

**ASSESSING CONSUMER'S PREFERENCE FOR LOCAL RICE IN BRUNEI:
AN APPLICATION OF CHOICE MODEL**

Fadil Galawat and Mitsuyasu Yabe

Department of Agriculture and Resource Economics, Faculty of Agriculture, Kyushu University,
6-10-1, Hakozaki, Higashi-ku, Fukuoka City 812-8581, Japan.

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ABSTRACT

Consumer analysis was undertaken on preference for rice consumption in Brunei with the aim to study which attributes of rice consumers are valued. The specific methodological approach employed was Choice Model Technique which is used to evaluate non-market goods by eliciting people's stated preference for different options in a hypothetical setting. It is capable of eliciting respondent preferences for new products and outcomes that do not currently exist in the market place. The economic valuation in this study also involves consumer willingness to pay, which is defined as the maximum value of money that an individual contributed to equalize utility. Our analysis shows how it can yield invaluable information regarding consumer demand that can uniquely assist Brunei policy makers, particularly the government and farmers, in developing new domestic rice production, pricing and marketing strategies.

Key words: food self sufficiency, rice attributes, willingness to pay.

INTRODUCTION

Brunei Darussalam (hereafter Brunei) has relied too heavily on oil and gas as the country's income contributors since it was founded in 1929. Oil and gas contributed B\$M 2,600 or 63 percent in 1993 and B\$M 3,500 or 57 percent in 2003 to Brunei GDP (DEPD,2007a; DEPD,2007b). Although Brunei has enjoyed the wealth derived from these contributors for the past decades, it cannot rely on them perpetually to generate income as these non-renewable resources will eventually deplete in time. Thus, other alternatives of economic diversification must be put in place in order to alleviate the effects of depletion of the fore-mentioned non-renewable resources.

If economic growth on the whole, is not kept in pace with population growth, it will cause not only economic problems but also social unrest like in many developing and poor countries. Brunei's economy and growth rates are vulnerable to movements in global oil prices and fluctuations in the oil price making it difficult to predict long term prospects. The decline in oil price, for example, might reduce government revenues. Therefore, for these reasons the government has made vigorous effort to find alternatives from over reliance on these hydrocarbon resources (Tisdell,1998; Minnis,1997). The Brunei government sees agricultural development as one of the strategies toward economic diversification. It is one of the most important sectors because it also can provide food security in the country while having the potential to contribute greatly to the country's economy. The contribution of agriculture to Brunei GDP has increased in recent years, where it increased from B\$M 125 or 3.1% in 1993 to B\$M 180 or 3.7% in 2003 (Department of Agriculture, 2008). Food self sufficiency is an important agenda because Brunei imports a large bulk of overall food requirement from foreign countries. Natural disasters and political uncertainties in the producing countries might

affect food supply to the nation. For this reason, the government perceives that reaching self sufficiency in food production is crucial.

Although rice is the main staple food or traditional diet for Bruneians, domestic or local rice production is still at an unsatisfactory level. About 95 percent of domestic rice consumption is imported with about 3 percent of self sufficiency level (Department of Agriculture, 2008). Migration of rural labor to urban area to seek better livelihood, low production yield and high production cost are some of the main factors that hinder the development of the rice sector (Upex and Ulluwishewa, 2002). However, due to self sufficiency considerations, the government sees that the rice sector should not be just neglected. In addition, it has a potential to provide employment opportunities especially in the rural areas, hence easing the socio-economic pressure in the urban areas. Consequently, the government has aggressively carried out various programs and plans in order to increase rice production. It is the purpose of this study to assist and inform stakeholders like the government, policy makers, private sectors and farmers to determine what kind of rice is highly preferred by the Brunei populace by considering public demand has to be met and that local rice had to suit the taste of the population. Based in this interest, this study applied the Choice Modeling (CM) technique which identifies which attributes rice consumers value.

Most studies which examined consumer preferences on rice applied hedonic prices method to evaluate quality characteristics as well as welfare gains from improved quality under various assumptions. Unnevehr et al. (1992a) assembled the reports that used this method from various countries in Southeast Asia (except Brunei and Singapore) and Bangladesh with the aim to contribute to increased the understanding of the variation in rice quality (attributes) preference across countries and the role market incentives play in rice improvement.

Consumer preferences for quality rice vary from country to country. For example, Efferson (1985) mentioned that Japanese consumers prefer well-milled, very recently processed, short-grain Japonica rice and consumers in Thailand prefer well-milled, aged, long grain Indica rice. Middle East consumers generally prefer long-grain, well milled rice with strong aroma while European consumers prefer long-grain rice with no scent. Unnevehr and co-workers (1985) reported that consumers in the Philippines, Indonesia and Thailand have strong preferences on milling quality (fewer broken grain and more polished) with aroma. Although their preferences in shape and chemical attributes vary, consumers generally prefer intermediate amylose content.

In America, consumer preference for rice is associated with specific cooking, eating, processing characteristics and product uses (Webb et al, 1985). For example, traditional mild tasting long grain varieties are preferred for parboiled rice, quick-cooking rice, canned rice, canned soups, dry soup mixes, frozen dishes and other convenience products. On the other hand, traditional medium and short grain varieties are preferred as dry breakfast cereals, baby food and for brewing. Improvement in rice quality (such as size, shape, aroma, amylose content) is considered important because it enhances consumer welfare and expands market potential (Unnevehr et al., 1992b). If consumer welfare is enhanced through rice quality improvement at a lower price, consumers will demand more rice and producers may thus benefit from an expanded market.

It also important to note that consumer preference for quality rice is highly associated with standard of living (ability to pay) and per capita consumption of rice (Efferson, 1985). The higher the standard of living and the lower the per-capita consumption, the wider is the range of prices consumers will pay for difference in rice qualities. In contrast, the lower the standard of living and higher per-capita consumption, like in developing countries, the smaller the difference in prices consumer will pay. Therefore, as consumers living in this area prefer large volumes at a reasonable price, they will pay little attention to quality differences.

This study sought to assess consumer willingness to pay for local rice variety and determine the variation of rice attributes in demand between urban and rural consumers.

METHODOLOGY

Study Area

Brunei has a small population of 400,000 people and is divided into four districts namely Belait, Tutong, Brunei Muara and Temburong. However, this study was conducted in Brunei Muara and Temburong districts only. Although Brunei-Muara is the smallest districts in term of area with only 570 sq. km, it is the most populous where 66 percent (213,000) of the total population resides. The state capital, Bandar Seri Begawan, is located in this district and is also the centre of government and business activities of the country making it as the most important and bustling district. Temburong, on the other hand, is located in the eastern-most district in Brunei. It is an exclave, as it is separated from the rest of Brunei by Malaysia and Brunei Bay. The main town located in the district is Pekan Bangar which is accessible by boat from Bandar Seri Begawan. The district borders Brunei Bay to the north and Sarawak, Malaysia to the east, south and west. It has a population of 9,300 (2.9 percent) and covers 1,166 sq. km and a large number of the society are still involved in agricultural activity particularly rice farming as a part time job. Therefore, because of the socio – economic difference between the two districts, Brunei Muara district is considered as an urban area in this study, meanwhile Temburong district is the rural area.

This study compared urban consumer's preference with rural consumer's preference in relation to demand for local rice. This is to investigate whether comparison in consumer preferences in both areas could be significant because of their distinctness in socio-economic characteristics.

Analytical Framework

Data was collected through face to face interviews during the whole month of March 2008 and with the help of 7 research assistants (undergraduate students), where 138 rice consumers in the urban (Brunei Muara district) and 80 rice consumers in the rural (Temburong district) areas were interviewed. The survey was performed in various locations including supermarket, wet market and shopping complex in both rural and urban areas. These locations were chosen to ensure a random sampling encompassing a cross section of Brunei people and to survey consumers at the same place and time where actual purchase decisions were made, in order to better elicit their true preferences.

Respondents were randomly selected after their shopping activities and were first asked if they are willing to participate in this survey. If they agreed to participate then the survey objectives were explained to them. This is followed with an explanation of the questionnaire and the choice set. The first part of the questionnaire includes how willing the consumer wanted to pay for local rice if local rice is to be marketed. They were given dichotomous choice to vote 'yes' or 'no' to pay a kilogram of rice at a 6 different prices. The second part was choice modeling questions (Table 1).

In the choice set, respondents were presented with three options; Option A, Option B and Option C. They were required to choose one out of three options. Option A is local rice and Option B is imported rice. Option A and Option B are imaginary options meaning that combinations of attributes and levels in these options were changed in every set. This was done in order to investigate which attributes of rice consumer are valued. However, in Option C or status quo, the attributes and levels remain unchanged in every set. This option has the attributes and levels of imported rice which is consumed daily by Bruneians.

Table 1. A choice set sample used in the survey.

	A (Local Rice)	B (Imported Rice)	C (Actual Imported Rice)
Physical Appearance	Red + Long	Brown + Short	Bright White + Long
Texture	Glutinous	Non - Glutinous	Glutinous
Taste and Smell	Sweet + Aromatic	Sweet + Non - Aromatic	Tasteless + Aromatic
Health Hazard Awareness	Non - Organic	Organic	Non - Organic
Price	B\$1.70	B\$0.70	B\$1.20
I would choose (<input checked="" type="checkbox"/> one only)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Table 2 summarizes the attributes and levels that were used to create choice sets using $2^4 \times 4^2$ orthogonal effects design (Louviere et al., 2000) which produced 32 choice sets and were divided into 6 versions. CM technique requires the respondent to compare and select 1 option out of 3 in all the choice sets.

Table 2. Descriptions of attributes and levels used in the Choice Set.

Attribute	Description	Attribute Level
Physical Appearance	The color and size of rice grains	1) Bright white 1) Short 2) Brown 2) Long 3) Red 4) Purple
Texture	Condition of rice after cooking	1) Glutinous 2) Non - glutinous
Taste	Taste of rice after cooking	1) Sweet 2) Tasteless
Smell	Smell of rice after cooking	1) Aromatic 2) Non-aromatic
Health Hazard Awareness	Whether the rice is organically or non-organically produced	1) Organic 2) Non-organic
Price	Amount that consumer will pay for their preferred rice per kg	1)B\$0.80 3)B\$1.40 2)B\$1.10 4)B\$1.70

Choice modeling (CM) that used attribute based technique was first applied by Louviere and Hansher (1982) and Louviere and Woodworth (1983) in a report prepared by Adamowicz and co-workers (1998). This technique originated in market research and transport literatures and was recently applied to the environment (Bateman, 2002). CM is also a technique that used to value non-market goods, which is specifically rice attributes in this study. It involves eliciting people's stated preference for different options in a hypothetical setting. Therefore, being a stated preference technique, CM is capable of eliciting respondent preferences for new products and outcomes that do not currently exist in the market place. In CM, people are usually confronted with a series of choice questions that are characterized by specific attributes, levels and prices. Furthermore, consumers derive satisfaction not from the goods themselves but from attributes they provide (Lancaster, 1966). Therefore, one of the main contributions of CM is that it can identify what attributes are significant

determinants people has place on non-market good.

The options chosen by respondents in the CM can be modeled in random utility framework which can be expressed as the sum of systematic component (Adamowicz et al., 1994). The utility obtained by individual i from choosing alternative j in a choice set can be expressed as;

$$U_{ij} = V_{ij} + \varepsilon_{ij} = V(X_i) + \varepsilon_i \quad (1)$$

where V_{ij} is the component utility, X_i is the characteristics of the relevant good and ε_{ij} indicates error component. When the i-th respondent selects j, the utility of V_{ij} of the selected alternative j is higher than the utility V_{ih} of other alternatives, and its probability (π_{ij}) can be defined by equation below;

$$\pi_{ij} = Pr \{V_{ij} + \varepsilon_{ij} > V_{ih} + \varepsilon_{ih}; \forall h \in C_i\} \quad (2)$$

where C_i is the choice set for individual i. V_{ij} is a conditional indirect utility function and has a linear form,

$$V_{ij} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n \quad (3)$$

where $\beta_1 - \beta_n$ is vector of coefficient attached to the vector of attributes $X_1 - X_n$. Assuming that the error terms are Gumbel distributed, the probability of choosing option j is

$$\pi_{ij} = \frac{\exp(V_{ij})}{\sum_{j \in C} \exp(V_{ij})} \quad (4)$$

The marginal value of a change within a single attribute can be represented as a ratio of coefficients as follows;

$$MWTP = \frac{-\beta_{attribute}}{\beta_{monetary\ variable}} \quad (5)$$

Option C was coded as zero value and alternative specific constants (ASC) which were equal to 1, when either option A and B was selected. In this study, the software package LIMDEP 8.0 NLOGIT 4.0 (Greene, 2002) was used to estimate conditional logit model.

RESULTS

The demographic and socio-economic information of the respondents or consumers who participated in the survey both in the urban and rural areas are shown in Table 3. About 52.3 percent of the respondents or consumers were male and 47.7 percent were females and majority were confined within 31 to 40 years old. About 43 percent attained secondary school level, 30 percent high school or vocational level and the remainder 26 percent completed university level and beyond. About 37 percent of the respondents have household incomes of more than B\$3,000 and about 30 percent have household incomes between B\$1,500 to B\$3,000 as well as less than B\$1,500.

The percentage of respondents in the rural area who attained higher education was lower compared to those in the urban area and the percentage of rural households' income of less than B\$1,500 is higher than these urban respondents.

Because of the survey was conducted in a shopping complexes in both areas, most of respondents came with their family members. Therefore, all the questions like WTP, choice

experiment, statement agreement and so on presented in the questionnaire were discussed among the family members and the results represent the opinions of the household.

Table 3. Socio - economic characteristics of rice consumers in Brunei, 2008.

Category		Urban		Rural		Total	
		n	%	n	%	n	%
Gender	Male	70	50.7	44	55	114	52.3
	Female	68	49.3	36	45	104	47.7
Age	Below 20 years	4	2.9	2	2.5	6	2.75
	21 – 25	15	10.9	8	10	23	10.55
	26 – 30	34	24.6	7	8.75	41	18.80
	31 – 40	33	23.9	23	28.6	56	25.69
	41 - 50	29	21	26	18.8	55	25.22
	Over 51 years	23	16.7	14	17.5	37	16.97
Education	Secondary	54	39.1	40	50	94	43.12
	High school/Vocational	44	31.9	22	27.5	66	30.28
	University	40	30	17	21.5	57	26.15
Household Income	Below B\$1500	35	25	28	35	67	30.73
	B\$1500 – B\$3000	48	35	19	24	67	30.73
	Over B\$3000	55	40	33	41	81	37.15

Source; Survey data, 2008.

Household expenditures and consumption of local rice between urban and rural consumers indicate that there is not much difference in information between urban and rural consumers (Table 4). Each urban household had an average of 7.55 members and rural households had 6.85 members. Out of this total, about 5.36 members in each urban household and 5.56 members in rural household prefer to consume local rice. The survey also revealed that each urban household consumed an average of 25.27 kg of rice while rural household consumed 25.54 kg per month. Out of this total, each urban household bought an average of 8.87 kg of local rice while rural household purchased 9.27 kg per month. Generally, urban households spent about B\$37.25 while rural households spent B\$38.76 in buying rice per month.

Table 4. Rice expenditures and consumption per household per month in Brunei, 2008.

Category	Urban	Rural
Total rice consumption (kg)	25.27	25.54
Local rice bought (kg)	8.87	9.27
No. of persons per household	7.55	6.85
No. of persons consuming local rice	5.36	5.56
Expenses for rice (B\$)	37.25	38.76

Source: Survey data, 2008.

Local rice is quite unpopular among younger generations especially the children compared to

older generations. Some of the main reasons are because of the availability of imported rice and people are used to consume imported rice since their childhood. This could have an impact on the country's local rice production should the population prefer imported rice than local rice creating doubt if there is any interest to consume, should Brunei produce own local rice. However, when asked whether they are willing to buy local rice should it production increase, 83.33 percent of respondents in the urban area and 76.25 percent in the rural area claimed that they are willing to buy local rice (Table 5). This could bring in a positive sign that there are demands for local rice in the future and prospects for developments of rice industry in Brunei.

Table 5. Urban and rural percentage on tasting local rice and willingness to buy local rice in Brunei, 2008.

Item	Urban	Rural
Have tasted local rice (%)	91	95
Willing to buy (%)	83.33	76.25
No. of respondents	138	80

Willingness To Pay (WTP) can be defined as the maximum value of money that an individual contributed to equalize utility. It is also an indicator of a value that an individual is able to pay for a commodity. We are interested in establishing how much the consumers are willing to pay using the bid function approach. They were presented a dichotomous vote “yes” or “no” and were asked if they are willing to pay a kg of rice at bid level ranging from B\$0.70 to B\$2.00 per kg. This amount is expected to improve the socio – economic and living standard of the farmers and their families. Besides, it also can be used to improve rice output and quality. Both local rice and imported rice in Brunei are subsidized and sold in the market at B\$1.20 per kg. Interestingly, this study shows that the mean WTP is relatively higher even after the maximum bid price of B\$2.00 per kg (Figure 1 and Figure 2). Therefore, we can assume that from this result, both urban and rural consumers have the ability to pay more than the original price B\$1.20 and maximum bidding price of B\$2.

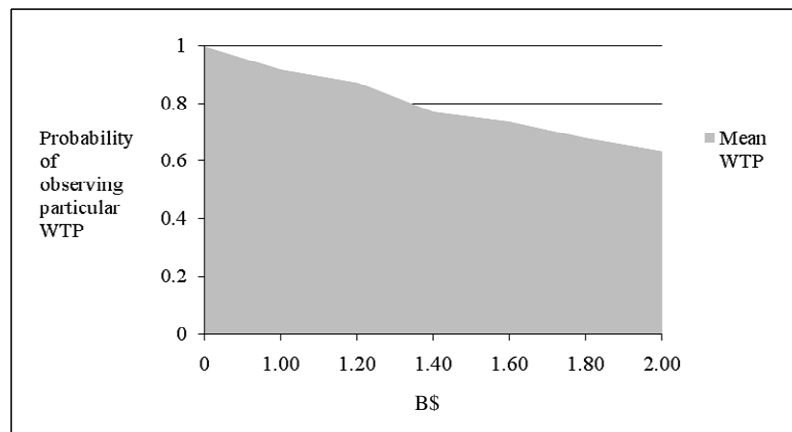


Fig. 1. Urban consumers WTP estimate for local rice in Brunei, 2008.

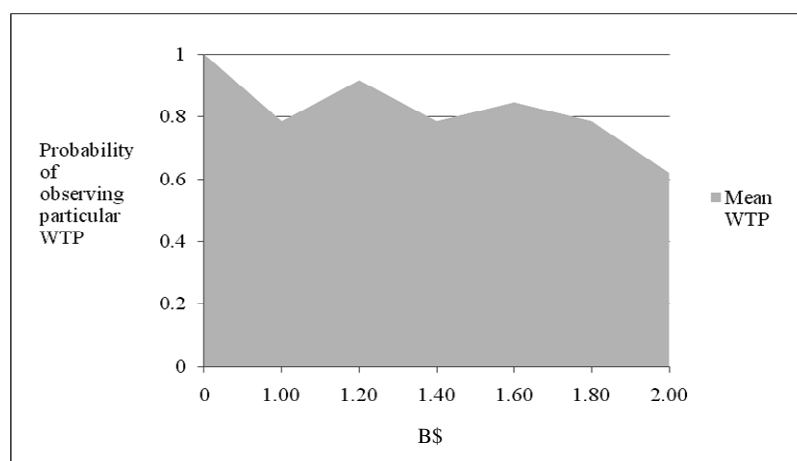


Fig. 2. Rural consumers WTP estimate for local rice in Brunei, 2008.

RESULTS AND DISCUSSION

Two attributes with four levels and three attributes with three levels were estimated using conditional logit model. Marginal willingness to pay for the preferred attributes was also estimated using equation 5. Attributes and levels were coded as shown in Table 6.

Table 6. Explanation of attributes and non-attributes in the Choice Model.

Variables	Attributes	Codes
ASC	Alternative Specific Constants	
WHITE	White	(1=White, 0=Brown)
RED	Red	(1=Red, 0=Brown)
PURPLE	Purple	(1=Purple, 0=Brown)
LONG	Long	(1=Long, 0=Short)
NGLUTIN	Non – Glutinous	(1=Nonglutinous, 0=Glutinous)
SWEET	Sweet	(1=Sweet, 0=Tasteless)
AR	Aromatic	(1=Aromatic, 0=Non-aromatic)
ORGNC	Organic	(1=Organic, 0=Non-organic)

A conditional logit model was specified and estimated from the choice data (Table 7). For urban consumers, most of the variables are found to be statistically significant at 1% and 5%. Only variables RED and SWEET are found to be insignificant indicating that these variables are not important to urban consumers. The statistical model indicates that variables WHITE, PURPLE, LONG, NGLUTIN, AR and ORGANC are factors which positively influence choice for urban households. PRICE is a negative factor as expected, where we predicted that consumers WTP is higher than the price stated.

On the other hand, about half of the variables are found to be significant at 1% and 5% in the rural consumer's estimate. Variables ASC, RED, PURPLE, LONG and AR are found to be insignificant, indicating that these variables are not important for rural consumers. The statistical model indicates that variables WHITE, SWEET and ORGNC are factors which positively influence choice for consumers in the rural. However, NGLUTIN variable showed a negative sign and was statistically significant indicating rural consumer's preference for glutinous rice. As expected PRICE variable showed a negative sign and was 1% statistically significant meaning that rural consumers do not prefer offered price in the options. From these results, rural consumers preferred rice that has these attributes: white, glutinous, sweet and organic.

In the conditional logit model, the coefficients cannot be directly interpreted as the direct effects of the respective explanatory variables on the probability of choosing each particular rice options. Rather, these represent the direct effects associated with each of the explanatory variables on the (unobservable) utility function which can be used to calculate the mean WTP for each attributes. In other words, each of the WTP estimates is calculated as the ratio of the coefficient associated with the attribute of Price coefficient. WTP for each attribute was calculated by using Equation 5 and the result is shown in Table 7. The confidence intervals for the different marginal WTP (MWTP) estimations were obtained following the procedure suggested by Hanemann and Kanninen (1999).

Table 7. Conditional logit model estimation for CM application.

Variables	Coefficient		MWTP		95% C.I	
	Urban	Rural	Urban	Rural	Urban	Rural
ASC	-1.1007**	-0.3292	-4.55	ns	(-7.37, -1.73)	
WHITE	1.3620**	0.8365**	5.63	4.49	(3.18, 8.08)	(0.79, 8.17)
RED	-0.1089	0.2058	ns	ns		
PURPLE	0.5322**	0.1353	2.2	ns	(1.57, 2.83)	
LONG	1.0760**	0.2606	4.45	ns	(2.49, 6.41)	
NGLUTIN	0.2543*	-0.3290*	1.05	-1.76	(0.18, 1.92)	(-3.48, -0.04)
SWEET	0.1176	0.2961*	ns	1.59	(-0.04, 3.22)	
AR	0.5588**	-0.059	2.31	ns	(1.21, 3.41)	
ORGNC	0.6906**	0.5855**	2.85	3.15	(1.60, 4.10)	(0.86, 5.44)
PRICE	-0.2417**	-0.1860**				
Log-likelihood	-751.87	-444.23				
Observation	737	425				

Note; ** and * indicate statistical significant at 1percent and 5percent respectively.

The MWTP indicates, for each attribute, the average amount of Brunei Dollar (B\$) that a person would prepare to pay, indefinitely, for an increase (decrease) of one unit in the attribute level. Urban consumers are willing to pay more for white rice, estimated at B\$5.63 than purple rice at B\$2.20. This could indicate preference for the former than the latter. The size of the rice grain which has significant utility for urban consumers is the second most favored attribute, with an associated WTP estimate of B\$4.45 for long rice. Increase in health concern or awareness as well as education are expected to be the main factors for consumers choosing organic rice, where it is the third preferred attribute with WTP estimate at B\$2.85. This is followed with the attributes aromatic, purple and non-

glutinous.

For rural consumers, they are willing to pay for rice that have white, sweet and organic attributes where WTP estimates are B\$4.49, B\$1.59 and B\$3.15, respectively. However, rural consumers are found not willing to pay for non-glutinous rice where MWTP estimate showed negative sign. This appears to support previous results that rural consumers prefer glutinous rice instead.

If we compare both urban and rural MWTP, results indicate that urban consumers have higher WTP for white attributes where MWTP estimate is B\$5.63 compared to B\$4.49. Urban consumers prefer non-glutinous attribute with MWTP estimate of B\$1.05 but rural consumers prefer glutinous attribute because non-glutinous MWTP shows a negative sign.

CONCLUSIONS

Our findings show an interesting point that consumers had the ability to pay more and the mean WTP exceeds the maximum bidding value at B\$2.00 while the current price of local rice is B\$1.20. This could contribute to immense policy implication on setting the price of rice especially on local rice. Besides, this amount can help to improve the farmer's socio - economic condition as well as their farm output and rice quality. It is observed that urban consumers prefer rice which has white, purple, long, non-glutinous, aromatic and organic attributes. They also demonstrate to have firm preference for white, long, and organic rice by observing the high amount of MWTP for these attributes. Meanwhile, rural consumers prefer rice which has white, glutinous, sweet and organic attributes. Rural consumers also show strong preference for white, sweet and organic rice by observing the high amount of MWTP for these attributes. Therefore, it is recommended that Brunei should produce rice that have these attributes.

This study also reveals that there is an increase in health awareness among Brunei consumers as health and food safety are priorities when choosing food. This information also can be used as a guide to develop the first organic rice in Brunei as there is great demand for organic rice.

One of the reasons why the price of WTP for local rice is yet to be determined is because of the small sample size. Therefore for future surveys, sample size should be increased to help understand the real WTP and assist policy makers on their decisions about the price of local rice. It is recommended that maximum WTP should be increased by B\$2.00 because results show that consumer's mean WTP is higher than this price. Therefore, for the median WTP to be known, it is recommended that in a future study, bidding price should be greater than B\$2.00.

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