

ESTIMATING WILLINGNESS TO PAY FOR PLASTIC BAG WASTE MANAGEMENT IN BANGKOK, THAILAND

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Abstract - The globe has concerned about adverse effects from plastic bag use. Many countries then set the regulations to take control plastic bag distribution such as plastic bag ban and levy. The plastic bag levy cannot only gain the revenue to improve the quality of plastic bag waste management, but it also directly affects as the strong sign to customers and make they realize the plastic bags are not for free. However, in Thailand, these kinds of implementation still lack, so the customers still currently get plastic bags for free from a store. This study then focuses to elicit the willingness to pay (WTP) by contingent valuation method with payment card and determine the influencing factor. Therefore, the regression result shows that attitude about environmental preserving and support for plastic bag levy are correlated with willingness to pay. 1.43 Baht or US\$0.044 per a plastic bag is the mean willingness to pay for plastic bag waste management in Bangkok. Consequently, policymaker can apply and set the new regulation for charge with the levy while people eventually start to realize more about environmental problems and cut their use of plastic bags.

Keywords - Contingent valuation method, Plastic bags, Plastic bags levy, Willingness to Pay.

I. INTRODUCTION

Nowadays, the population of Thailand has been increasing and the number of the consumption of goods and service are also escalating. Therefore, there are many new convenience store and supermarket in the country for meeting the huge social consumption demand. However, the convenience from the consumption can directly causes to the high amount of garbage amount especially the waste of plastic bags. In 2015, Thailand had 2 tons of plastic bags garbage or 7.4% of the total garbage quantity [9]. Meanwhile, the average amount of garbage quantity in Bangkok was 360,000 tons in 2015 and it consists of plastic bags portion around 75,600 tons or 21% of the total garbage quantity of Bangkok [6]. Furthermore, plastic bags garbage is usually sent to the landfill for disposal, but this kind of garbage is tough for waste management because it will take decades for natural degradation. Moreover, plastic bags have low density and they can resist to the high compression as dominant characteristics. The plastic bag is also the one of the causes of global warming due to plastic pellet in production process, which come from petrochemical industry. When it is eliminated by burning with inadequate high temperature, it will be adversely harmful to the environment and the health of the living thing [10].

So, the globe is now concerning to these problems and emphasizing to manage the amount of plastic garbage by using many kinds of approach. For instance, the city of Mumbai, India, had restricted the manufacture and the use of plastic shopping bags since 2000 due to clogging storm water drains and causing flooding [10]. Nevertheless, some jurisdictions believed that thicker plastic bags would be reused and not discarded. Then, they focused only on banning the thin plastic bags which is less than 20

or 25 microns, but other jurisdictions banned all kind of plastic bags outright [4]. In Modbury, England, the big revolution of this small West Country town led here is the first town in England, where has been without any plastic bags use since April 2007. Voluntary action for stop providing any plastic bags was applied by all 43 local traders and eventually 6 months later this town was completely out of plastic bags distribution[11]. In Republic of Ireland, there was successful from policy setting about plastic bags charge as known as "PlasTax" for the plastic littering control by charging €0.15(US\$0.18) per a plastic bag in 2002, which reduced more than 90% of the plastic bags consumption after the enforcement [5]. While the manufacturers and importers of plastic bags in Denmark were first required to pay a tax based on the weight of plastic bags which was €2.6(US\$3.06) per kg before it later increased to €2.90 (US\$3.41) per kg in 1998 [12]. Furthermore, the level of taxation has been unchanged since then and has therefore not followed the price development. During the taxation period, the plastic bags in the market had been reduced up to 66%. Moreover, the plastic bags consumption was cut to a half from 800 million bags to 400 million bags and approximately 80 bags per person annually[8].

Furthermore, there was a study in Utah about willingness to pay estimation for continued use of plastic grocery bags by using contingent valuation method in 2012. The result showed that a mean willingness to pay for continued use of plastic grocery bags is US\$0.33 per plastic bag used[7]. Besides, some study in Thailand found that people have been willing to pay to improve the municipal solid waste management. The study was conducted with 1,064 samples by focusing on three scale settlements as case studies which includes Greater Phang Khon Area (peri-urban settlement), Muang

Hua Hin Municipality (a moderately urbanized settlement) and Bangkok. The WTP analysis from payment card technique indicated that the respondents' WTP were US\$0.73/month, US\$1.96/month and US\$1.65/month in each area, respectively. Accordingly, they were willing to pay more than the municipal solid waste fee, which is partially subsidized, that currently charged by each municipality though it is lower than the full cost of the fee [3].

Therefore, the policy setting by an economic approach, for willingness to pay estimation of plastic bags from the convenience store, is the challenging and interesting issue for the research whether that can be a major mechanism to urge more potential of the waste reduction and management in Thailand. Consequently, it will provoke to the society to emphasize how significant of the solid waste reduction and management are, which Thai government has already set the solid waste issue as National agenda.

Setting policy by using plastic bags levy is a challenge especially in developing countries like Thailand. Moreover, this research will amplify the feasibility of policy and enhance the efficiency of upstream waste management. Besides, it will be a sustainable solution to mitigate plastic bags waste problems in the society and people will be provoked for changing their attitude. Furthermore, Thai government is now emphasizing about the solid waste problem as the national agenda of the nation waste master plan (2016-2021) [9]. Therefore, this study will be important and necessary to setting the law or regulation for control and limit the use of free plastic shopping bags.

II. DETAILS EXPERIMENTAL

2.1. Survey and questionnaire designs

The survey of this study for data collection is in Bangkok, where is the capital of Thailand lies in Southeast Asia. The data collection covered respondents who are currently live in Bangkok and use plastic bag in their daily life. Moreover, the questionnaire was initially designed and tested as pre-test survey before used as main survey. This process of surveys aimed to check and adjust the questions in questionnaire whether the respondent or reader precisely understand the whole context and eliminate any redundant questions and ambiguity at the same time. The main survey of this study is an online distribution for data collection of 108 respondents.

The questionnaire can be divided into two main sections which are socio demographic and plastic bag use behavior section and another section is willingness to pay for plastic bag waste management. The type of plastic bag is provided before the respondents were asked for data collection in the questionnaire. Table 1 represents to studied

variables which also includes descriptions for each of them. For instance, use frequency, USE, and reuse frequency, REUSE, of plastic bag were asked to respondents and make them select their answer in the 5-choices scale ranges from high (1) to low (5) which are "Always" to "Never", respectively. Attitude, ATT, question was provided to the respondents which is about measure their attitude on environmental preserving and natural resource conservation by reducing the use of plastic bags. Perception of threat, PER, questions are concerning the readiness or perception to stop using plastic bag to prevent environmental problems. These two aspects provided the 5-choices scale ranges from high (1) to low (5) which are "Strongly agree" to "Strongly disagree", respectively.

Table 1: Studied variables

Studied variables	Description
GEN	Gender of respondents
AGE	Age of respondents
ACC	Accommodation type
EDU	Highest education level
INC	Monthly income
USE	Use frequency
REUSE	Reuse frequency
ATT	Attitude score
PER_1	Perception of threat score
PER_2	Perception of threat score
PER_3	Perception of threat score
SUP	Support of plastic bag levy

2.2. Willingness to pay (WTP)

Contingent valuation method (CVM) is the one of environmental valuation techniques which is used to evaluate the value of environmental goods and services on the basis of the monetary values that individuals place on receiving or avoiding them and even they are not available in the market. CVM aims to estimate only how much purchasing power that people would be willing to give up for getting it, when they have to make the decision on hypothetical situation [1].

CVM with payment card technique is used to elicit the willingness to pay for plastic bag levy by using hypothetical situation in this study. The payment card technique had been applied to estimate the maximum willingness to pay. However, the hypothetical situation, type of plastic bag and market were explained before the respondents face to the willingness to pay question and they also can prevent any misunderstand about the payment of levy and make them answer the price related to that particular situation. Payment card in this study provides the choices of values between 0.5 – 10 Baht (or US\$0.016 – US\$0.31) with the interval of 0.5 Baht (or US\$0.016) which shows in Fig.1.

This research assumes that the value of willingness to pay of each respondent as WTP_i , and the equation of willingness to pay is defined in (1).

Price: Baht/bag				
0.5	1	1.5	2	2.5
3	3.5	4	4.5	5
5.5	6	6.5	7	7.5
8	8.5	9	9.5	10

or others _____ Baht/ 1 bag

Fig.1. Payment card choices for willingness to pay

$$WTP_i = X_i'\beta + u_i(1)$$

Where X_i' is characteristics of individuals (i) while β is the coefficient of the characteristic and u_i is an error term that is normally distributed with mean at zero. Due to the willingness to pay value is latent, so the it is assumed that it is between the choices that the respondents select as lower interval WTP_{ll} , and the next choice of value which is higher interval WTP_{hh} in the payment card. Equation is explained in (2).

$$WTP_{ll} \leq WTP_i \leq WTP_{hh}(2)$$

However, from the limitation of interval regression, it was assumed that the actual willingness to pay from respondents who answer for 0 Baht might be in between 0 Baht and 0.5 Baht which is the lowest number in the payment card as shown in (3). Conversely, the respondents who answer above the number in the payment card express in (4).

$$\Pr(X_i'\beta + u_i < WTP_{0.5 \text{ Baht}}(3)$$

$$\Pr(X_i'\beta + u_i > WTP_{10 \text{ Baht}}(4)$$

WTP_i was evaluated by interval regression via STATA 15, while maximum likelihood estimation technique was also applied to find the probability of individuals' likely contribution. The procedure follows the guidance by [2] and [3]. Besides, the relationship between willingness to pay and socio demographic are also determined by regression analysis.

III. RESULTS AND DISCUSSION

3.1. The demographics of respondents

The demographics of respondents from the online survey in this study shows that male is slightly over female respondents which is 47.2% of male and 52.8% of female. Most respondents were in 30s generation (43.5%), lived in detached house (47.2%), graduated at undergraduate degree as the highest education level (65.7%). Most of them also have monthly income in the range between 15,000-25,000 Baht(or US\$465 - US\$775) (35.2%).

3.2. Willingness to pay(WTP) analysis

Fig.2 represents about the percentage of respondents whose willingness to pay lies within each value of the payment card. The percentage of respondents who are willing to pay for plastic bag waste management is 60.2%. On the other hand, the respondents who are not willing to pay or who selected 0 Baht is 39.8%. Furthermore, the mode, or 26.9% of the respondents who are willing to pay for plastic bag waste

management, lies on 0.5 Baht(or US\$0.016) which is lowest value of the payment card. While the next largest group of respondents is about 13% who selected 1 Baht(or US\$0.031) as their maximum willingness to pay. However, there is 0.9% of respondents who selected other value in payment card which is 0.25 Baht. The regression results were used to estimate mean willingness to pay for plastic bag waste management in Bangkok which is 1.43 Baht or US\$0.044 per a plastic bag (95%CI: US\$0.032, US\$0.055).



Fig.2. The percentage of respondents on payment card

In addition, the amount of grained mean willingness to pay is similar to mean willingness to pay for a plastic bag (US\$0.028 per a plastic bag) in Ireland. However, Irish plastic bag levy, so called "PlasTax" was set to be six times higher than the mean WTP before Irish government achieved from the plastic bag use reduction more than 90% by introduced a levy of €0.15 (US\$0.18) per a plastic bag in the first year of implementation [5].

3.3. Influencing factors of WTP

Table 2 shows the interval regression results for the dependent variable WTP_{ll} and WTP_{hh} run against eleven independent variables (N = 108).

Table 2: Mean WTP and relationship with studied variables

VARIABLES	WTP model
GEN	-0.00368 (0.0132)
AGE	-0.00460 (0.00955)
EDU	0.00124 (0.00837)
INC	-0.00216 (0.00614)
USEFRE_B	-0.00222 (0.00702)
REUSEFRE_B	0.00479 (0.00667)
ATT_B	-0.0216* (0.0125)
PER1_B	0.0196 (0.0123)
PER2_B	-0.000846 (0.0149)
PER3_B	-0.00523 (0.0123)
SUP	-0.0407*** (0.0152)
Constant	0.122** (0.0508)
Mean WTP (US\$)	\$0.044***
Observations	108
Standard errors in parentheses	
*** p<0.01, ** p<0.05, * p<0.1	

The coefficients from regression analysis indicated that gender, GEN, was negatively correlated with WTP. So, it implied that the male respondents are prone to be less likely to willingly pay for plastic bag waste management than the female respondents. Meanwhile, the increasing age shows an inverse relationship with WTP which represents that older respondents might not be willing to pay for plastic bag waste management than younger respondents. Plus, the older respondents might be familiar for using cloth bag for their shopping trip. Education factor, EDU, positively correlated with WTP which implied that people with higher education level are prone to be more willing to pay than people with lower education level for plastic waste management. However, monthly income, INC, affected negatively relationship with WTP and it means the respondents who has lower monthly income tended to be more supportive for WTP of plastic bag management. Nevertheless, these mentioned socio demographic factors are statistically insignificant. Then, plastic bag use behavior section includes use frequency, attitude, perception of threat and support for plastic bag levy. Plastic bag use frequency of the respondents, USE, is negatively correlated with WTP but the scale of this aspect ranks from high to low frequency or "Always" to "Never". Therefore, it indicated the respondents who more often use plastic bag tended to be more willing to pay for plastic bag management. However, REUSE is positively correlated with WTP which implies that respondents who do not usually reuse would be willing to pay more than respondents who more often reuse their plastic bags. Besides, respondents were provided the statement and make them indicate their opinions for attitude, ATT, a scale also ranks from high to low which is "Strongly agree" to "Strongly disagree". So, ATT shows the negatively relationship with WTP which means people with greater attitude is strong predictor of changes in WTP ($p\text{-value} < 0.1$). Three statements of perception of threat PER_1, PER_2 and PER_3, which are "Plastic bags can lead to a critical environment issue", "We must not put off but rather emphasize measures against plastic bags uses." and "We must reduce plastic bags uses as soon as possible.", respectively. They are the provided statements and make the respondents indicate their opinions on the same scale as the attitude scale. It was found that PER_1 is positively correlated with WTP. However, PER_2 and PER_3 are negatively correlated with WTP which indicated that people, who have more perception about enthusiasm of plastic bag use reduction, likely tended to be willing to pay more for plastic bag waste management. The respondents selected their opinion about support of plastic bag levy and it collected for the model which represent 1 is "Yes" and 2 is "No". So, SUP is negatively correlated with WTP. The supports for government to conduct national plastic bag levy is strong predictor on WTP ($p\text{-value} < 0.01$). It

represents that people who support the plastic bag levy would be willing to pay for plastic bag waste management.

CONCLUSIONS

The willingness to pay for plastic bag management in Bangkok was studied as well as the influential factors. Hence, the major conclusions are as follows:

1. Willingness to pay (WTP) analysis shows that 1.43 Baht per bag or US\$0.044 per a plastic bag is the mean willingness to pay amount for plastic bag waste management in Bangkok, Thailand.
2. Based on interval regression analysis, attitude, ATT, and support on the plastic bag levy, SUP, factors are statistically significant. Therefore, people are prone to be more willing to pay for plastic bag waste management if they have greater attitude about environmental preserving and natural resource conservation by reducing the use of plastic bags ($p\text{-value} < 0.1$). Moreover, people who support on the plastic bag levy tended to be more willing to pay if the government impose the plastic bag levy for plastic bag waste management ($p\text{-value} < 0.01$).

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