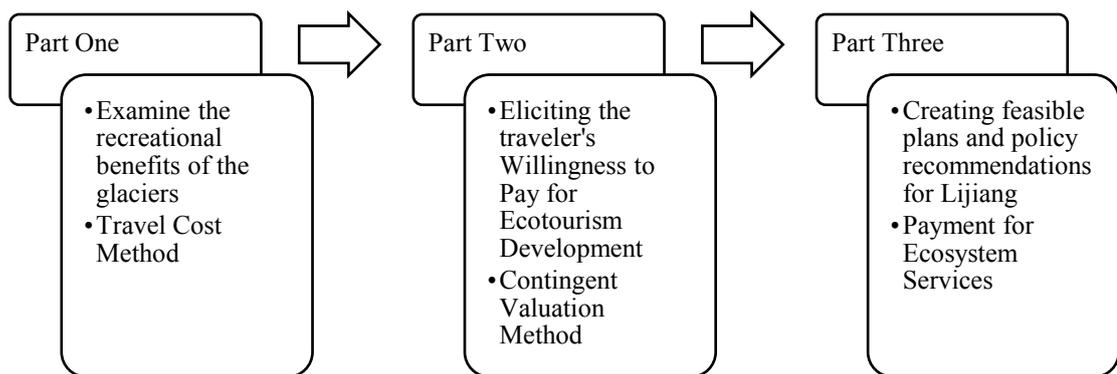


Figure 1.2 The Conceptual Framework

CHAPTER 2

ESTIMATING RECREATIONAL BENEFITS OF THE GLACIER-BASED HIGHLAND ECOSYSTEM: A CASE STUDY OF MT. YULONG, CHINA

2.1 Introduction

The first question to be answered for any attempts to develop policy interventions for environmental assets is: “Is it worth the money and effort, and will the implemented rules and policies to conserve the environment pay off in the long run?”

In order to answer this question, I aim to assess the monetary value of the glaciers on Mt. Yulong by employing the well-developed Travel Cost Method (henceforth, TCM). Such an approach was firstly introduced by Harold Hotelling (1949) and extended by Clawson and Knetsch (1966: 328) in order to estimate the nonmarket value of assets, especially environmental resources, which, in most of cases, are public goods and therefore the traditional asset valuation approaches, for example, the market value approach or the acquisition cost approach, are normally not applicable. TCM attempts to extract the value of the public good from the revealed preference of the consumers (Brown Jr. and Mendelsohn, 1984). There have since been extensive discussions and debates regarding the functional forms and econometric approaches of estimating traveling demand under the framework of TCM (Bowes and Loomis, 1980; Strong, 1983), yet it remains to be one the most adopted methods to assess the value of an environmental asset. In addition, TCM employs secondary data to observe the ex-post use value of traveling (Offenbach and Goodwin, 1994). Therefore, TCM provides not only a fair approximation of the value

of a certain environmental asset but also a first glance at whether the protection of such an asset is economically sound.

2.2 Methodology

The entrance fee (price) to an environmental asset or a tourist attraction site normally does not vary much across different travelers and does not vary much across time. It is not feasible to estimate the “actual” demand curve. Alternatively, TCM assumes that the time and money visitors have to spend on traveling so as to gain access to the tourist site affect their utility. (Freeman III, 1979: 272; Kealy and Bishop, 1986). In other words, the time and money spent on traveling constitute a great proportion of the “price” travelers pay to visit the site. The utility one receives from visiting a site can, thus, be theorized to depend on the total cost of traveling (C), number of visitation to the site (V) and his or her income (Y):

$$MAX \{U = (C, V, Y)\}$$

The utility maximization solution would yield the Marshallian demand function:

$$V^* = F(C, Y)$$

The demand curve or function is essential for an estimation of the consumer surplus. Various prior studies adopting TCM, such as Clawson and Knetsch (1966) and Bowes and Loomis (1980), have assumed a linear form of the demand function, but it is now generally agreed that the linear demand model overestimates the consumer surplus (Strong, 1983) comparing to other forms of the demand curve.

In this study, I apply the zonal TCM in order to gauge the use value associated with the glaciers under the tourism industry. There are three main reasons for the selection of zonal TCM: (1) the site of study provide primarily use value for human being as recreational benefits, where as other use and non-use values are relatively insignificant; (2) the objective of this research is to have a first glance at the use value of the glaciers and to provide information on whether the glaciers are valuable enough and worth of any further research and intervention; to serve this objective, I would estimate the lower bound of consumer surplus and zonal TCM is a superior choices due to its cost effectiveness in comparison to other methods; (3) the zonal TCM uses

secondary data and captures the revealed preferences of the travelers, which would provide a different perspective and robust check for the stated preference in the next section of this study.

I attempt to estimate both the linear and quadratic forms of the demand equation. The consumer surplus calculated from each specification is then evaluated and compared for more valid results. Below are the econometric specifications I employ:

$$\frac{V_{it}}{N_{it}} = \alpha_i + \beta_1 \cdot C_{it} + \beta_2 \cdot I_{it} + \varepsilon_{it} \quad (1)$$

$$\frac{V_{it}}{N_{it}} = \alpha_i + \beta_1 \cdot C_{it} + \beta_2 \cdot I_{it} + \beta_3 \cdot I_{it}^2 + \varepsilon_{it} \quad (2)$$

$$\frac{V_{it}}{N_{it}} = \alpha_i + \beta_1 \cdot C_{it} + \beta_2 \cdot C_{it}^2 + \beta_3 \cdot I_{it} + \varepsilon_{it} \quad (3)$$

$$\frac{V_{it}}{N_{it}} = \alpha_i + \beta_1 \cdot C_{it} + \beta_2 \cdot C_{it}^2 + \beta_3 \cdot I_{it} + \beta_4 \cdot I_{it}^2 + \varepsilon_{it} \quad (4)$$

where V_{ij} is the number of visitations from zone i in year t , N_{it} is the population of zone i in year t (in millions); C_{it} the cost of travel from zone i in year t and I_{it} the monthly income (on average) of zone i in year t , which was included in the demand equation to represent the zonal characteristics. Under the zonal TCM approach, the demand was estimated by assuming each zone as an integrated entity that determines the visitation demand; therefore, most of other commonly used socioeconomic attributes such as education, gender, or occupation become irrelevant, as those attributes vary at individual level rather than zonal level. Unfortunately, the zonal attributes, such as consumption references or traveling destination choices, are essentially unobservable and hence treated as stochastic, which are represented by the random error ε_{it} . (Hanemann 1984)

Both equations (1) and (2) are linear models, with different ways to control for the effects of income. Equations (3) and (4) utilize the quadratic form of the demand function, while controlling for income. After obtaining the estimators - α and β s - I calculate the consumer surplus by plugging the demand equation into the following equation (5):

$$CS_{it} \text{ per one million population} = \int_{C_{it}}^{C_k} \left(\frac{V_{it}}{N_{it}} \right) dC$$

where C_k is the choke price (at which the visitation rate becomes zero).

2.3 Data and Empirical Results

I collected data from various sources. Annual data on the travel cost and income in each zone between 2012 and 2014 were gathered from the National Statistical Bureau of China. Information about the origin of more than 2 million travelers was obtained by directly requesting from the Lijiang tourism statistic office.

Table 2.1 Descriptive Statistics of Each Zone

Zone	Distance to Lijiang (in Kilometers)	Average Cost of Traveling (in CNY)	Monthly Income (in CNY)	Population (in Millions)
1	1,510	2,784	3,557	37.62
2	1,640	3,886	2,017	25.82
3	1,857	3,215	6,239	45.19
4	1,868	3,135	3,029	5.77
5	1,890	2,415	3,561	66.81
6	1,892	3,298	2,642	79.37
7	2,030	2,843	3,256	6.53
8	2,040	3,264	2,870	36.27
9	2,250	2,963	5,683	54.93
10	2,360	2,971	3,196	73.26
11	2,400	2,842	2,632	60.25
12	2,430	4,033	7,544	24.05
13	2,506	4,305	5,617	24.96
14	2,574	4,153	7,739	21.06
15	2,650	2,702	4,825	37.67
16	2,890	3,315	8,168	14.60
17	2,942	3,712	5,097	43.92
18	3,463	4,492	3,910	27.51
19	4,100	3,962	3,120	38.38
20	5,200	4,713	3,087	22.59

Source: Distance to Lijiang and Cost of Traveling: Tourism Authority of Yunnan;

Monthly income and Population: Provincial Bureau of Statistics, Yunnan

Note: Distances are the average flight distance; figures in table are reported as 3 years' average during 2012 to 2014.

The domestic travelers, according to their origin, were grouped into 20 different zones. The zoning was primarily based on the provinces of China. However, not all provinces are used due to data limitations. Provinces with similar geographical and demographical characteristics were grouped together. Table 2.1 showed the

descriptive statistics of each zone. Some big and highly populated provinces were instead dissected into multiple zones. Table 2.1 reports the distance between the Mt. Yulong and the airport of the provincial capital or the largest city, annual income, the cost of traveling for each zone. The population figure is the three years' average.

The econometric estimations of TCM typically do not include all relevant variables, because not all the characteristics of travelers that affect their demand can be observed and accounted for, and also because the unequal population from each zone may result in heteroscedasticity. Bowes and Loomis (1980) used zonal averages to tackle the heteroscedasticity problem but Strong (1983) argued that by taking zonal averages, the Ordinary Least Square (OLS) estimators is likely to be inefficient even though unbiased. Bowes and Loomis also suggested the use of Generalized Least Squared (GLS) to reduce the variance; while Strong claimed that the Weighted Least Square (WLS) would also yield estimated parameters equivalent to those derived from GLS.

In order to control for unobserved variables and heteroscedasticity, I compiled a panel dataset. Crucial information from each of the zones was collected for three years (2012 – 2014). Because the unobserved variables, such as the traveling preference of the travelers, are not time-invariant and are normally uncorrelated with the independent variables, the Random Effect GLS was selected. (Greene 2003: 283-338)

Table 2.2 and Table 2.3 show the estimation results. All specifications yield a negative coefficient on the cost of traveling, which is as expected and indicate that a higher cost of traveling will result in a lower visitation rate. In contrast, I would expect that income and visitation rate have a direct relationship. The positive estimate for income in all the four regressions confirms the theoretical conjecture.

The choke price was calculated for each zone in each year by plugging the estimated coefficients and the annual average income of each zone into equation (1) to (4) respectfully. Consumer surplus can be obtained by plugging the estimates derived from each of equations (1) – (4) into equation (5), and the mathematical computation results are reported in Table 2.4. The computed consumer surplus by using the estimated parameters from equation (1) is fairly similar to that from

equation (2), where equations (3) and (4) also yield a similar pattern. Therefore, only results from equations (1) and (3) are reported.

Table 2.2 Econometric Estimations of Tourism Demand by Assuming Linear Demand

Variable	Equation (1)			Equation (2)		
	Coefficient	Std. Error	p-Value	Coefficient	Std. Error	p-Value
Constant	893.976	297.814	0.003***	1277.176	494.985	0.01**
Cost of Traveling	-0.157	0.759	0.039**	-0.162	0.0756	0.033**
Income	0.233	0.033	0.000***	0.067	0.1778	0.705*
Income ²				0.000016	0.000017	0.347

Table 2.3 Econometric Estimations of Tourism Demand by Assuming Quadratic Demand

Variable	Equation (3)			Equation (4)		
	Coefficient	Std. Error	p-Value	Coefficient	Std. Error	p-Value
Constant	392.499	1037.23	0.705	932.421	1224.03	0.446
Cost of Traveling	0.1478	0.6003	0.806	0.0263	0.6188	0.966
Cost ²	-0.00004	0.000084	0.608	-0.000027	0.000086	0.760
Income	0.2289	0.0337	0.000***	0.067	0.1778	0.666
Income ²				0.000015	0.000017	0.405

* significant at 10%; ** significant at 5%; *** significant at 1%

Figures in Table 2.4 exhibit several crucial reflections. Firstly, the annual consumer surplus from the domestic travelers was estimated over 3 billion CNY¹

¹ It is arguable that this amount of consumer surplus was the consumer surplus of traveling to Lijiang instead of traveling to Mt. Yulong. Under a multiple destination trip, the consumer surplus of a certain destination can be obtained by weighting each destination by the time travelers spent (Mendelsohn, Hof, Peterson and Johnson, 1992). However, we will treat that the traveling to Lijiang and traveling to Mt. Yulong to be the same trip and consider the recreational benefits of traveling to Lijiang to be indifferent from that of traveling to Mt. Yulong. The reasons of doing so are: (1) Most of travelers consider Lijiang and Mt. Yulong to be the same destination when they are planning for the trip, and Mt. Yulong can only be accessed by traveling to Lijiang; (2) among all the travelers to Lijiang in the past three years, more than 70% of them visited Mt. Yulong, while the rest 30% were mostly business travelers or regular visitors; (3) time spent by travelers to visit Mt. Yulong is normally 6 to 8 hours, which is more than the time of all other tourists activities in Lijiang combined; (4) Loomis, Yorizane and Larson (2000) examined the effects of small proportion of multiple destination travelers over the recreational benefits and found that by omitting the multiple destination travelers and consider them as single destination travelers, it created "...no significant differences among consumer surplus per trip".

(approximately 500 million USD), indicating that the value of the glaciers for the tourism sector is substantial. The economic loss, if the glaciers were no longer accessible to tourists, could be as high as 3 billion CNY per annual.

Secondly, the consumer surplus based on a linear functional form of the demand curve is noticeably higher than that based on a quadratic form. Such a finding corroborates those of Ziemer, Musser and Hill (1980) and Strong (1983). They explained that such a difference in consumer surplus between different functional forms of demand was due to "...the linear form of demand equation grossly misestimates the intercepts of the demand equation...", so a linear form of the demand curve leads to an imprecise estimation of the choke price² and overstates the consumer surplus. From this perspective, Strong (1983) argued that the quadratic or other non-linear forms of the demand should provide better estimates of the consumer surplus than the linear model.

Another intriguing finding from Table 2.4 is that regardless of the form of the demand curve, the zones with a higher cost of traveling in general had a lower consumer surplus, which is as expected; but at the same time, income seemed to play an equally important role over the consumer surplus. Zones with a higher level of annual average income generated a higher consumer surplus than zones with lower income. Such a pattern is more pronounced under the linear demand models. As illustrated in Table 2.4, the consumer surplus computed from the linear demand curve was extremely high for zones with high income, and was extremely low for zones where the average income was low. However, under the quadratic demand model, the difference in consumer surplus estimates from zones with high income and those from zones with low income is much smaller. This finding illustrates the problem of aggregating the demand curve for each zone, as these zones had different income levels and consumer preferences, the choke (reservation) price, which represents the maximum willingness to pay, is expected to vary across zones. Unfortunately, the aggregation of the demand under a single equation results in a single choke price to be applied to all zones and is used as the upper bound in calculating the consumer surplus. This certainly leads to an inaccuracy of the estimation of consumer surplus.

² Choke price is the price at which the visitation would become zero. Conventionally also known as the reservation price, but named as the choke price under TCM.

Table 2.4 Consumer Surplus for Each Zone (in million CNY)

Zone	Linear Demand			Quadratic Demand		
	2012	2013	2014	2012	2013	2014
1	168.23	213.26	198.71	123.84	116.49	169.78
2	15.34	23.98	25.26	84.87	90.78	103.06
3	411.22	439.48	537.52	255.59	296.98	278.78
4	15.89	22.53	23.85	21.36	19.50	22.92
5	335.76	344.97	451.22	181.51	239.96	208.67
6	131.58	189.66	309.53	304.00	301.78	236.93
7	25.09	29.53	31.87	21.71	22.46	24.50
8	104.37	120.35	114.29	134.61	129.76	139.60
9	491.45	541.26	530.09	255.24	273.68	345.92
10	2,360	255.26	306.98	347.63	277.11	265.21
11	2,400	156.15	182.74	212.44	171.76	187.78
12	2,430	238.69	260.64	315.05	206.68	217.77
13	2,506	144.33	186.01	209.06	197.86	178.97
14	2,574	206.03	233.92	281.79	188.98	198.75
15	2,650	261.92	291.87	358.76	154.13	172.41
16	2,890	186.28	207.48	221.22	99.59	112.45
17	2,942	242.60	316.13	378.99	287.25	266.06
18	3,463	95.91	100.03	118.47	150.59	170.82
19	4,100	93.68	110.88	130.10	180.35	179.34
20	5,200	31.68	51.01	63.26	116.49	117.27
Total	3,611.46	4,172.72	4,859.10	3,413.54	3,558.22	3,564.52

Although it is obvious in Table 2.4 that selection of the demand curve is important for the estimation of consumer surplus, as suggested by Strong (1983), and different models may have their own limitations that resulted in the imprecise estimation the consumer surplus, it is still fair to argue that the total consumer surplus in the tourism sector of the studied site is substantial and consumer surplus is increasing over time. As income rises and the change in the cost of traveling remains negligible, it is likely that the consumer surplus continues to grow in the future.

2.4 Conclusion

The objective of this study is to estimate the tourism demand and to assess the economic value of a unique environmental asset – the glaciers – in Mt. Yulong, Lijiang, China. Zonal TCM technique was employed and secondary data were exploited to estimate the demand curve. I selected two different functional forms of the demand curve and estimated them against the data.

Empirical findings suggest that even though the quadratic function and linear function did not yield similar accounts of the consumer surplus, the results arrived from both functional forms indicate a significantly high use value of the glaciers. The value of glaciers represented by the consumer surplus was more than 3 billion CNY per annual. This value was approximately 10% of the local GDP and it has been increasing over time. If the glooming picture painted by environmental scientists is correct, then this valuable asset to the locals is on the edge of disappearing and the economic loss to the locals might be catastrophic due to the high value of this asset in the tourism sector and the local GDP. Such findings inevitably imply that the local authorities should consider urgent policy interventions in order to conserve the glaciers. Suitable policy interventions, including instruments and process of implementations, remain to be explored in future studies.

The next interesting question to be answered is, given the value of the glaciers in the tourism industry, whether and by how much would the travelers be willingness to pay for its conservation. Under the conventional points of views, the conservation of natural resources should be the sole responsibility of the resources owners, which in the case of Lijiang will be the local government; but modern economists challenged the view and pointed out that it is both inefficient and unfair for the resource owners to bear the cost of conservation, since the resource owners are not necessarily beneficiaries of the natural resources: in this case, the direct beneficiaries of the glaciers are the travelers. Given that the TCM has revealed that the total consumer surplus in the tourism industry was more than 150 million USD, the travelers should also have high willingness to pay for the conservation of the glacier.

CHAPTER 3

ESTIMATION OF THE MAXIMUM WILLINGNESS TO PAY BY THE TRAVELERS OVER THE CONSERVATION OF THE GLACIERS AND ECOSYSTEMS IN MT. YULONG

3.1 Introduction

This chapter continues from the findings of the previous chapter and attempts to elicit the willingness to pay by the travelers for the conservation of the glaciers and an eco-friendlier tourism service.

It has long been a general believe that the valuations methods of any environmental assets are not necessary, as the environmental assets are normally “pure public goods” and hence there would be no need to answer the question regarding the optimal allocation of resources. (Bateman and Willis, 1999). Yet the natural resources also deplete, in more recent years, there have been more and more concerns in identifying the economic benefits and costs of conserving certain natural resources.

Three common valuation methods have hence been developed. The Travel Cost Method (TCM) tries to value an environmental resource by estimating the consumer surplus of such resource under the tourism development; the underlying economic theory behind the TCM was the consumer choice and revealed preferences (Hoteling, 1949). Hedonic Pricing (HP) Method values the environmental assets by examine the impact of changes over the environmental assets on the prices of other marketable assets (for example, houses). Both of these methods are trying to measure the use value of environmental assets where the remaining problem is that they required some kind of established markets in relation to the environmental assets in question, whereas the non-use value or the value under some “assumably better”

hypothetical markets, lie out of scope of these two methods. (Bateman and Willis, 1999)

The Contingent Valuation Method (CVM) provides a solution to the previously mentioned valuation problems where the real market approaches (such as TCM, HP, or market experiments) are not applicable (Cameron, 1992). Despite of the intense debate over the considerable measurement biases (Cummings, Brookshire and Schulze, 1986) and the technical dispute over the willingness to pay and willingness to accept (Hanemann, 1983), the CVM had been largely applied in the studies of environmental valuation in 1970s all around the world and it had been recognized as the recommended technique for environmental asset valuation by the US Water Resource Council and the National Oceanic and Atmosphere Agent (NOAA). (Bateman and Willis, 1999)

The Contingent Valuation Method was firstly developed based on the Hicksian Consumer Demand Theorem (Hicks, 1939: 294-300 and 1956) by assuming that individual consumers have implicit preferences and those preferences would somehow be “revealed” in their consumption choices, and such preferences were believed to be “complete, transitive, continuous and convex” (Sugden, 1999), in other words, could be “represented by a downward sloping convex indifference curve” The CVM hence attempts to elicit those preferences through well-conducted survey.

CVM possesses some obvious advantage in comparison to the TCM and HP valuations: (1) it is the only technique that can elicit non-use value as well as the use value associated with a public good; (2) most of biases in estimation are closely related to the survey and therefore, they could be theoretically eliminated by the carefully designed surveys; (3) many field-studies and controlled experiments (Bishop, Herberlein and Kealy, 1983; Dickie, Kerr and Schwinghamer, 1987; Kealy, Dovidio and Rockel, 1988) have provided credentials to the CVM that it yielded reasonable estimates of the Hicksian consumer welfares.

The critiques of the CVM mainly stated that (1) the accuracy of CVM heavily depend on the researchers’ ability to “specify all relevant features and ensure they have been understood” (Boyle and Bergstrom, 1999), which is hard to ensure under certain circumstances; (2) CVM normally leads to an overestimation of the “real” willingness to pay or willingness to accept due to that the respondents of the survey

would tend to state an amount higher than their true willingness to pay in order to reflect their “rational self-image” without considering the actual budget constraints nor the availability of substitutions (also known as the “warm glow effect”), as the survey is normally not binding and do not affect the respondents’ financial position (Das, 2013); (3) the validity of the non-use value and their relevance to the public policy is still under heavy debates (Carson, Mitchell, Hanemann, Kopp, Presser and Ruud, 1992) since the lacking of consensus over the technical definition of “economic value”³.

3.2 Methodologies and Empirical Model

3.2.1 Welfare Measurement of Willingness to Pay and Willingness to Accept

Hicksian Welfare Theorems measure the changes over the welfare of consumers when there is a change in the price of certain good x (Hicks, 1939: 294-300 and 1956):

$$\text{Compensating Variation: } CV = E_{(P^0, U^0)} - E_{(P^1, U^0)}$$

$$\text{Equivalent Variation: } EV = E_{(P^0, U^1)} - E_{(P^1, U^1)}$$

Where the Compensating Variation (CV) measures the monetary payment the consumers would undergo in order to maintain the same level of utility as of that before the price has changed, hence known as “willingness to pay (WTP)” for a change; the Equivalent Variation, on the other hand, measures the monetary compensation a consumer would agree on in order to move to a new utility level after the price has changed, and hence known as the “willingness to accept (WTA)” for the price change.

In most of the cases of valuating the environmental assets or public goods, the variations of prices are either non-existing or not concerned. Instead, the more intriguing question would be how much the changes of consumer welfare are when the “quantity” of such assets changes: for example, more trees in the neighborhoods, less air pollutions in town, etc. Mäler (1974) extended the Hicksian Welfare

³ See Hargrove 1992 and Turner 1999 for details related to defining “economic value”.

Theorems into measuring the welfare changes for consumers when the quantity of a certain good x (normally public good) changes as:

$$\text{Compensating Surplus: } CV_{(q,U)} = E_{(q^0,p,U^0)} - E_{(q^1,p,U^0)}$$

$$\text{Equivalent Surplus: } EV_{(q,U)} = E_{(q^0,p,U^1)} - E_{(q^1,p,U^1)}$$

Under Mäler's modification, the compensating surplus measures the monetary compensation that would cause the consumer to remain at their old utility level U^0 when the quantity of the public good x changed from level 0 to level 1: if the quantity change is positive, that is an improvement in the availability of public good, then the compensating surplus would be the measurement of the WTP by the consumer for such improvement; if the change of quantity is negative, that indicates a degradation of certain public good or increasing in some public "bad" (such as pollution), then the compensating surplus will be a positive amount measuring the consumer's WTA of a monetary compensation in order to suffer the negative change. Similarly, the Equivalent Surplus measures what the consumer's WTA, which is the monetary compensation they would receive for not receiving the positive change: The Equivalent Surplus will be an estimation of consumer's WTP for avoid the negative change in the public good. (Hanemann, 1999)

Willig (1976) illustrated that for a change in price, CV and the Equivalent Variation would be the same in the absence of income effect, but Hanemann (1994) showed that in the case of quantity change, both income and substitution effect played roles in creating the disparity between the compensating surplus and the Equivalent Surplus – that is to say, the WTP and WTA can only be assumed to be same if there is relatively small income effect and zero substitution effect.

3.2.2 Discrete Choices and Random Utility Model

Unlike the conventional neoclassical consumer choices models in microeconomics, where the quantity demanded is assumed to be a continuous set and therefore the optimal choices by the consumer could be obtained by calculus (the first order differentiation); under the context of consumer choices regarding the environmental goods, the consumer choices are more commonly a mixture of quantitative and qualitative decisions: the optimization would be largely regarding "whether to choose x or not" and "which one to choose" as well as "how many to

choose". The answers to such qualitative choices questions are not continuous and therefore could not be obtained from the first order conditions; instead one may seek the solution by utilizing the Discrete Choice Model. (McFadden, 1978)

Discrete choice model considers the consumer choices to be influenced both by the characteristics of the goods available as well as the personal preference attributes. The Discrete Choice Model attempts to estimate statistically the probability, or likelihood, that a consumer chooses a particular consumption good x over its alternatives (Hanemann, 1984). By assuming that the personal attributes of consumers do not vary significantly through time, the Discrete Choice Model becomes useful in examining the alterations of consumer choices when certain characteristics of the consumer good have changed.

Hanemann (1983) illustrated the basic features of the Discrete Choice Model as: Assume a consumer's utility associates with his discrete choice i is U_i , which is determined by a set of attributes, such as his income, cost of each choices available and other socioeconomic factors. The individual's choice was represented by a set of binary indicators δ_i where $i = 1, 2, \dots, n$; $\delta_i = 1$ if i th action was chosen, otherwise $\delta_i = 0$. The utility maximizing problem of this consumer could be generalized by comparing the utility of each action:

$$\begin{cases} \delta_i = 1 & \text{if } u_i > u_j \\ \delta_i = 0 & \text{if } u_i < u_j \end{cases} \quad \forall i, j = 1, 2, \dots, n \quad (1)$$

The difficulty arises from the attempts to measure the attributes that affect the consumer choices is that even though we can assume the preferences (or the utility function) of a consumer is implicitly determined and fixed for this particular consumer, some of the attributes within this deterministic utility function remained to be unobservable to others. Those unobservable attributes could either be the characteristics of the good or the characteristics of the consumer him-/herself. Hanemann (1984) combined the principle idea of economics that preferences vary among each consumer with the statistics idea of random variables: the unobserved attributes possess similar statistical characteristics as the random variables, hence created the Random Utility Model; an econometric model suitable for estimating the probability of discrete consumer choices empirically.

In equation (1), if u_i consists of both observable and unobservable attributes, then u_i can be written as $u_i = v_i + \varepsilon_i$, where v_i is the set of observable attributes of the utility function and ε_i is the set of unobservable attributes. By considering ε_i as random variables with zero mean and a joint distribution function $F_\varepsilon(\varepsilon_1 \dots \varepsilon_n)$, then the coefficients of v_i and moments of $F_\varepsilon(\cdot)$ can be estimated econometrically by the observable attributes. (Hanemann, 1983)

Since both the observable and unobservable attributes are assumed to be known factors to the consumers themselves (but remain unobservable to others), the discrete choice set δ_i should also be definite for the consumers. However, for other people, those unobservable attributes are random variables. The probability of the consumer choosing option i can be defined as:

$$\begin{aligned} \text{Prob}(\delta_i = 1) &= \text{Prob}(u_i > u_j) \\ &= \text{Prob}(v_i + \varepsilon_i > v_j + \varepsilon_j) \\ &= \text{Prob}(\varepsilon_j - \varepsilon_i < v_j - v_i) \end{aligned}$$

Therefore,

$$\text{Prob}(\delta_i = 1) = F_i(v_i - v_j) \quad \forall i, j = 1, \dots, n \quad (2)$$

Equation (2) is a cumulative density function and McFadden (1978) specified that if ε_j is distributed according multivariate normal distribution, then equation (2) would be a probit model, otherwise equation (2) will be a logit model.

3.2.3 Econometric Modeling for Estimate the Compensating Variation/ Willingness to Pay

From equation (2), a traveler's WTP for a certain policy intervention over the environmental asset can be estimated. Let Y denotes for traveler's income and A denotes for the mean WTP, the Random Utility Model specified that for a utility maximizing consumer, the WTP for any change α must satisfy:

$$v(\alpha, Y - A; X) + \varepsilon_1 \geq v(0, Y; X) + \varepsilon_0$$

where X is a set of observable attributes of both the consumer and the environmental asset. The probability for the traveler to be willing to pay is:

$$\text{Prob}(\text{yes}) = \text{Prob} \{v(\alpha, Y - A; X) + \varepsilon_1 \geq v(0, M; X) + \varepsilon_0\}$$

If we define the difference in utility of the consumers as:

$$\Delta\rho = v(\alpha, Y - A; X) - v(0, Y; X) + \varepsilon_1 - \varepsilon_0$$

then the consumer would be willing to pay for the intervention iff $\Delta\rho \geq 0$

$$\text{Prob (yes)} = F_i(v_i - v_j) \forall i, j = 1, \dots, n$$

Compensating Surplus (which is also represented by A) for the intervention α is defined as:

$$v(\alpha, Y - A; X) = v(0, Y; X)$$

Variable A is the estimator of the mean WTP of the consumer and can be calculated after assuming the explicit form of utility function v , if we assume that v takes a linear explicit functional form of $v = \alpha + \beta Y + \delta X + \varepsilon$; then the estimators α and β can be estimated by plug the utility function into the cumulative density function (equation (2)). The utility of the consumer if he/she say yes to the policy instrument is:

$$u(\text{yes}) = \alpha(\text{yes}) + \beta(Y - A) + \varepsilon(\text{yes})$$

And the utility of the consumer if he/she says no the policy instrument is:

$$u(\text{no}) = \beta Y + \varepsilon(\text{no})$$

$$CV = \frac{\alpha(\text{yes})}{\beta}$$

There are two important implications of the Random Utility Model:

Firstly, since the true form of utility function is not observable and can only be assumed, the linear model is commonly adopted for its simplicity. By assuming a linear or quasi-linear form of utility function, we also assume that the zero income elasticity of the consumers at the same time. (Hanemann and Kanninen, 1999)

In Mt. Yulong, the site and the environmental asset are unique while most of the travelers do not visit more than once in short period of time regardless of their income changes, it suggests that the income elasticity of the demand for the glacier is small, therefore assuming it to be zero would not cause serious biasness. But a model with non-zero income elasticity should still provide valuable comparison.

Secondly, the unobservable attributes - which are treated as random variables - played a significant role in both estimations of behaviors and valuation of welfare (Hanemann and Kanninen, 1999). Since the unobservable attributes are considered stochastic statistically, policy intervention or behavior changing techniques are assumed to have no influence over those attributes, which weakens the policy implications drawn from the valuation.

3.3 Study Design

3.3.1 Pilot Survey:

A pilot survey was conducted before designing and launching the main survey. Travelers who have been to the glaciers in Mt. Yulong during 2010 to 2013 were contacted by phone calls and emails. In order to keep security of their personal information, the Tourism Authority of Lijiang conducted this pilot survey with our highest appreciation. More than 400 travelers were contacted through telephone and emails, around 150 provided valuable feedbacks on their experiences and expectations regarding the journey to the glaciers.

The main objectives of the pilot survey are: (1) to understand the travelers' perspective and feeling about the current condition of glaciers; (2) to examine the travelers' opinions over the plans to conserve the glaciers and (3) to roughly check the range of monetary cost that they are willing to bear for the improvement plans. (4) to discover the optimal payment options.

The pilot survey sought information in four aspects:

1) the travelers' awareness of the environmental problem over the glaciers. More than 80% of the respondents claimed that they had knowledge about the problem from various source, while around 50% of them claimed that they had noticed the problem during their visitation.

2) The necessity of interventions. Almost all the respondents answered "yes" for this question, even for those who were not aware of the problem stated that they agreed to intervention "if the problem was real". Only 3 out of 150 respondents answered "not my concern". When asked about the party that should be responsible for the conservation, 75% of the respondents chose the local government or local tourism authority, while the other 25% felt that they should be responsible.

3) The willingness to pay for the conservation. Even without specifying the details of the conservation plans, around 50% of the respondents felt a certain fee charged on the travelers was reasonable, while the rest claimed that they had already paid for the trip therefore the travel agents or local governments should be the one who pay for the conservation of the glaciers, but those people did not exhibit strong objections to a "slightly higher cost of traveling". When asked about the amount, the

answer varied from ten CNY (approximately 1.5 US Dollars) to several thousand CNY: since this payment would not directly affect those respondents, given that they might not visit the glacier again in short period of time, and they normally had little time to think, this amount was hardly informative. Nevertheless, most of the respondents stated an amount between 100 CNY to 250 CNY, which is similar to our expectations.

4) The preferences over the intervention instruments/payment vehicles. Around 30% of the respondents believed a straightforward quantity control are the best option for the glacier conservation, while the rest agreed that price-based intervention would be more favorable. But most of the respondents showed indifference among the different payment vehicles (for example, entrance fee, tax, etc.), a few respondents claimed that they “did not understand the differences among each payment vehicles”. This might occur as a surprise to many western researchers, but given the Chinese political and economic system, it is not hard to explain: as property right and entity trust was not fully addressed in the Chinese markets and economic systems, and all the natural resources are considered as public owned, common people hold no bias in trust toward the State, Provincial or City government, nor the tourism authority and travel agents; therefore their WTP does not vary among each of the different payment vehicles.

3.3.2 Contents of Survey Questionnaires

The survey questionnaires were originally designed in Chinese language, each of the survey questionnaires contains four main sections.

The first section is a one-paragraph illustrated the problems in the glacier. This section compares the condition of the glaciers status ten years ago and now, as well as giving out the predictions regarding the glacier by the environmental scientists. The objective of this section is to ensure the scenario credibility, that is, to prevent the public from believing that the public good will be freely available forever⁴.

The second section consists of qualitative questions regarding travelers’ perceptions regarding the glacier condition and their travel-experiences. The objective

⁴ See Rowe and Chestnut, 1983 in Bateman et al., 1999 for more details about scenario credibility.

of this section is to collect information regarding the travelers' awareness to the problem and their level of satisfaction regarding the current situation of the glacier. This section would be useful to testify the extreme high/low value of WTP.

The third section asks questions regarding the travelers' WTP for improvement in the glacier condition and traveling experience on the glacier if the improvement plans were offered at different prices. The fourth section contains questions regarding traveler's preferences regarding the payment vehicles and their potential doubts about the program that might change their WTP. The final section is designed to collect socioeconomic attributes of the traveler and their general preferences of traveling.

In the final section, several questions were asked in order to acquire information regarding the most suitable type of improvement in the respondents' perspective. This section is not directly related to the CVM valuation but might provide useful insight for the policy maker.

3.3.3 Experimental Design

The survey was conducted on site at Mt. Yulong, Lijiang with the help of personnel for the Lijiang Tourism Authority and local travel agents. The main respondents of the survey and questionnaires were travelers who traveled to Lijiang, visited the glacier at Mt. Yulong and the majority of focus-group talks and survey was conducted on their way back to the hotels.

At the first glance, it might appear to be appealing if the survey was conducted to a wider range of travelers and should include the travelers who have not been to the glacier before (which are considered as "potential customers" under the conventional consumer theory), as their opinion would also provide interesting implications. However, to ensure the scenario credibility and to reduce the uncertainty regarding benefit/cost of conserving the glaciers, potential travelers were excluded.

Currently, Mt. Yulong and the glaciers are open to travelers all year round, while the condition of the glaciers varies little throughout the year. The survey was conducted within a 6-months' period from July 2015 to January 2016. A total of 1,500 questionnaires were distributed.

3.3.4 Elicitation Procedure (WTP Questions)

Literatures regarding the elicitation of WTP have largely supported that the Dichotomous Choice provides more accurate estimations of the WTP than the Open-Ended questions (Samuelson, 1954; Marwell and Ames, 1981; Bateman, Langford, Willis, Turner and Garrod, 1993b; Hoehn and Randall, 1987; Cooper, 1993; Kanninen, 1995). As Bateman, Langford and Rasbash (1999) concluded that "...the Open-Ended question normally underestimates the true willingness to pay..." due to several reasons: Samuelson (1954) some respondents would state an amount less than their true WTP due to the intention of being a free-rider; Heohn and Randal (1987) suggested that the respondents are normally uncertain about the benefit and cost of hypothetical program, they might understate their WTP under the risk-averse motivation.

In this research, the Double Dichotomous Choice (2DC) approach is applied, followed by an Open-Ended WTP question for robust check, though it is expected that the Open-Ended question would incur strong starting point bias – the situation under iterative bidding game when the initial bid affect respondents and therefore causing their final bids to be close to the initial bids⁵.

After the respondents listened to an oral explanation of the condition in the glacier by the research team and read the introduction paragraph regarding the conservation scheme, a qualitative WTP question with binary answer was firstly asked:

“Will you be willing to pay a certain amount of fee in addition to the current entrance fee in order to conserve the glacier?”

People who answered “no” to the qualitative WTP question, no bid will be provided but a follow up question was provided to seek for their reasons for unwilling to pay in order to identify the “Protest Bidders”⁶. This question does not affect the estimation of WTP but would provide useful information to the policy makers.

⁵ See Boyle, Bishop and Welsh, 1985 for more details on Starting Point Bias

⁶ Protest Bidders are those who stated to be unwilling to pay under any contingent valuation survey due to some “dissension regarding the contingent valuation itself”. (Jorgensen et al., 1999)

For those who answered “yes” to this question will be further provided with the dichotomous bidding question:

“Are you willing to pay the fee of (50, 100, 150, 200, 300)?”

Five bids (50, 100, 150, 200, 300) were randomly assigned to each of the respondents with approximately equal amount of respondents receiving each of the five bids. A second dichotomous bidding question will follow depending on the respondents’ answer to the first dichotomous bidding question:

-If the respondents answered “no” to the first bid, a following bid which is 30 CNY⁷ lower than the initial bid will be asked.

-If the respondents answered “yes” to the first bid, a following bid which is 30 CNY⁸ higher than the initial bid will be asked.

And the last bidding question will be an opened-ended question that asked the respondents to state their maximum WTP for the conservation plan. Even though the answer to this question was expected to incur significant starting point bias, it would still be useful as the stated amount would still be an estimation of the lower bound of the WTP.

3.4 Survey Results

3.4.1 Public Perceptions on the Importance of Glaciers for the Traveling Experience

Table 3.1 shows that among all the respondents who had completed the questionnaire, 72% thought the glaciers were a crucial part of their traveling experience, and only less than 15% of people stated that the glaciers would not affect their traveling experience. Historical data by Lijiang Tourism Authority showed that among all travelers arrived at Lijiang since 2003 to 2013, 76% of the them visited Mt. Yulong, which was consistent with the survey result.

⁷ For the initial bid of 250 CNY, follow up bid is 200 CNY.

⁸ For the initial bid of 250 CNY, follow up bid is 350 CNY in order to capture the upper bound of WTP.

Table 3.1 The Importance of Glaciers to the Traveling Experience

Question	Count	Percentage
It is the reason for me to visit Lijiang	241	28.15%
My traveling experience would reduce significantly without the glacier	374	43.69%
Glacier is important part of my traveling, but not the only reason	117	13.67%
I would still enjoy my traveling even without the glacier	76	8.88%
I do not care about the glacier and it would not affect my travel experience	48	5.61%
Total	856	100.00%

3.4.2 Public Perceptions Toward the Importance of Glaciers as a Resource

As exhibited in Table 3.2, 55% of the travelers realized the important use value of the glacier under the tourism, while only 2% of the travelers had awareness of the use and non-use value of the glaciers to the locals and the ecosystem; 25% of the travelers believed the glaciers were useless other than being unique scenery. These responses revealed that most of the travelers did not realize the true value of the glaciers, and their WTP had great potential to increase if more information regarding the glaciers, including its importance to the local climate, water supply and ecosystem, could be provided to the travelers.

Table 3.2 Public Perceptions toward the Importance of Glaciers as a Resource

Question	Count	Percentage
Important because it is valuable resources and important for local people	21	2.45%
Important because it rare scenery and unique tourist attraction	473	55.26%
Unimportant because it is useless for people	211	24.65%
Unimportant because it is abundant	50	5.84%
I am not sure about the value of the glacier	101	11.80%
Total	856	100.00%

3.4.3 Reasons of Unwilling to Pay and Protest Bidders

Among the 989 respondents who have completed the questionnaires, there were 133 respondents answered “no” to the binary willing to pay question (“are you willing to pay an additional amount for the conservation of the glaciers?”). The reasons for their unwillingness to pay are listed in Table 3.3. Even though the question allowed the respondents to select more than one choice, most of them only picked one. Around 40% of the respondents who answered this question felt that the money they pay, even if paid as a tax, would not actually be spent on the conservation plans; I would not go further to explore the faults of Chinese administrative systems, but given the lack of transparency of government budget and spending, this answer was well-expected. The second most important reason of unwilling to pay was that the respondents felt the protection and conservation of natural resources should be the responsibility of the local governments, when asked further about the reason, most of them responded that the locals were the ones who receive benefits from the glaciers, not the travelers. This reflected that many people in China still lack the awareness of public goods and could not extinguish the real beneficial party of certain environmental assets.

Table 3.3 Reasons for Unwilling to Pay

Question	Count	Percentage
I do not believe the glaciers are worth protecting	17	12.78%
I have already paid enough	14	10.53%
The protection should be the responsibility of locals	42	31.58%
I do not believe the money I pay would be used in protecting the glaciers	51	38.35%
I believe command and control is more efficient than pricing intervention	9	6.77%
Total	133	100.00%

3.4.4 Result of Survey (Data Descriptions)

One thousand and five hundred survey questionnaires were distributed follow by the oral introduction, 511 of those were incomplete and was not included in the

result calculation; 133 people⁹ answered “NO” for the willingness to pay and therefore was considered as Protest Bidders and excluded; the usable sample size for the WTP estimation is 856.

In Table 3.4, respondents who answered “yes” for the first bid and “yes” to the second bid (higher than first bid) are reported as YY; similarly, YN represents the respondents who answered “yes” to the first bid but said “no” to the second bid (higher than first bid); NY represents respondents who answered “no” to the initial bid but answered “yes” to the follow up bid (lower than the initial bid) while NN stood for people who answered “no” to both bid. The column YES is the summation of YY, YN, NY, which represents people who were willing to pay at certain bidding amount, column NO represents people who were unwilling to pay at any amounts in the bidding game (but might be willing to pay at a lower amount).

Table 3.4 Summary of the Bidding Game (in percentage)

Bid	YY	YN	NY	NN	YES	NO	TOTAL
BID 50	39.88%	34.10%	18.50%	7.51%	74.85%	25.15%	100.00%
BID 100	9.04%	32.45%	19.68%	38.83%	42.25%	57.75%	100.00%
BID 150	8.29%	14.92%	19.34%	57.46%	23.30%	76.70%	100.00%
BID 200	3.66%	7.32%	18.29%	70.73%	10.98%	89.02%	100.00%
BID 300	0.69%	2.76%	6.90%	89.66%	3.45%	96.55%	100.00%

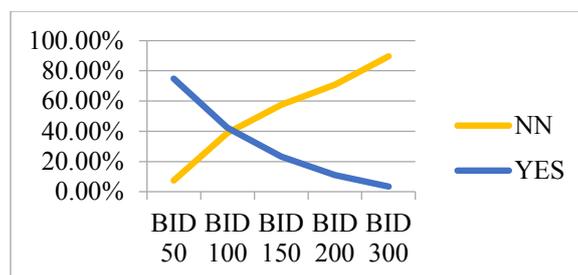


Figure 3.1 Graphical Result of the Bidding Game.

⁹ There are 17 people who chose “I do not believe the glaciers are worth protecting” were technically not protest bidders, but according to Jorgensen et al. (1999), they also should be excluded from the WTP estimation due to “...they do not state the true economic value.”

In Figure 3.1, the percentage of travelers who answered yes exhibits a downward slope as the initial bid increases; and the percentage of people who say no to both bidding amount increases as the initial bid amount increases, indicating that they are less willing to pay at a high bidding amount.

3.5 Empirical Results

3.5.1 Parameters Estimation and WTP of the 2DC Bidding Games

The accuracy of WTP estimation heavily depends on the assumed form of the consumer utility function, which is essentially unobservable (McFadden, 1994). For the reason of simplification, most of the literatures assumed linearity of the utility function; but as we explained in the previous section 3.2.3, Hanemann and Kanninen (1999) proved that by assuming the linearity of utility function, one also assumed the zero income elasticity of demand. While it is hard to conclude on the relationship between income and willingness to pay for an ecosystem services, I will try to estimate the WTP under both linear and log-linear utility functions, where the latter would capture the income effect, if there is any.

The econometric models for estimations of WTP were given in McFadden (1994) and Hanemann (1999):

1). Assume Linear Utility Function and Standard Normal Distribution of WTP:

$$\text{Prob}(yes) = \Phi(\alpha - \beta * A) \quad (1)$$

2). Assume Linear Utility Function and Logistic Distribution of WTP:

$$\text{Prob}(yes) = (1 - e^{-\alpha + \beta * A}) \quad (2)$$

3). Assume Log-linear Utility Function and Standard Normal Distribution of WTP:

$$\text{Prob}(yes) = \Phi\left(\alpha + \beta * \ln\left(1 - \frac{A}{Y}\right)\right) \quad (3)$$

Where A is the stated WTP by the respondents and Y is the income of the respondents, α and β are the parameters to be estimated.

The log-likelihood estimation was performed with LIMDEP and the results of were listed in Table 3.5:

The Expected WTP under the function (1) is:

$$E(WTP) = \frac{ALPHA}{BETA} = 221.774$$

The Expected WTP under the function (2) is:

$$E(WTP) = \frac{ALPHA}{BETA} = 218.76$$

The Expected WTP under the function (3) is:

$$E(WTP) = Y * \left(1 - e^{-ALPHA/BETA}\right) = 253.22$$

Table 3.5 Maximum Likelihood Parameter Estimations

Equation	Variable	Coefficient	Standard Error	b/St.Er.	p-Value
(1)	ALPHA	0.687	0.115	5.974	0.000***
	BETA	0.003	0.001	3.250	0.001***
(2)	ALPHA	1.094	0.189	5.778	0.000***
	BETA	0.005	0.002	3.713	0.002***
(3)	ALPHA	0.728	0.097	7.546	0.000***
	BETA	-158.640	31.514	5.034	0.000***

* significant at 10%; ** significant at 5%; *** significant at 1%

The unit of currency used in these estimations is CNY, all three models estimated the willingness to pay for a conservation scheme over the glaciers is around 220 ~ 250 CNY (approximately 35 USD, with exchange rate of January 1, 2016), where the estimated WTP by assuming the log-linear utility function was slightly higher than those estimated from linear utility functions, which indicates that the existence of income elasticity, but it is relatively low; and different forms of distributions do not affect the estimated WTP significantly, which fits the claim by Hanemann and Kanninen (1999).

The amount of WTP of 220 CNY under the 2DC bidding games is approximately twice as high as the current entrances fee to Mt. Yulong and almost half of the total cost of traveling to the glacier from Lijiang. This amount is higher than expected and reveals that most of the travelers felt that the glaciers have high economic value and they would receive more utility if the glaciers were conserved.

3.5.2 Parameters Estimation and WTP of the OE Question

The TOBIT Model was applied to estimate the Open-Ended question of WTP¹⁰. Hanemann and Kanninen (1999) explained that the Open-Ended questions for WTP are subject to the starting point bias, which could be hugely affected by the initial amount in the bidding game: as more respondents are likely to yes to the lower starting point, more people would be expected to answer the OE question if the initial bid amount they got is low and therefore the estimated WTP from the OE questions could not correctly state the maximum WTP, but could provide a glance at the lower bound of the respondents' WTP.

The Parameter estimation was obtained directly from LIMDEP and the WTP is give in Table 3.6. The WTP could be obtained after calculation, in we assume the parameters are normally distributed:

Table 3.6 Parameters Estimation by TOBIT Model

Variable	Coefficient	Standard Error	b/St.Er.	p-Value	Mean of X
<i>Primary Index Equation for Model</i>					
Constants	73.968	4.823	15.338	0.000	
Income	0.00024	0.00007665	3.113	0.002	55299.06
<i>Disturbance Standard Deviation</i>					
Sigma	67.05153	1.6457	40.743	0.000	

$$\frac{Z\beta}{\sigma} = \frac{(73.98 + 0.00024 * 55299.07)}{67.052} = 1.3013$$

$$X = CDF \text{ of } \frac{Z\beta}{\sigma}$$

$$Y = PDF \text{ of } \frac{Z\beta}{\sigma}$$

$$WTP = X * Z\beta + Y * \sigma = 90.2872$$

As expected, the estimated WTP from the OE question was much lower than the estimated WTP from the 2DC bidding games. And this amount was very close to

¹⁰ See J. Tobin, 1958, "Estimations of Relationships for Limited Depend Variable" for more details of TOBIT Model

the average initial bidding offered weighted by percentage of people saying “yes”. Yet this amount was still higher than the entrance fee to the glacier.

3.6 Conclusions

The objective of this chapter is to estimate the willingness to pay of the travelers for a conservation plan that aims to conserve and protect the glaciers in Mt. Yulong by using the Contingent Valuation Method. Survey among the travelers was conducted on site at Mt. Yulong during July 2015 to December 2015. This survey adopted a focus-group talk technique to ensure the scenario credibility and the travelers were asked to complete a set of questionnaires; a total of 1,500 questionnaires were distributed, 989 questionnaires were completed but 133 were considered as Protest Bidders, only 856 responses were used in the WTP estimation.

Both normal and logistic distribution were tested with the maximum likelihood estimation, both distributions generated results of WTP for the amounts of approximately 220 CNY (or 35 US Dollars). This amount is much higher than the current entrance fee that the travelers have to pay in order to enter Mt. Yulong. With over 1.5 million visitors visiting Mt. Yulong every year, the total monetary payments that can be collected for the conservation of the glaciers from the tourism sector would be totaling for more than 330 million CNY per annual (equivalent to 55 million US Dollars).

The surprisingly high figure of WTP has demonstrated great opportunities for the further research as well as for the creation of policy instruments: the high WTP does not only provide another piece of evidence to the important of glaciers in the recreational industry, it also provide a useful insight on how much the travelers would value the conservation scheme. And the total amount that the travelers are willing to pay implied that the public strongly supports the conservation of the glaciers and they are willing to provide financial support for such conservation.

CHAPTER 4

RECOMMENDATIONS ON POLICY INSTRUMENTS FOR LIJIANG

4.1 Introduction

The findings from the TCM and CVM in the previous chapters provided essential evidences that policy interventions for conserving the glaciers and achieving sustainable tourism development is strongly desired by the public.

Firstly, the consumer surplus in the recreational industry, which represents the use value of the glaciers, is more than 1.8 billion CNY per annual, losing the glaciers would result in unbearable amount of loss in the recreational revenue as well as consumer welfares.

Secondly, the consumers are willing to pay a surprisingly high amount for the conservation of the glaciers, which proves that the conservation of glaciers and the sustainable ecotourism schemes are well aligned with the public interests. Moreover, the gross amount that the travelers are willing to pay is above 300 million CNY per annual, which can be used to finance the ecotourism conservation schemes development without creating financial burdens to the locals.

In this chapter, we will examine the common ways of sustainable ecosystem services developments and discuss the most suitable scheme for Lijiang and Mt. Yulong.

4.1.1 Ecosystem Services

Ecosystem services, or also widely called as environmental services or ecological services¹¹ in various research and publications generally refer to the “benefits human beings obtain from the environment or ecosystem”. In 2006, the

¹¹ For consistency, this paper will use the term “payment for ecosystem services”.

Millennium Ecosystem Assessment formally defines the ecosystem services into four main categories:

1) Provisioning Services, which refers to the products that can be obtained directly from the environment, such as food, water, minerals, etc.

2) Supporting Services, which means the benefits of an ecosystem or environment provide to the productions of other goods and services. For example, the water recycling and photosynthesis provided by the forests that enables other production such as farming.

3) Regulating Services, which refers to the benefits that could be obtained from regulating or improving the environment and ecosystem. For example, the pollution controls and the terraforming.

4) Cultural Services, which means the non-physical benefits, such as spiritual or cognitive development human beings obtain through the interactions with the environment. The examples of this category include recreations and tourism.

4.1.2 Why Environmental Assets and Services Are Under-protected

Even though many of the ecosystem services possess high economic value and important ecological functions, they are most of time hugely under-protected. Farrier (1995) and Salzman (2009) concluded there are three main reasons for the under-protection of the environmental assets:

4.1.2.1 Ignorance

One common but dangerous belief within the human society was that the environment is “nature creations” and it would always be available for human exploitations and consumptions – that we took the natural environment of our planet for granted without even asking the fundamental questions: “how were the ecosystem services we enjoyed for so long created and maintained?”

Even today, with most of countries started to realize the importance of the ecosystem services and many environmental laws and regulations are in place, most of those laws and regulations are merely another ironic example of our ignorance: the environmental laws and regulations were drafted in order to protect human benefits instead of the environment or ecosystem itself. (Salzman, 1997)

4.1.2.2 Inadequate Institutions

Another main issue that resulted in the under-protections of the ecosystem services is the intuitional set-up: more than commonly, the ecological importance of an area is not well aligned with its economic value – that is to say, the regions that possess significant ecological value are normally economically under developed and therefore lack adequate institutional setups. Meanwhile, protecting the ecosystem services generally requires cooperation amount many institutions that may be very different in their interests and objectives. (Salzman and Ruhl, 2000)

4.1.2.3 Market Failure Resulted from the Externality and Public Goods

Economically, the market failure also causes the under-protection of the ecosystem services: in most of the cases, people who enjoys the ecosystem services do not need to pay for the services, and the owners of such services, regardless private or public, do not receive any benefits for providing such services. This scenario is known as public good in economics and the market normally fails to provide sufficient amount of public goods than the amount at which would be efficient.

Farrier (1995) discussed the failure in the ecosystem services markets and concluded that private owned environmental assets suffer more obvious market failure than the public owned assets, and he argued that the public owned assets could be “set aside for conservation”. Even though Farrier’s argument seems reasonable, another important point to notice here is that even for the public owned environmental assets, the market failure still causes conservation of such assets and the provisions of ecosystem services to be economically costly, as the protection and provision of such services normally become the burdens of the governments and tax payers.

4.2 Conventional Intervention

Conventionally, the interventions for environment protections try to regulate or limit the use of environmental assets and services in the process of production or consumption in order to reduce the damages, this approach is often referred to as “command and control” regulations. Examples of the command and control regulations include the Clear Air Act of 1970 and Clean Water Act of 1972 in the United States of America. (Stavins, 1998)

The major problems associate with the command and control regulations are: (1) the regulations are designed to enforce on all firms and households to bear similar or exactly the same burden for the environmental protection, regardless of the differences in benefits received from the environmental assets; (2) the command and control regulations set similar targets for each parties without considering the cost of meeting those targets, therefore sometimes those regulations becomes economically inefficient and counter-productive. (3) the command and control regulations provide no incentive for firms and households to go beyond the targets set by the regulations, therefore parties who already meet the standards have no motivations to invest in environmental protections further.

4.3 Market Base Instruments

Other interventions normally involve monetary payment and hence are known as market base instruments (MBIs). Commonly seen MBIs include property rights and financial payments.

The property rights are instruments that reallocate the right to access the environmental resources through trading systems, such as the carbon credits trading or the US Clear Air Act. Financial payments, on the other hand, implement penalties and charges over the usage of environmental resources in order to bring a behavior change. Financial payments are normally in the form of environmental taxes and fees. Heal et al. (2001) experimented each of the intervention tools in a scenario of water quality improvement. He discovered that all the above-mentioned instruments, though somewhat effective in improving the ecosystem services, did not address the market failure issue.

In order to create a more economically effective instrument instead of merely trying to correct the under-conservation or under-production problem directly, economists try to “set correct incentives for conserving or providing ecosystem services” (Salzman, 2009) by creating an adequate payment system in order to realize the real economic benefit and economic cost of the ecosystem services. Such instruments are formally known as the Payment for Ecosystem Services.

4.4 Scientific Studies on the Glaciers Problem

When explaining the factors that caused the retreats of the glaciers in Mt. Yulong, experts and researchers from the Chinese Academy of Sciences were unable to achieve unanimous: with some of them are concerning the global warming and changing in the Eastern Pacific Monsoon (which result in less rain/snow falls in the whole Himalaya region), and the glaciers retreating rate in Mt. Yulong was not significantly faster comparing to those in Alps and Andes; while others are also concerned that increasing tourism activities, which involves higher carbon emission than traditional agricultural production, which was the major local activity: increasing amount of airborne and land transportation vehicles released huge amount of carbon dioxide and other greenhouse gases; hotels, restaurants and other tourism related business were rushing into Lijiang, attracted by the booming tourism business rocketed the energy consumption and heat emission in the city of Lijiang. The combined forces lead to a significant increase in the local temperature, created a thermodynamics phenomenon called “Warm Island Effect¹²”, which is the opposite to the common Cold Island Effect in the desert: the warmer surrounding areas have higher rate evaporation than the glacier, which would cause the hot air to rise and cover the cold air above the glaciers, significantly reduce the amount the snowfall over the glaciers, and stopping the new glaciers from forming.

With the influences of global warming and Warm Island Effect, Ning et al. (2006) expected that by year 2050, more than half of the current glaciers would disappear, and the remaining glaciers by then will retreat to above altitude 5000 meters, leaving the current tourists attraction site an area covered by bare frozen rocks.

Increasing number of tourists also push up the demand of food, energy and water, which leads to over exploit of the natural world and deforestation. Demographical Survey revealed that the population of local residents had grown from 1.16 million to 1.24 million in the past 10 years, but the environmental pressure caused by the population growth is far greater: the increasing tourism opportunities

¹² See He and Zhang, 2004 for more details on the thermodynamic issues.

have attracted large amount of transient population: small business owners, vacationers, and temporary labors. It was estimated that the total number of transient population is around 3 million.

Many environmental scientists are proposing that the tourism authority to employ the command and control method to reduce the environmental pressure. Currently, the glaciers receive more than 17,000 visitors each day, while the environmental scientist from Chinese Science Academy proposed a quota of 3,500 to 5,000 persons/day based on the carrying capacity (maximum 6,000) of the glacier and nearby ecosystem. Obviously, the new quota would drastically reduce the revenue from the tourism, as well as reduce the number of people willing to travel to Lijiang, bringing huge economics impacts.

Table 4.1 listed some of the most famous MBIs by developed countries.

Table 4.1 MBIs in Practices

Projects	Region	Type
Clean Air Act	USA	MES
Chicago Climate Exchange	USA	MES
Clean Water Act	USA	MES+PES
Environmentally Sensitive Area Scheme	UK	PES
Clean Air Act	USA	MES

4.5 Design of the Policy Instruments for Lijiang

In the previous sections, I conducted valuation of the glaciers by adopting the Travel Cost Method and the Contingent Valuation Method. Both research provided important information regarding the possibilities of developing the ecotourism. In this paper, I will explore the possibilities of utilizing the Payment for Ecosystem Services in order to create a sustainable and eco-friendly tourism industry based on the glaciers; I will also attempt to provide a primitive policy instrument package as a foundation for the policy maker to consider.

In the case of Lijiang and Mt. Yulong, policy intervention faces several challenges:

1) Low public awareness of the environmental issues. The CVM survey revealed that even though most of the travelers acknowledges that the glaciers and the ecosystem in Mt. Yulong need conservation, yet only around 60% of the travelers were fully aware of the significance of the glaciers problem; among the travelers, around 30% did not realize the value of the glaciers, and another 40% only see the value of the glaciers in tourism.

2) Tourism service providers are not motivated to provide eco-friendlier services. The glaciers are pure public goods, and the tourism business that relies on the glacier does not own them. This is a typical example of the market failure that has been caused by the public goods: conservation of the glaciers would benefit the users of the glaciers, but it does not provide direct benefits to the people who provide such conservation. Therefore, there is no incentive for the tourism business to engage in conservation activities.

3) Cost of conservation. The conservation of the glaciers and ecosystem, no matter through the conventional way of command and control or through the provision of ecosystem services would result in a monetary cost. Even though the per capita income in Lijiang is above the poverty threshold, it is still a huge burden for the locals if they would have to be paying for the conservation of the glaciers.

Given those challenges, the command and control intervention and the conventional MBIs such as pigouvian tax would not be effective due to their inabilities to address the market failure fully: as those instruments set standard for taxation or quantity control without considering the differences in cost amount each parties; whereas the tradable permits would also be inappropriate in this case due to the objective of the intervention was not to regulate the current activities but rather to promote the provisions of the environmental conservation and ecotourism.

Similar issues have been addressed successfully in Europe. Many tourism attractions in Europe has been classified as “Environmental Sensitive Areas” (ESA) by the European Environmental Agency, and since late 1980s, efforts have been made by economists and policy in order to create sustainable development plans in those ESAs to ensure economic development as well as the conservation of environmental assets. The practices that have been implemented successfully include the new

ecotourism scheme in Austria Alps (Hammer and Siegrist, 2008) and the ESA Schemes in the United Kingdom (Hanley et al. 1998). The idea was that the lifestyles and production activities by the people who lived around the ESAs are considered to be essential to the maintaining of the wildlife and landscape quality: in Scotland, farmers may “join” an ESA scheme and change their ways of living/farming/producing according to restrictions and methods that were created to conserve the local environment; in return to the restricted activities, farmers would receive annual payments on two tiers: preserve and enhance the environmental quality (Hanley et al. 1998); in Austria, tourism operators are required to alter their ways of serving the travelers and modify the travel packages to become fully integrated with the environmental conservation goals. This idea was based on the economic theory of payments to produce a positive public goods and these approaches are widely echoed amount the OECD countries (EEA Technical Report, 2005). Similar schemes have also been applied in southern African national parts for protecting the wildlife from poaches.

4.6 Creation of PES Scheme

The conditions in Lijiang were quite similar to many ESAs in Europe: some environmental sensitive resources (glaciers, in this case) are at the core of the local tourism development as well as the economic advancement; meanwhile, the development of tourism and economy threatens the existence of this environmental asset. An approach that ensures the sustainability of the environmental resources without harming the local economic situation was called for, while most of the conventional interventions could not effectively address the source of market failure, which is the lack of incentives for locals to provide environmental conservation and other ecosystem services. Payment for Ecosystem Services, or PES, recognizes the problem and attempts to create adequate economic incentives for the provisions of ecosystem services by treating the provisions of the ecosystem services equivalent to the provisions of the marketable goods: which is to allow the people who provide such services to be paid by the people who are beneficent from the services; in the case of Mt. Yulong, that is the travelers who receive better traveling experiences

through the ecotourism to pay for the locals who incur costs of resources and money in order to provide such ecotourism.

In Chapter 3 of this dissertation, I have elicited the maximum WTP by the travelers and estimated it to be at around 220 CNY per traveler; with a total amount of more than 1.7 million¹³ travelers visiting the glacier in year 2014, the total annual payment that can be collected for the provisions of ecotourism and conservations of the ecosystem would be more than 340 million CNY, which could be used to award the locals who provides the ecosystem services. Hanley et. al. (1998) described a tactical example of the PES design, which was applied in the Environmentally Sensitive Areas in Scotland, UK:

1) The travelers were asked to pay a flat rate for the ecosystem services or the ecotourism package. This amount of payment was firstly estimated through the Contingent Valuation and Choice Experiment survey and thereafter adjusts by continuously feedbacks from the travelers.

2) The local tourism operators and the residences were encouraged into participating in the provisions of ecotourism. The main objectives of such ecotourism or ecosystem services were to reduce the negative impacts done to the environmentally sensitive areas due to the daily activities of the local productions and tourism. A monetary reward would be provided to the locals due to their different levels of ecosystem services provided: three different tiers was set, which were named as protecting, enhancing and promoting.¹⁴

3) The local governments and authorities collected the payments from the travelers and monitored the activities of locals. At the end of each year, local firms were assigned into each tiers based on their provision of ecosystem services in the past year and the authority would assign a reward according to the tiers.

Same practice could also be effective in Lijiang. Hanley et al. (1998) and Hammer and Siegrist (2008) have suggested several guidelines of the possible criteria as listed below:

Tier 1: Conserving

¹³ See Chapter 2 for the number of travelers

¹⁴ See Hanley et. al., 1998 for more details of the three tiers and their respective monetary rewards.

1) Provide information and guidelines for energy and water conservation.

2) Provide training and set standard for the staff to conserve water and energy.

3) Minimizing the harms to the environments caused by regular/emergency activities.

Tier 2: Promoting

1) Promote local traditions and culture to the travelers.

2) Enhance the local welfare through tourism operations.

3) Increase the awareness of the travelers regarding the local environment and culture.

Tier 3: Enhancing

1). Minimize the adverse effect over the local community

2). Enhance the travelers experience with the ecosystem and environmental assets

3). Effectively integrate the tourism operation with ecological context.

4.7 Recommendations for Lijiang and Mt. Yulong

The consumer surplus estimate by the Travel Cost Method in Chapter 2 suggested that Mt. Yulong and its glaciers still have high value that could be explored further: a total consumer surplus of over 30 billion CNY of consumer surplus per annual (more than 1,000 CNY per traveler per annual) does not only demonstrate the high value of glaciers in the tourism sector but also implies the economic potential of the glaciers. Meanwhile the welfare estimation from the Contingent Valuation Study in Chapter 3 showed that the travelers value the glaciers as one of the most important components in their traveling experience and they are willing to pay around 220 CNY for its protections and improvements, this amount is almost thrice as high as the current entrance fee to the glaciers (which is at 80 CNY); the CVM survey also revealed that most of the travelers preferred taxation as the payment vehicle as they felt that the local government is more trustworthy than any other private or public organizations.

Based on the information discovered in the previous two chapters, I would propose an Environmental Tax of 150 to 200 CNY to be charged on all travelers who visit Mt. Yulong, based on the number of travelers in the past three years, the total Environmental Tax can be collected each year would be around 250 to 300 million CNY, which could then be allocated to the development of ecotourism and the conservation of the glaciers. Currently, the tourism development and economic activities in Mt. Yulong and the glaciers are managed by the Mt. Yulong Management Committee, which is one office under the Tourism Authority of Lijiang and headed by the director of the tourism authority. Since the tax payment have to be collected directly by the government of Lijiang, I propose to create a new committee which is co-managed by the city government and the Tourism Authority of Lijiang. The new committee (PES committee) will be in charge of inspection and determination of all the tourism related entities and to assign them into different tiers based on their levels of ecotourism engagements, and to issue monetary rewards based on their tiers. The local travel agents and tourism service providers, hotels, transportation contractors and tourists-receiving restaurants are entitled to enter the PES scheme by their own choices: registration with the PES committee will be made if they are willing to participate in the PES scheme, and the PES committee will thereafter be monitoring their activities by requesting annual reports and sending inspectors at random times during a year. Figure 4.1 shows the proposed organizational chart of PES.

Base on Hanley et al. (1998) and Hammer and Siegrist (2008) and considering the local situation at the moment, I would propose several criteria for categorizing the PES participants:

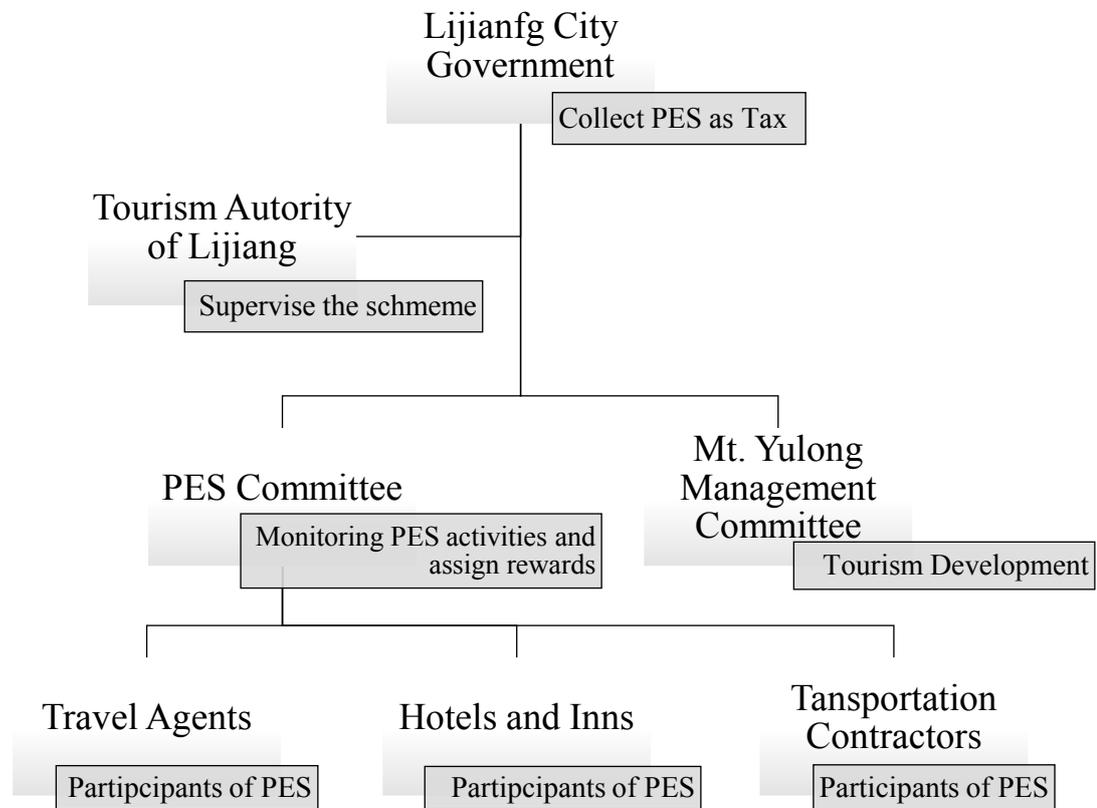


Figure 4.1 Proposed Organization Chart of PES

Tier 1: Conserving

The main objective for all participants in this tier is to ensure that their tourism activities do not bring any harmful impacts to the ecosystem in Mt. Yulong and Lijiang as well as to increase the overall awareness of travelers toward the environmentally sensitive resources. Several measurements that could be taken to achieve this objectives: Firstly, ensure all wastes are carried out of the mountain site and provide appropriate cleaning; secondly, only use designated tracks/roads and regularly maintaining the existing vehicles, to ensure no above-normal emission of the greenhouse gases; thirdly, train the tour guides and drivers and make sure they do not conduct any harmful activities; finally, introduce the ecotourism benefits and the importance of the environments to all travelers.

The Tourism Authority of Lijiang already enforces most of tier 1 activities and we would estimate that tier 1 does not increase the operating cost of the participant

significantly, as most of the activities requires minimal among of efforts, and many of the tourism service providers in Lijiang has already achieved it. I propose an annual monetary reward of 100,000 to 300,000 CNY for all participants who reach this tier.

Tier 2: Promoting

Under tier 2, participants do not only maintain their regular ecotourism activities (as proposed under tier 1) but also actively seeking for potential improvements, such as: firstly, stop using the disposable items; secondly, eliminate the usage of Chlorofluorocarbons in air-conditioning and refrigerators; thirdly, provide and promote the use of recyclable products; next is to prepare readings and guidebooks for travelers regarding environmental protection and ecotourism; finally, reduce unnecessary illuminations and lights.

Tier 2 would require the participant to actively modify their current activities and will incur mainly management costs for the participants. I propose an annual reward if 800,000 to 1,000,000 CYN for participants in this tier.

Tier 3: Enhancing

To reach tier 3, participants need to go beyond their own activities by attempting to integrate the local society and culture into their tourism services and actively seeking to enhance the local ecosystems. Some of the possible activities in tier 3 are: firstly, create and develop proper recycling system for all tourism activities; secondly, develop new tourism packages that allows the travelers better experience through non-harmful interactions with the ecosystems; thirdly, reduce the size of each tour group in order to bring better care and experience to travelers; fourthly, restructure the routes to achievement maximum efficiency of energy consumption; finally, replace the old vehicles with electricity/hydro gas/LPG powered vehicles and promote local cultural and value to the travelers by integrating local traditions and activities into the tourism services.

To achieve tier 3, large amount of effort and resources are required, whereas tier 3 is the primary benchmark for the successful PES scheme. I would propose an annual reward of 3,000,000 to 5,000,000 CNY to the participant in this tier.

Unfortunately, I lack the information and data to predict the total cost of PES scheme and the time frame to achieve it, but Mr. Zhang Kunsheng, who had 30 years' experiences as tourism administrator in Yunnan and Mr. Pan Guirong, who is

currently the managing director of China Tourism Service Co. in Lijiang, have both estimated the cost of fully achieving tier 3 within 5 to 10 years is around 800 million to 1 billion CNY; given that the annual environmental tax collection was estimated to be around 250 million CNY, the PES scheme could be fully funded by the environmental tax payments made by the travelers without creating any financial burden to the locals.

4.8 Conclusion

When aiming the environmental conservations and economic development at the same time no specific type of policy instrument could fit into all circumstances and solve all problems in one stroke. MBIs became overwhelmingly popular, especially in the United States due to its effectiveness economically comparing to the conventional command and control interventions; meanwhile, more European countries favored the PES, as it addresses the market failure caused by the public good directly. In China, Command and Control and Taxes are two of the most common ways used by the government to encounter the environmental problems.

After inspecting the situations in Lijiang and Mt. Yulong, I recommend the local authority to consider the PES instead of other intervention instruments due to it could promote the provisions of environmental conservation as well as increase the revenue from the tourism business. In the previous sections of this dissertation, I examined the consumer surplus of the travelers and their WTP for the environmental conservation, both result is positively supporting that a well-designed PES scheme would economically effective and appropriately fit to the current situation in Lijiang.

CHAPTER 5

CONCLUSION

The aim of this research is to examine the use value of the glaciers on Mt. Yulong, China and to understand the economic significances of the glaciers to the local tourism development through examining the consumer surplus and compensating surplus. Another objective of this research is to prove a viable Market Based Instrument in order to achieve sustainable tourism development and reduce the damage caused by the tourism development to the sensitive environmental asset. This research can be divided into three parts:

The first part is a research paper that examines the tourism demand and then derives the consumer surplus of travelers when visiting a unique tourist attraction site: glaciers in Mt. Yulong, Yunnan, China by using the Zonal Travel Cost Method (henceforth, zonal TCM). I aim to uncover the use value of this particular site in tourism development. Domestic travelers were divided into 20 groups based on the demographical and geographical characteristics of their place of residence. The empirical results show that the economic value of the glaciers in the tourism industry is more than 3 billion CNY, roughly equivalent to 500 million dollars, which is approximately 10% of the local GDP. The high estimated value of the glaciers suggests that some conservation policy interventions are necessary. Major criticism of the zonal TCM is that it tends to overestimate the consumer surplus and use value (Strong, 1983). Further studies on the context of consumer surplus by adopting other feasible methods, such as the individual Travel Cost Method or a combined method of TCM and CVM (Cameron, 1992) may reveal more accurate results regarding the use value of the glaciers and the consumer surplus.

The second research paper attempts to elicit the maximum WTP by the travelers for the ecotourism development, which would conserve the glaciers and the

ecosystem in Mt. Yulong. The survey was conducted in Mt. Yulong among the travelers during June to December 2015, and the focused group talk technique was applied. A total of 1,500 survey questionnaires were distributed and 856 returned with completed information. The estimated WTP by each travelers' averages around 220 CNY, which is equivalent to 35 US Dollars at the exchange rate of March 2016. This amount was almost twice as high as the entrance fee to the site and indicates that the travelers are highly concerned with the environmental quality during their traveling experiences and are in favor for the eco-friendlier tourism. Due to the limitations of time and financial resources, the period of survey and research was constrained into a 5 months period: extending the period of survey may improve the estimated WTP even though I do not expect large dispersions; another possible improvement would be to elicit the travelers' WTA of a monetary discount if the glaciers are no longer available: as Hanemann (1999) proved in his statistical modeling, WTA normally generate less estimation errors and presumably more accurate result than WTP.

The third part of this dissertation is a discussion paper that aims to compare different techniques of intervention instruments based on the particular situations in Lijiang and Mt. Yulong. This paper combines researches and recommendations from the environmental scientists of Chinese Science Academy and the economic attributions uncovered from the previous two parts of this dissertation into consideration. Even though various MBIs have their unique advantages and might all be achieving in the case of Mt. Yulong, the Payments for Ecosystem Service package (henceforth, PES) seems to be most effective in addressing the environmental conservation issues as well as enhancing the economic development. Due to lack of data and information, I was unable to estimate the real cost of carrying out the PES and I could not conduct a complete benefit and cost analysis; therefore, this research can only provide a general guide of the PES. Experiments and more detailed plans of the PES are still to be done before the PES can be implemented.

A final question that remains to be answered is whether the implementation of PES scheme would actually solve or improve the environmental threat faced by Mt. Yulong and Lijiang. This is also one of the most raised challenge to any environmental economics projects: the cause of environmental problem is normally complicated and many of those, such as global warming or the change of monsoons

due to the activities of the sun, are not within the context of economics; therefore, whether the PES will be able to reduce the speed of glaciers retreatment or extend the life cycle of Mt. Yulong ecosystem is hard to conclude. More scientific discoveries and evidences regarding the causes of glaciers problem must be acquired before one could predict the future of the glaciers.

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APPENDICES

Appendix A
Questionnaire for the Contingent Valuation Survey
(Original)

丽江及玉龙雪山一直以来是大家十分钟爱的旅游度假目的地，然而伴随着旅游业的繁荣以及丽江城市的发展，越来越多的环境问题正在威胁着玉龙雪山的冰川及森林，有研究表明，按照现在的状况，20年内玉龙雪山冰川将会消退至5000米海拔线之上，游客将会无法看到任何冰川。欧洲许多国家正在推广的一项收费的环境保护项目能够减少旅游业能源消耗及温室气体排放，从而降低旅游业对当地环境造成的负面影响并且提升游客的旅游体验。如果该项目能够在丽江实施，将能够大幅度的改善冰川地区气候及环境，并能有效减少游客参观玉龙雪山的等待时间，使您获得更好的旅游体验。

我们十分感激能够占用您宝贵的时间和精力，回答下面的问题：

1. 您是否愿意为此项目支付一定数额的费用？

- 是
- 否（请跳至第6题）

2. 您认为(X)元¹的费用是否合理：

- 合理（请跳至第4题）
- 过高

¹ The amount of bid is randomly assigned out of five possibilities: 50, 100, 150, 200, 250 CNY

3. 您认为(X-30) 元²的费用是否合理

- 合理 (请跳至第 5 题)
- 过高 (请跳至第 5 题)

4. 您认为(X+30) 元³的费用是否合理

- 合理
- 过高

5. 您愿意支付的最高额度是 _____ 元

6. 能否请您简单描述不愿意支付的原因：

- 我不关心这个问题
- 我不认为我应该为环境问题负责
- 我认为改善环境问题应该是政府的责任
- 我认为当地居民应该为环境问题负责
- 其他 _____

7. 您认为玉龙雪山对您丽江之旅的重要性是：

- 是我来丽江旅游的主要原因
- 是我来丽江的重要的原因之一，但是不是全部原因
- 玉龙雪山只是丽江的一个景点，对我来说并不特别重要
- 玉龙雪山不是我来丽江的原因
- 其他 _____

² The amount of follow up bid is (X-30) CNY if the first bid is 50, 100, 150 or 200. The second bid is 350 CNY for the first bid of 200.

³ The amount of follow up bid is (X+30) CNY if the first bid is 50, 100, 150 or 200. The second bid is 350 CNY for the first bid of 250 CNY in order to capture the upper bounds.

8. 您认为保护玉龙雪山及其冰川的重要性及原因是：

- 非常重要。因为冰川对当地来说是重要的资源
- 非常重要。因为冰川是独特的景观，对旅游业至关重要
- 不重要。因为冰川没有利用价值。
- 不重要。因为冰川并不是稀有资源。
- 我不了解冰川的价值及重要性。
- 其他_____

9. 您的职业是：

- 公务员
- 企业员工
- 管理人员
- 学生
- 私营业主
- 其他_____

10. 您个人每月的开销大约是：

- 小于 1500 元
- 1500 ~ 2500 元
- 2501 ~ 3500 元
- 3501 ~ 4500 元
- 4501 ~ 5500 元
- 5501 ~ 6500 元
- 6501 ~ 7500 元
- 7501 元以上

Appendix B
Questionnaire for the Contingent Valuation Survey
(Translated¹)

Lijiang and Mt. Yulong has long been a favorite travel destination. However, as the prosperity of tourism industry and the modernization of Lijiang municipal, more and more environmental problems started to emerge in Mt. Yulong. The scientific research has predicted that the glaciers in Mt. Yulong will retreat to the altitude 5000 meters' line within 20 years, by then the travelers will no longer be able to enjoy this magnificent scenery. A scheme that aims to reduce the energy consumption by tourism industry and therefore reduce the greenhouse gas emission has been created in many European countries. This scheme has successfully reduced the damage to the environments resulted from tourism industry and improved the traveling experience of travelers. If Lijiang is to adapt a similar scheme, it would require every traveler to pay an additional fee.

We will be highly appreciated if you could spend a few minutes to answer to following questions:

1. Will you be willing to pay an additional charge for an eco-friendly travel experience?

- Yes
- No (Please Jump to Q6)

2. Are you willing to pay the fee of X CNY ²?

- Yes (Please Jump to Q5)
- No (Please Continue to Q3)

¹ This is a translated version of the questionnaire, which has not been distributed to any travelers. The layout and some contents might not be exactly the same as the Chinese version due the differences between two languages.

² The amount of first bid (X) is randomly assigned out of five possibilities: 50, 100, 150, 200, 250 CNY

3. Are you willing to pay the fee of X-30 CNY³?

- Yes (Please Jump to Q5)
- No (Please Jump to Q5)

4. Are you willing to pay the fee of X+30 CNY⁴?

- Yes
- No

5. Your maximum willingness to pay for a fee is: _____ CNY.

6. Could you please state the reason(s) for unwilling to pay?

- The glacier problem is not my concern
- I do not think that I am responsible for the environmental problems
- Local government and travel agents should be paying for the conservation of the glaciers
- Local Residents should be paying for the conservation of the glaciers
- Others _____

7. How important the glaciers and Mt. Yulong are for your traveling in Lijiang?

- It is the reason for me to come to Lijiang.
- It is an important part of my travel experience, but it is not everything.
- It is just one of the tourist attractions and I will still feel good about my travel without it.
- I am no interested in Mt. Yulong and the glaciers.
- Others _____.

8. How important is the conservation of glaciers? And what is the reason?

- Important. Because the glaciers are valuable resources.
- Important. Because the glaciers are unique scenery and very important tourist attraction.
- Not important. Because glaciers are useless to human.
- Not important. Because the glaciers are abundant.
- I am not sure about the value and importance of the glaciers.
- Others _____.

³ The amount of follow up bid is (X-30) CNY if the first bid is 50, 100, 150 or 200. The second bid is 350 CNY if the first bid of 200.

⁴ The amount of follow up bid is (X+30) CNY if the first bid is 50, 100, 150 or 200. The second bid is 350 CNY for the first bid of 250 CNY in order to capture the upper bounds of WTP.

9. Your occupation is:

- Government Official
- Corporation Employee
- Manager
- Students
- Self-Employed
- Educational
- Unemployed
- Others _____

10. Your personal expenditure per month is approximately :

- Less than 1500 CNY
- 1500 - 2500 CNY
- 2501 - 3500 CNY
- 3501 - 4500 CNY
- 4501 - 5500 CNY
- 5501 - 6500 CNY
- 6501 - 7500 CNY
- Above 7500 CNY

BIOGRAPHY

NAME

Zhuoran Zhang

ACADEMIC BACKGROUND

2012 – 2016: Ph.D. Candidate, School of
Development Economics, National
Institution of Development
Administration, Thailand

2006 – 2007: Master of Science in
Financial Management, University of
Exeter, UK

2001 – 2005: Bachelor of Business
Administration in Finance, Assumption
University, Thailand

PRESENT POSITION

Lecturer, Business Economics
Department, Assumption University,
Thailand

Managing Director, SponserUnion Co.
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