

## Valuing Attributes of Fluid Milk in Laos\*

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This study estimates the random utility function of fluid milk using 1,165 survey responses in Laos. It finds that both products' attributes and individual characteristics affect consumers' preference for the milk and the hypothetical brand of Laos-Korea has a potential compared to four real dairy products. Results also show that calories have a positive relationship with consumer's preference while the price and fat content have a negative one. The decision for choosing each brand is significantly affected by individual characteristics such as gender, age, whether or not respondents live with their children, the level of education, income, the frequency of purchasing milk per week, and the region where they live. The preference for five brands appears in the order of Foremost, Nabong, Thai-Danish, Meiji, and Lao-Korea, and probabilities of purchasing each brand at the mean level are 30.9%, 17.48%, 21.48%, 15.0% and 10.39%, respectively. Nabong that was Lao national milk brand still has a significant market power even though it was closed in 2008. The policies to promote milk industry by implementing its national milk brand again would be more effective if it focuses on the young generation, female consumers, families with children, quality of dairy products, and Vientiane capital areas.

*Keywords:* Laos, Consumer Preference, Fluid Milk, Conditional Logit, National Brand  
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## I. INTRODUCTION

The Lao People's Democratic Republic (Laos) is one of the most underdeveloped countries in Asia, and the lack of nutrients has been continuously issued throughout the National Socio-Economic Development Plan (NSEDP). In 2012, for instance, 27% of children under five years old showed a low level of body weight while 44% has malnutrition due to undernourishment according to the World Health Organization (WHO) and the Ministry of Health (MOH) of Laos. The 8th NSEDP (2016-2020) emphasizes on providing food supplements including milk to children at schools as well as promoting value-added livestock industry (MPI, 2015). Previously, Lao government had managed the national milk brand, Nabong, to boost its milk industry but it failed due to lack of business capacity in 2008. Understanding consumers' preference for dairy products can be useful for enhancing business capacity when Lao government considers its national milk brand again as a public business sector in the future.

On the other hand, one early study indicates that national brand is reflected and changed over time through product image (Nagashima, 1977). The national brand image usually depends on the culture which incorporates economic development, education, economic size, population, and political situation (Forgas and O'Driscoll, 1984). As many projects from international donors, so called, official development assistance (ODA) has been actively undertaken, such activity can play a significant role in creating donors' brand image to consumers. That is, ODA can be linked with private sectors that want to promote their market capacity to other countries. An empirical study (Kim and Lee, 2010) has also proven to have positive effects of ODA on the formation of Korean national brand especially with the intention to visit Korea and purchase Korean products from recipient countries.

The primary purpose of this research is to find out which factors can affect significantly on consumers' behavior of buying milk products using brand images with basic information including price, calories and fat content, which has never been done before in Laos. More specifically, it estimates the value of attributes of fluid milk and consumers' characteristics comparing four real products (Foremost, Nabong, Thai-Danish, and Meiji) to one hypothetical product (Laos-Korea) assuming that the willingness to pay for the one would reveal a latent brand power of Korea in Laos. Also, the study can touch on indirect effects of Korea's aid to Laos by

adding the name of Lao-Korea in milk brands and comparing it with other milk brands existed in the current market.

It can be essential and needed for developing dairy industry by focusing on demand side so that this study explores factors affecting consumers' decision on milk products through market research in Laos. There is similar market research of finding factors for dairy products. Turkey, for instance, where most households consume raw milk, researchers find that the income and education have a positive relationship with the consumption of pasteurized milk, that is promoted by the government while the number of households and age of household head have a negative one (Tiryaki and Akbay, 2010). In the region of Qingdao in China, consumers prefer pasteurized milk to low-fat milk and low-fat milk to fresh milk. There are four important attributes such as butterfat, processing methods, tastes and prices for purchasing dairy products, and female consumers like raw milk compared to males, and the old is more sensitive to the fat contents than the young (Bai et al., 2007). Therefore, Understanding Lao consumers' recognition of milk brands including its national brand, Nabong, that is not available in the current market can be substantial if Lao government retries to have its national milk brand again in the market.

To respond to this research agenda, major factors that affect consumers' preference for dairy products are examined first by implementing the pretest based on previous literature. Preparing survey questionnaires considering price endogeneity problem and communicating with Lao customers is essential for collecting reliable data. Thus, a randomized block design for levels of attributes and research cooperation with National University of Laos (NUOL) has been done in advance and then survey is implemented in three big cities such as Vientiane, Luang Prabang, and Pakse.

The main finding is that the price, the brand, the amount of calorie and butterfat content are the most important factors when consumers decide to purchase fluid milk in Laos, which is similar to previous research (Bai et al., 2007; Tiryaki and Akbay, 2010). Lao consumers prefer existing brands to a hypothetical one in the order of Foremost, Nabong, Thai-Danish, Meiji, and Lao-Korea. Moreover, previous national brand, Nabong still has a market power. This study has its uniqueness in a sense that it provides parts of fluid milk information and consumers' awareness of their dairy products in Laos.

This paper is organized as follows. First, the survey design is explained with attributes and levels of factors for dairy products including random block assignment.

Second, survey procedure and questionnaires are studied including summary statistics. Third, results from conditional logit estimation will be discussed with probabilities of buying each brand at the average level. Finally, policy implications to promote milk business by Lao government will be suggested to speed up its national goals for achieving economic development.

## II. SURVEY DESIGN AND DATA DESCRIPTION

### *1. Survey Design*

Based on in-depth interviews with the sale staffs on the market in the Vientiane capital in the spring of 2015, there are three popular milk brands, which are the Foremost, the Thai-Danish, and the Meiji, and all are imported from Thailand. Consumers in Laos are still aware of their national dairy brand of Nabong even though it was closed in 2008 since it had been marketed for more than ten years. The Lao-Korea is the hypothetical milk brand that is assumed to have a potential brand power resulted from Korea's aid activities in Laos. As a result, five milk brands are compared with one another for valuing attributes of fluid dairy products as well as consumer's characteristics.

The prior 127 consumers' survey conducted in May 2015 results in 4 superior attributes, namely, brands, prices, calories, and butterfat in the order of importance among ten possible attributes of milk products. Comparing prices to calories, men prefer prices to calories while females prefer calories to prices on average. However, there is such a limit as the high participation rate of those between 15 and 19 years old and those in their 20s in the previous survey. Contrary to consumer's preference of milk-processing method in China done by Bai et al. (2007), Lao consumers do not consider that they distinguish the sterilized milk from the pasteurized milk since most products are sterilized milk with a long shelf life in Laos due to the lack of the cold chain management.

As shown in Table 1, five levels for each attribute are considered based on the results of the pretest. For the choice experiment, total combinations of three attributes with five levels are 125 profiles ( $5^3$ ) in the full factorial design assuming

the brand being fixed in the questionnaire. Price ranges from 2,000 to 6,000 kip<sup>1</sup> for one small pack, a calorie from 110 kcal to 190 kcal per a pack, and butterfat 0 g to 15 g per a pack. One small box of sterilized milk contains 200 ml in general in Laos.

Table 1. Attributes and Levels in Choice Experimental Design

Attributes	Levels
Price (kip/a pack)	2,000, 3,000, 4,000, 5,000, 6,000
Calorie (kcal/a pack)	110, 130, 150, 170, 190
Butterfat (g/a pack)	0, 4, 8, 12, 15

Blocking is one way of reducing total questions for each respondent without losing essential information from respondents since blocks are balanced partitions of choice questions usually with equal size focused on main effects, and it can eventually increase response efficiency (Johnson et al., 2013). Block randomization as one of a fractional factorial design can reduce sampling variability and ensure subgroups being available for separate analysis (Gerber and Green, 2012). For this survey in Laos, only ten questions are asked with the block randomization to keep their concentration on the survey.

There are five blocks as the minimum since it has complete 125 designs and only two blocks are used for this research shown in in Table 2. One possible limitation using two blocks would be over or under estimation of willingness to pay for each brand since it does not consider perfectly balanced design for each brand. However, it can still provide useful information regarding consumer's preference for each brand since it follows the random block assignment. For instance, the average price is 4,000 kip, average fat is 7.8 g and an average calorie is 150 kcal for both block A and B, which indicates that overall dispersion is quite balanced within the block at the mean level. When it comes to 10 questions for each person, the average price for Foremost, Nabong, Thai-Danish, Lao-Korea, and Meiji are 3,700, 4,200, 4,100, 4,100, and 3,900 kip, respectively, which is slightly different from the average but still within a certain range.

<sup>1</sup> 8,000kip corresponds to USD 1\$ approximately.

Table 2. The Composition of Attributes for 10 Questions with Two Blocks

Attributes	Questions									
	1	2	3	4	5	6	7	8	9	10
	Block A					Block B				
Foremost										
Price	2,000	4,000	4,000	4,000	5,000	2,000	2,000	5,000	6,000	3,000
Fat	0	8	15	4	8	4	8	4	8	4
Calorie	110	150	190	110	170	130	190	170	170	110
Nabong										
Price	4,000	6,000	6,000	3,000	2,000	3,000	5,000	4,000	5,000	4,000
Fat	0	0	8	0	4	15	15	8	0	12
Calorie	170	150	190	190	150	190	130	130	190	190
Thai-Danish										
Price	3,000	5,000	3,000	4,000	6,000	6,000	2,000	4,000	5,000	3,000
Fat	8	0	4	12	4	4	12	0	12	8
Calorie	110	130	170	130	130	190	170	110	150	150
Lao-Korea										
Price	3,000	5,000	3,000	5,000	6,000	6,000	2,000	4,000	2,000	5,000
Fat	12	15	15	4	12	0	0	15	15	8
Calorie	150	150	130	190	170	130	150	170	110	110
Meiji										
Price	5,000	2,000	2,000	6,000	2,000	3,000	6,000	3,000	4,000	6,000
Fat	12	15	12	15	8	0	15	12	4	12
Calorie	110	170	190	110	130	170	150	130	150	110






## 2. Survey Procedure and Questionnaire

The survey was carried out between July 8th and August 18th, 2015 by targeting total 1,200 people with 400 people in each of the three biggest cities, Vientiane, Pakse and Luang Prabang in Laos supported by the students from the college of agriculture at National University of Laos (NUOL).

Each question has six choices with four real brands, one hypothetical brand, and the case of not choosing any name shown in figure 1. The order of each brand is identical for all respondents, and the level of attributes for each brand is changed based on the random assignment from Table 2. Since the milk size is the same for each brand, a typically sterilized milk with the size of 200 ml is assumed. Price

information is right above the check box considering that consumers' final decision would be much more affected by price information than the others such as fat and calorie content. Here, both Nabong and Lao-Korea are not in current market while Nabong was Lao national milk brand before. Lao-Korea is the hypothetical one that is assumed to have a potential brand power from the bilateral cooperation between Korea and Laos.

Figure 1. An Example of Survey Questionnaire for Milk in Laos

Q.1						None:  I Would not Purchase any of these Products
	Fat: 0g Kcal: 110	Fat: 0g Kcal: 170	Fat: 8g Kcal: 110	Fat: 12g Kcal: 150	Fat: 12g Kcal: 110	
	<input type="checkbox"/> 2,000 kip	<input type="checkbox"/> 4,000 kip	<input type="checkbox"/> 3,000 kip	<input type="checkbox"/> 3,000 kip	<input type="checkbox"/> 5,000 kip	

### 3. Demographics and Consumer's Profile

Table 3 provides summarized statistics for necessary information obtained from the survey. A total 1,165 respondents participated in the survey<sup>2</sup>. There are total 69,900 observations since each consumer responds to 10 questions with six choice options. There are three attributes which include the price, the calorie and the butterfat as well as individual characteristics such as gender, age, whether or not to have kids in their family, the level of education and income, previous consumption behavior, and location where respondents are living. For the gender, 36% of those participants are men while 64% are women. The average age of participants is 24.4 years, and people in their 20s are about 50%, and those in 30s are 21.5%. Respondents living with their children under the age of 12 are 59%. Also, 81% of the interviewees

<sup>2</sup> Data that we used comes from previous research (Kim and Lee, 2015) and it is re-evaluated by new methodology, which provides both products' attributes and consumers' characteristics more suitable than before.

are graduated from high school. The average income ranges from 500,000 to 1,000,000 kip and most people purchase milk once a week on average.

Table 3. Summary Statistics for Survey Respondents

Variables	Number of Observation	Mean	Std. Dev.	Min	Max
<b><i>Products Attributes</i></b>					
Brand (1 for Foremost, 2 for Nabong, 3 for Thai-Danish, 4 for Lao-Korea, 5 for Meiji, 6 for None)	69,900	3.5	1.7078	1	6
Price (1,000 kip) (0, 2, 3, 4, 5, 6)	69,900	3.3	1.9720	0	6
Fat (g) (0, 4, 8, 12, 15)	69,900	6.5	5.7082	0	15
Calories (kcal) (0, 110, 130, 150, 170, 190)	69,900	125	61.5769	0	190
<b><i>Respondents' Characteristics</i></b>					
Gender (1 for male, 0 for female)	69,840	0.36	0.48	0	1
Age (1 for 10s, 2 for 20s, 3 for 30s, 4 for 40s, 5 for 50s, 6 for 60s)	69,600	2.44	1.04	1	6
Kid (1 for household having kids, 0 otherwise)	69,540	0.59	0.49	0	1
Education (1 for completing secondary school, 0 otherwise)	69,180	0.81	0.39	0	1
Income (1 for less than 500,000, 2 for $\geq 500,000$ and $< 1,000,000$ , 3 for $\geq 1,000,000$ and $< 1,500,000$ , 4 for $\geq 1,500,000$ and $< 2,000,000$ , 5 for $\geq 2,000,000$ and $< 2,500,000$ , 6 for $\geq 2,500,000$ and $< 3,000,000$ , 7 for more than and equal to 3,000,000.)	69,720	2.80	1.82	1	7
Milk Consumption Frequency (0 for rare purchase, 1 for 1~2 times per week, 2 for 3~4 times per week, 3 for 5~6 times per week, 4 for daily purchase)	69,720	1.09	1.24	0	4
Region (1 for Vientiane, 2 for Pakse, 3 for Luangprabang)	69,900	1.9871	0.8208	1	3

The survey was carried out by having 400 people in each of the three cities with the target of 1,200 respondents in total. However, 20 errors occurred in Pakse, and 15 errors occurred in Luang Prabang.

Table 4 shows the selected frequencies of each brand from 1,165 respondents. Since ten questions were given to each person, the total frequencies would be 11,650. In the case of the frequency, Foremost shows the highest rate of 29.73%, followed by Thai-Danish (22.09%), Nabong (15.92%), Meiji (15.35%), and Laos-Korea (10.39%) given the level of attributes shown in Table 4.



Table 4. Selected Frequencies from 1,165 Respondents by Each Brand

	The Order of Questions										Total
	1	2	3	4	5	6	7	8	9	10	
Foremost	370 (31.76)	354 (30.39)	328 (28.15)	331 (28.41)	373 (32.02)	270 (23.18)	334 (28.67)	346 (29.70)	294 (25.24)	464 (39.83)	3,464 (29.73)
Nabong	209 (17.94)	165 (14.16)	144 (12.36)	283 (24.29)	191 (16.39)	159 (13.65)	177 (15.19)	111 (9.53)	243 (20.86)	173 (14.85)	1,855 (15.92)
Thai-Danish	271 (23.26)	265 (22.75)	351 (30.13)	229 (19.66)	227 (19.48)	262 (22.49)	200 (17.17)	316 (27.12)	225 (19.31)	228 (19.57)	2,574 (22.09)
Lao-Korea	81 (6.95)	99 (8.50)	106 (9.10)	122 (10.47)	109 (9.36)	132 (11.33)	207 (17.77)	148 (12.70)	107 (9.18)	100 (8.58)	1,211 (10.39)
Meiji	185 (15.88)	201 (17.25)	175 (15.02)	137 (11.76)	176 (15.11)	264 (22.66)	151 (12.96)	181 (15.54)	210 (18.03)	129 (11.07)	1,809 (15.35)
None	49 (4.21)	81 (6.95)	61 (5.24)	63 (5.41)	89 (7.64)	78 (6.70)	96 (8.24)	63 (5.41)	86 (7.38)	71 (6.09)	737 (6.33)
Total	1,165 (100.0)	1,165 (100.0)	1,165 (100.0)	1,165 (100.0)	1,165 (100.0)	1,165 (100.0)	1,165 (100.0)	1,165 (100.0)	1,165 (100.0)	1,165 (100.0)	11,650 (100.0)

Ratios for selected frequencies are in parentheses.

Since this research is based on the survey result of three big cities in Laos, comparing overall selected frequencies from Table 4 with real market share would be needed for the reliability of the survey. However, the current market information in Laos is not available so that conjecturing total selected frequencies with existing brand power in Thailand would be an alternative way since Thailand and Laos share a cultural and linguistic proximity even in the milk sector (Phoutthakeo et al., 2014).

According to the 2015 study about liquid milk with 286 participants in Thailand by Di-Marketing showed well-known brands of Foremost, Thai-Danish, and Meiji in order of their awareness (Di-onlinesurvey, 2015), which is similar to our overall selected frequencies in its ranking shown in Table 4. The Nabong dairy farm was started in 1985, rented by Nabong Farm Co., Ltd (NAFCO), the Lao-Swedish joint venture company in 1992 and established with a formal contract for 20-year lease between the company and Ministry of Finance (FAO, 2014). Therefore, total 15.92% would be possible considering its business history in Laos.

### III. ESTIMATION RESULTS: CONDITIONAL LOGIT APPROACH

Conditional logit model fits McFadden's choice model, which is a specific case of the more general conditional logistic regression model (McFadden, 1973). Table 5 shows results of estimating random utility function for milk preferences in Laos using the (alternative-specific) conditional logit model.

Price and fat content affect negatively on Laos consumers' utility while calorie content increases the utility, and those attributes are all significant at 1% level. The negative effect of the fat content on consumers' utility would be explained by the fact that there had been 44.8% decrease in sales of whole milk which contains total fat content while 30.0% increase in low-fat milk between 1966 and 1987 in the U.S.A. (Gould et al., 1990). The findings of both calories and fat content indicate that if Lao government wants to promote milk consumption, controlling fat content is more important than calorie content since willingness to pay for an additional fat content is -775.9 kip ( $1,000 \text{ kip} * -0.0270/0.0348$ ), which is much higher in the absolute value than 48.9 kip ( $1,000 \text{ kip} * 0.0017/0.0348$ ) of willingness to pay for an additional calorie.

When it comes to the personal characteristics, male consumers are less likely to prefer milk products than females on average except the hypothetical brand of Laos-Korea that shows indifference between males and females. It means that policy toward females for milk consumption would be more effective than males.

Regarding age groups, the utility is reduced when consumers are getting old. For instance, the utility for Foremost that is the most prevalent in Laos shows a negative relationship with the consumers of their 20s, 30s, and 40s compared to the 10s. It might be due to various substitutes for keeping their health status when people get old. This result also provides a thoughtful insight on the importance of policy toward young children when the government wants to increase milk consumption for their people's nutrition.

Table 5. Random Utility Estimation Using Conditional Logit Model

Parameters	Foremost	Nabong	Thai-Danish	Lao-Korea	Meiji
<b><i>Product's Attributes</i></b>					
Price (1,000 kip)			-0.0348*** (0.0076)		
Calories			0.0017*** (0.0004)		
Fat			-0.0270*** (0.0022)		
<b><i>Respondent's Characteristics</i></b>					
Constant	1.8904*** (0.1846)	1.3813*** (0.1989)	1.3411*** (0.1895)	0.8822*** (0.2093)	0.9848*** (0.1984)
Gender(Male dummy)	-0.2023** (0.0868)	-0.2197** (0.0929)	-0.2582*** (0.0896)	-0.0012 (0.0989)	-0.2487*** (0.0936)
20th	-0.4023*** (0.1347)	-0.1797 (0.1444)	-0.3457** (0.1392)	-0.0138 (0.1564)	-0.0641 (0.1458)
30th	-0.3032* (0.1621)	-0.1059 (0.1738)	-0.2102 (0.1669)	-0.0292 (0.1873)	-0.3299* (0.1764)
40th	-0.5017*** (0.1828)	-0.2940 (0.1975)	-0.3207* (0.1873)	-0.3700* (0.2169)	-0.6748*** (0.2027)
50th	0.2514 (0.2593)	-0.0011 (0.2846)	0.3960 (0.2638)	-0.0525 (0.3096)	-0.2210 (0.2889)
60th	0.6835 (0.4883)	0.1526 (0.5388)	-0.8337 (0.5229)	-2.0820* (1.1077)	-1.0531** (0.6505)
Kid	0.4657*** (0.0846)	0.1856** (0.0905)	0.4253*** (0.0872)	0.3175*** (0.0974)	0.3802*** (0.0911)
Education	-0.0062 (0.1067)	0.0598 (0.1149)	0.1015 (0.1103)	-0.0957 (0.1165)	0.0957 (0.1164)
Income	-0.0202 (0.0258)	-0.0046 (0.0280)	0.04547* (0.0264)	0.0169 (0.0300)	0.0720*** (0.0277)
Number of purchases per week	-0.2120*** (0.0316)	-0.1094*** (0.0338)	-0.1230*** (0.0323)	-0.1000*** (0.0367)	-0.0704** (0.0338)
Pakse	-0.0204 (0.1070)	-0.0187 (0.1115)	-0.04273 (0.1104)	-0.0017 (0.1184)	0.0832 (0.1136)
Luangprabang	0.0813 (0.1023)	-0.6687*** (0.1121)	0.08534 (0.1051)	-0.6961*** (0.1220)	-0.2097* (0.1107)
Observation :	68,700		Log Likelihood :		-18884.334
Wald Chi2 (63) :	732.65		Prob > Chi2 :		0.0000

Standard errors are in parentheses(\*\*\* p<0.01, \*\* p<0.05, \* p<0.1).

The level of education does not affect consumers' utility for fluid milk. However, consumers living with the children under the age of 12 tend to have a positive relationship with their utility compared to those without children. It indicates that parents recognize the importance of milk consumption for their kids and policy toward family with children would be more effective than those without kids. Consumers are less likely to enjoy their utility for fluid milk if they purchase it more per week, which indicates that Laos consumers are not satisfied with their current milk consumption. It might be the fact that the most common milk in Laos is sterilized one that is known as less tasty than the fresh milk.

Consumers with higher income tend to prefer Meiji and Thai-Danish rather than Foremost and Nabong. Fluid milk of Meiji and Thai-Danish are usually imported from Thailand. However, those have their national brand of Japan and Denmark, respectively and can be regarded as high-quality products. Laos consumers with high income do not prefer their national brand of Nabong, which means that having a national brand of the developed country might be a good starting point if Lao government promotes its national milk industry.

Compared to the consumers in Vientiane, those in Luang Prabang are less likely to have their utility for the brand of Nabong, Lao-Korea, and Meiji. In other words, consumers in Vientiane capital are more likely to buy milk products of Nabong, Lao-Korea and Meiji compared to the Luang Prabang. Thus, policy towards boosting milk business focusing on Vientiane capital can be more effective than other cities.

Regarding brand power, Foremost shows the highest level of preferences followed by Nabong, Thai-Danish, Meiji and Lao-Korea based on the estimates of constant for each alternative. That is, consumers are more likely to buy real milk products especially Foremost that is the most familiar brand in Laos. Consumers also show a strong preference for their national brand, Nabong on average even though it is not available in the current market, which means that Laos consumers have a tendency toward their national brand and Lao government has an advantage of having national milk company. This result can provide valuable insights on its national plan of the 8<sup>th</sup> NSEDP (2016~2020) for developing livestock industry in Laos.

Table 6 indicates marginal effects of both products' attributes and consumers' characteristics, which derived from the conditional logit model estimated from Table 5. Marginal effects can be calculated by making derivative of the probability

of each brand with respect to each attribute (Greene, 2003: 723). When the price increases by 1 unit (1,000 kip), odds of choosing a specific brand are expected to decrease by 0.74% for the brand of Foremost, 0.50% for Nabong, 0.58% for Thai-Danish, 0.32% for Lao-Korea and 0.44% for Meiji. Foremost is highly sensitive to the price changes while the hypothetical brand, Lao-Korea, is at the low level. When the butterfat increases by 1 unit (g), the probability decreases by 0.57% for Foremost, 0.38% for Nabong, 0.45% for Thai-Danish, 0.25% for Lao-Korea and 0.34% for the brand of Meiji. It seems that Laos consumers are more sensitive to fat content for Foremost and Thai-Danish than others. On the other hand, when the calorie increases by 1 unit (kcal), the probability increases by 0.04% for Foremost, 0.02% for Nabong, 0.03% for Thai-Danish, 0.02% for Lao-Korea and 0.02% for the brand of Meiji. It seems to be a quite similar across milk brands.

Table 6. Marginal Effects for Products' Attributes and Consumer's Characteristics

Parameters	Foremost	Nabong	Thai-Danish	Lao-Korea	Meiji
Price	-0.0074*** (0.0016)	-0.0050*** (0.0011)	-0.0058*** (0.0013)	-0.0032*** (0.0008)	-0.0044*** (0.0010)
Calories	0.0004*** (0.0001)	0.0002*** (0.0001)	0.0003*** (0.0001)	0.0002*** (0.0000)	0.0002*** (0.0001)
Fat	-0.0057*** (0.0005)	-0.0038*** (0.0004)	-0.0045*** (0.0004)	-0.0025*** (0.0003)	-0.0034*** (0.0003)
Gender (male dummy)	-0.0026 (0.0096)	-0.0045 (0.0079)	-0.0138** (0.0083)	0.0200*** (0.0061)	-0.0082 (0.0071)
Kid	0.0334*** (0.0093)	-0.0300*** (0.0078)	0.0145* (0.0080)	-0.0041 (0.0060)	0.0034 (0.0069)
Education	-0.0128 (0.0115)	0.0043 (0.0098)	0.0142 (0.0102)	-0.0130* (0.0074)	0.0091 (0.0090)
Income	-0.0023 (0.0027)	-0.0056** (0.0023)	0.0038 (0.0024)	-0.0011 (0.0018)	0.0066*** (0.0021)
Number of purchases per week	-0.0247*** (0.0037)	0.0040 (0.0031)	0.0019 (0.0031)	0.0033 (0.0024)	0.0092 (0.0027)
Probabilities at the mean level	0.3090	0.1748	0.2148	0.1039	0.1500

Standard errors are in parentheses (\*\* p<0.01, \* p<0.05, † p<0.1).

For individual characteristics, the probability of choosing each brand for males decreases by 1.38% for Thai-Danish and 2.0% for Lao-Korea over females. For those living with children under 12, the probability of selecting fluid milk increases by 3.34% for Foremost and 1.45% for Thai-Danish over those living without children while the likelihood of choosing Nabong reduces by 3.0%. In other words, parents with kids are more likely to buy Foremost and Thai-Danish and less likely to buy Nabong compared to the households without kids.

When the level of income increases by 1 unit (500,000 kip), the probability of choosing fluid milk decreases by 0.56% for Nabong while that of selecting Meiji increases by 0.66%. If consumers often purchase Foremost previously, the probability of repurchasing it decreases by 2.47%, and it depends on consumers' previous behavior, which means that Foremost did not have strong brand power even though it is quite popular in Laos.

Overall probabilities for selecting each brand at the average level of all explanatory variables are 30.9% for Foremost, 17.48% for Nabong, 21.48% for Thai-Danish, 10.39% for Lao-Korea, and 15.0% for Meiji. It demonstrates that the most popular fluid milk in Laos is Foremost, followed by Thai-Danish, Nabong, Meiji, and Lao-Korea, which is similar to frequencies for each brand shown in Table 4.

#### IV. CONCLUSION

This study has its uniqueness in a sense that it provides parts of fluid milk information and consumers' awareness of their dairy products in Laos, which has never done before in academic research. Based on the results, the price, the brand, the amount of calorie and butterfat content are the most important factors when consumers decide to purchase fluid milk in Laos. Based on the survey conducted in 2015, the price affects negatively to consumers' utility, which is reasonable and intuitive compared to previous research done in China and Turkey. The amount of fat reduces consumers' utility on average, which means that consumers prefer low fat to high fat from fluid milk. Increasing the amount of calorie can provide more utility for consumers as it is a source of energy. Since willingness to accept for an additional fat content is much higher than a willingness to pay for an extra calorie in the absolute value, focusing on fat content is more important than calorie if Lao government wants to promote fluid milk consumption for enhancing people's nutrition.

When it comes to brand power, consumers prefer existing brands to a hypothetical one in the order of Foremost, Nabong, Thai-Danish, Meiji, and Lao-Korea. The probability of buying the hypothetical product of Lao-Korea is 10.39% at the mean level of other explanatory variables, which indicates that there exists a potential brand power due to the impact of Korean wave in Laos.

Laos national brand, Nabong still has a market power with the probability of 17.48% on average compared to others although it is not available in the current market. Therefore, the effect of policy toward promoting livestock and dairy industry promulgated in the 8<sup>th</sup> NSEDP (2016~2020) would be accelerated if the government project for enhancing that industry is linked to their previous national brand. Moreover, since consumers prefer only Meiji when their income increases based on its marginal effect, it is better to look into its quality and market strategy of that brand when Lao government establishes their national brand again in the market.

Individual characteristics such as income, the gender, whether or not respondents to live with children, the frequency for purchasing fluid milk per week, age, and location are also significant factors for consumers' preference. Females tend to increase their utility when they buy fluid milk compared to males. People living with children are more likely to buy fluid milk compared to those without children. Consumers are less likely to enjoy fluid milk if they often purchase it on average. Consumers' utility decreases when they become old due to the high possibility of having other various sources for their nutrition. Consumers living in Vientiane capital would be more likely to buy fluid milk of Nabong, Lao-Korea and Meiji compared to the Luang Prabang. Therefore, the policies to promote milk industry by implementing its national brand would be more effective if it focuses on the young generation, female consumers, families having children, quality of dairy products, and Vientiane capital areas.

## *REFERENCES*

- Bai, J., Wahl, T. and P. Wandschneider. 2007. Valuing Attributes of Fluid Milk Using Choice-Based Conjoint Experimental Design. Paper Presented at the American Agricultural Economics Association Annual Meeting on July 29 - August 1, Portland, Oregon.
- Di-onlinesurvey. 2015. Liquid Milk Usage in Thailand, Retrieved from Slideshare. <<https://www.slideshare.net/dimvn/dim-072015-milk-report-thai>> (accessed May 2, 2017)

- Food and Agriculture Organization (FAO). 2014. Report of the Thirty-eighth Session of the Animal Production and Health Commission for Asia and the Pacific. A Report Presented at 38<sup>th</sup> of APHCA on 3-7 November. 2014, Chiang Mai, Thailand.
- Forgas, J. P. and M. O’Driscoll. 1984. “Cross-Cultural and Demographic Differences in the Perception of Nations,” *Journal of Cross-cultural Psychology*, vol. 15, no. 2, pp. 199-222.
- Gerber, A. S. and D. P. Green. 2012. *Field Experiments: Design, Analysis, and Interpretation*. New York: W.W. Norton & Company, Inc.
- Gould, B. W., Cox, T. L. and F. Perali. 1990. “The Demand for Fluid Milk Products in the U.S.: A Demand Systems Approach,” *Western Journal of Agricultural Economics*, vol. 15, no. 1, pp. 1-12.
- Greene, W. H. 2003. *Econometric Analysis*. 5th Ed. New Jersey: Pearson Education.
- Johnson, F. R., Lancsar, E., Marshall, D., Kilambi, V., Muhlbacher, A., Regier, D. A., Bresnahan, B. W., Kanninen, B. and J. F. P. Bridges. 2013. “Constructing Experimental Designs for Discrete-Choice Experiments: Report of the ISPOR Conjoint Analysis Experimental Design Good Research Practices Task Force,” *Value in Health*, vol. 16, no. 1, pp. 3-13.
- Kim, Y. and H. Lee. 2010. “The Study on the Influence of ODA on Nation Brand Equity,” *Korean Journal of Advertising*, vol. 21, no. 2, pp. 25-51. (in Korean)
- Kim, T. and J. W. Lee. 2015. Laos Consumer’s Preference on Milk Products, *Southeast Asia: Strategic Regional Depth Research I*. Korea Institute for International Economic Policy. Ch. 4. pp. 172-203. (In Korean)
- McFadden, D. 1973. Conditional Logit Analysis of Qualitative Choice Behavior. In Zarembka, P. (eds.) *Frontiers in Econometrics*. New York: Academic Press.
- Ministry of Planning and Investment (MPI). 2016. The 8<sup>th</sup> National Socio Economic Development Plan (2016-2020). Lao PDR.
- Nagashima, A. 1977. “A Comparative “Made in” Product Image Survey among Japanese Businessmen,” *Journal of Marketing*, vol. 24, no. 3, pp. 95-100.
- Phouthakeo, P., Otsuka, K., Ito, C., Sayamoungkhoun, P., Kounnavong, S. and M. Jimba. 2014. “Cross-border Promotion of Formula Milk in Lao People’s Democratic Republic,” *Journal Pediatrics and Child Health*, vol. 50, no. 1, pp. 51-56.
- Tiryaki, G. Y. and C. Akbay. 2010. “Consumers’ Fluid Milk Consumption Behaviors in Turkey: An Application of Multinomial Logit Model,” *Quality and Quantity*, vol. 44, no. 1, pp. 87-98.

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