Consumers' attitudes and willingness to pay for safer milk in Malawi

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Abstract:

This paper aims to contribute to the scarce literature on consumers' preferences and willingness to pay (WTP) for safer foods in Sub-Saharan Africa(in general) and in particularly Malawi. The results, from face to face interviews carried out in Malawi with urban consumers, showed that the majority of consumers prefer to buy raw milk and boil it before consumption. Nonetheless, 38% consumers opted for the ultra-pasteurized milk that is safe to consume without boiling but is significantly more expensive. Consumers were found to be willing to pay a price premium for safe milk which was significantly higher than the retail price premium. The results also showed that consumers' preferences and willingness to pay for safer milk are not only determined by consumers' socio-demographic characteristics but are also affected by consumers' attitudes, consumption habits and purchase habits of milk and other dairy products. Therefore, taking into account consumers' preferences and habits is crucial to boost the demand for safer milk in countries where the consumption of unsafe foods is still a major threat to the population life.

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1. Introduction

In recent years, a number of extremely serious foodborne disease outbreaks such as Cholera, avian influenza and diseases caused by Salmonella, Campylobacter, and Escherichia coli, have occurred on every continent. Foodborne diseases outbreaks have devastating health consequences in both developed and developing countries. According to the World Health Organization (WHO), foodborne and waterborne diarrhoeal diseases kill about 2.2 million people annually, 1.9 million of them are children and most of whom are residing in developing countries (WHO, 2010). In addition, foodborne diseases can have major economic impacts. For instance, a large proportion of households' incomes can be lost as a result of a decrease in the productivity of ill individuals and the increase of their expenditures on medical care. The country's economy can be badly affected as a result of high costs of investigating and controlling outbreaks, losses of foreign exchange when exported foods are rejected and losses of revenues when key sectors such as tourism are hit by serious food scandals.

Even though, the contamination of foods can occur at any level of the food supply chain. It is now accepted that many cases of foodborne illness occur as a result of improper food handling and preparation by consumers (Scott, 1996). Raw foods such as dairy products, meat, fish, selfish, fruits and vegetables are considered as the major sources of foodborne pathogens into the home (Scott, 2003). Milk that is widely known as an excellent source of energy and nutrients could, however, be a potential medium for bacterial growth and an important source of bacterial infection when consumed without pasteurization. All over the world, there are regulations that require proper hygienic handling of milk and its pasteurization. However, such regulations are not usually adhered especially in countries (e.g. Sub-Saharan countries) where the milk is mainly marketed informally[1] without being hygienically checked up and where many households do not have access to refrigeration facilities to safely conserve the milk.

It is true that thoroughly heating and consuming the raw milk right away is likely to eliminate most microbiological hazards. Nonetheless, the effectiveness of boiling milk before consumption is significantly reduced if the raw milk is kept unrefrigerated for several hours, which is probably the case of the raw milk sold in informal market. In fact, the bacteria "Staphylococcus aureus", a major cause of milk borne intoxications, multiplies into millions of cells within a few hours, producing Staphylococcal toxins that are resistant to heat and cannot be destroyed by cooking (Medveďová, 2009; Roesel and Grace, 2015). Ultra-pasteurized milk or ultra-high-temperature (UHT) milk[2], which is the type of milk that has

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[1] Roesel and Grace (2015) reported that in Kenya, Cote d'Ivoire, Uganda and Mali, raw milk sold by vendors and small-scale retailers account for 80%, 90%, 90% and 98% of the marketed milk.

[2] The raw milk is heated to approximately 135°C for just two seconds and then chilled down rapidly, resulting in milk that (1) is 99.9% free from bacteria, (2) has an extended shelf-life of up to three times the length pasteurized milk (heated to 72°C for 15 seconds), and (3) provides the same wholesome, quality of raw milk.

the lowest level of bacteria and toxins and longest shelf life, could be a solution to minimize the risk of milk intoxications in regions such as Sub-Saharan Africa.

It is possible that in regions like Sub-Saharan Africa, the convenience of long shelf life of UHT milk could be undeniable especially by households residing in urban and pre-urban areas. Unfortunately, data on consumers' preferences and demand for UHT milk in Sub-Saharan Africa that can confirm or revoke this hypothesis is non-existent. To the best of our knowledge, only five papers on the demand for milk in Sub-Saharan Africa have been published so far (Jansen, 1992; Mdoe and Wiggins, 1996; Agboda, 2003; Balagtas et al., 2006; Ecker and Qaim, 2011). None of these studies assessed consumers' preferences, attitudes and willingness to pay (WTP) for UHT milk. To fill this gap, we conducted a survey in the two biggest Malawian cities (i.e. Lilongwe and Blantyre) to identify, among others: (1) the main barriers/incentives to the purchase and consumption of raw, pasteurized and UHT milk, (2) consumers' purchase and consumption habits of the different type of milk, (3) consumers' preferences for safer milk, and (4) consumers' WTP for raw, pasteurized and UHT milk as well as the determining factors of their WTP for a safer milk.

2. Data collection

To assess urban consumers' preferences and WTP for safer milk in Malawi, face to face questionnaires were administered on 104 randomly-selected residents in Lilongwe and Blantyre in June 2013. Respondents' socio-demographics are displayed in Table. In comparison with the 2008 Malawian Population and Housing Census Estimates, the sample statistics show that the study over-represented respondents with secondary and university level of education and under-sampled female respondents. During the administration of the questionnaires, we noticed the clear reticence of females to be interviewed compared with males. Also because the interviewers were English speakers, consumers with none or low school studies found it difficult to complete the questionnaire[3]. It is noteworthy that we used a small sample size compared with what would be the size of a representative sample of the Malawian population. However, the main objective of this study is to gain insights on consumers' preferences and willingness to pay for safe milk in urban Malawi and not to produce country-wide estimates.

Respondents were asked to answer 21 questions about various aspects related to their preferences and WTP for different types of milk with the purpose of characterizing the sample and analysing their attitudes and purchase habits. This information was then used to determine the major factors that influence their preferences and WTP a price premium for UHT milk. The questionnaire was structured in four parts. The first part was intended to capture consumers' purchase and consumption habits of milk. For instance, respondents were requested to report whether they consume milk or not, the main reasons for consuming/not consuming milk, the frequency of milk consumption, the types and quantities of the consumed milk, the places where they habitually purchase milk, and the most important factors they consider when buying milk etc.

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[3] In total we interviewed 142 people. Thirty eight questionnaires were discarded because respondents could not complete the questionnaire or answer some of the key questions.

In the second part, respondents were provided with a single choice set (see figure 1) that consists of four options and were asked to indicate the option they prefer most. The first option is a raw milk that is soured (not safe) and priced at 50 Malawian Kwacha (MWK) per litre. The second option is a raw milk that would be safe to consume if it is boiled and it is offered at a price of 150 MWK per litre. The milk offered as a third option is an ultra-pasteurized milk that is safe to consume without boiling and is priced at 700 MWK per litre. Since it is not realistic to force respondents to choose one of the first three options of milk, we included a fourth option generally called "no choice option" and which the respondent can choose if she/he does not like any of the three types of milk described in the first three options. The objective of including this choice set in the questionnaire is (1) to see how consumers trade off safety and price and (2) to assess the key determinants of respondents' decision to choose the safest but the most expensive milk (I.e. UHT milk).

In the third part of the questionnaire, respondents were asked to report their maximum WTP for 500 ml of fresh milk, 500 ml of UHT milk, 500 g of powdered milk, and 500 g of condensed milk. In addition to finding out whether consumers are willing to pay a price premium for UHT milk, we also used the data collected in this part of the questionnaire to assess the determining factors of consumers' WTP for UHT milk.

Finally, in the fourth part, respondents were asked to report information about their socio-demographic characteristics such as; age, gender, education and income level, household size and the number of children in the household.

3. Data analysis

Regarding the analysis of the data, we first carried out a descriptive analysis to gain insights on respondents' consumption and purchasing habits of milk as well their preferences and WTP for safer milk. Then we estimated a Probit model to assess the key factors that explain respondents' decision for choosing safe milk (i.e. third option in the choice set). Probit is a binary data model for dependent variables that take two possible values:

$$y_i = \begin{cases} 1 & if \quad \text{respondent i chose option 3 (UHT milk)} \\ 0 & if \quad \text{respondent i chose option 1, 2 or 4} \end{cases}$$

In the case of the Probit model, the probability that respondent i chose option 3 is specified as follows:

$$p_i = \Pr[y_i = 1 | x_i] = \Phi(\beta x_i)$$

where x_i are the explicative variables that are described in table 2. $\Phi(.)$ is the cumulative distribution function of the standard normal distribution, so p_i is equal to:

$$p_i = \int_{-\infty}^{\beta x_i} \frac{1}{\sqrt{2\pi}} e^{-\frac{z^2}{2}} dz$$

We estimated the parameters β maximizing the joint log-likelihood function, written as:

$$lnL(\beta) = \sum_{i=1}^{n} \left(y_i ln\Phi(\beta x_i) + (1 - y_i)ln(1 - \Phi(\beta x_i)) \right)$$

Results from the estimation of the Pobit model are displayed in Table 3.

To assess the determining factors of the price premium that respondents revealed to be willing to pay for UHT milk (i.e. the dependent variable), we estimated a Tobit model. We opted to estimate the Tobit model because the price premium was found to be censored at zero. In fact we found that 24% of the observations were equal to zero. We specified the Tobit model as follows (Amemiya, 1984):

$$y_i = \begin{cases} y_i^* & if \ \ y_i^* > 0 \\ 0 & if \ \ y_i^* \leq 0 \end{cases}$$

$$y_i^* = x_i\beta + \varepsilon_i \qquad \forall i = 1, \dots, N$$

where i indexes cross-section units such that i = 1, 2, ..., N (N is the number of respondents). The matrix x_i is of dimension (N x K) and contains data on the observable explanatory variables of the model. The descriptions of the explanatory variables considered in the estimation of the Tobit model are given in Table 4. y_i is the dependent variable and is equal to respondent's WTP for UHT milk minus respondent's WTP for fresh milk. β is a vector of parameters to estimate. ε_i capture the stochastic disturbances of the model. We estimated the parameters β maximizing the joint log-likelihood function, written as:

$$lnL(y, \beta, \sigma_\varepsilon^2) = \sum_{i:y_i=0} log\left[1 - \Phi\left(\frac{\beta x_i}{\sigma_\varepsilon}\right)\right] - \frac{N_1}{2} log(\sigma_\varepsilon^2) - \frac{2}{2\sigma_\varepsilon^2} \sum_{i:y_i>0} (y_i - \beta x_i)^2$$

Where $\Phi(.)$ is the cumulative distribution function of the standard normal distribution and N_1 is the number of observations for which $y_i > 0$. Results from the estimation of the Tobit model are displayed in Table 5.

4. Results and discussion

In this section, we will first present and comment on the results from the descriptive analysis of respondents' purchase and consumption habits of milk products. Respondents' preferences for safer milk and the determining factors of choosing it will then be presented and discussed. Finally, results on respondents' WTP for milk products and the key factors that were found to affect the price premium they are willing to pay for UHT milk will be described and discussed.

4.1. Respondents' consumption and purchase habits

The results show that 96% (93%) of respondents are consumers (buyers) of milk. These respondents reported to purchase and/or consume milk because: (1) "it is a nutritious food", (2) "it is necessary for a healthy growth of children", (3) "it is a good source of energy", (4) "they use it to prepare coffee and other foods", and (5) "they grew up in a household whose members are consumers of milk". On the other hand, non-buyers and/or non-consumers of milk revealed that the high retail price and the non-availability of milk in the grocery shops they frequent most are the main barriers for purchasing and/or consuming milk.

Furthermore, the results show that 39%, 27%, 18%, 9% and 7% of respondents reported to consume milk daily, three days a week, two days a week, one day a week and one day every two weeks, respectively. Regarding the types of milk consumed by respondents, 65%, 53%, 45%, 28% and 23% were revealed to consume powdered milk, UHT milk, pasteurized milk, condensed milk and raw milk respectively. We also asked respondents about their households' weekly consumption of milk and they reported an average of 0.867 litres of raw milk, 1.317 litres of pasteurized milk, 1.476 litres of UHT milk, 398g of powdered milk and 92g of condensed milk. It is noteworthy that these levels of milk consumption are significantly higher than the numbers reported by Tebug (2012) who estimated the annual consumption of milk in Malawi to vary between 4 and 6 litres per capita per year. However, these two figure are not comparable as the latter is an aggregated estimation obtained by approximating the total supply of milk (domestic and imported) and dividing it by the population.

As regards to the places where respondents habitually buy milk, 59%, 19%, 29%, 13%, 14%, 1% and 1% buy milk from supermarket, mini-supermarket, urban small shops, rural shop, farmer, street vendors, and bulking groups respectively. Furthermore, yogurt, Ice cream, margarine and chambiko were mentioned by respondents as the other mostly purchased dairy products. Respondents also mentioned that safety, price, origin (locality of the product) and the brand name of milk are respectively the first, the second, the third and the fourth key determinants of their choice decision when buying milk.

4.2. Respondents' preferences for safer milk

The results from the descriptive analysis showed that 62% of respondents chose the second option in the choice set (raw milk priced at 150 MWK and that becomes safe only after being boiled). Thirty eight per cent of respondents chose the third option (i.e. UHT milk priced at 700 MWK). This shows that there is a large segment of urban consumers who are willing to pay a high price premium in exchange of an improvement in milk safety. Interestingly, none of respondents chose the first option (i.e. unsafe milk) although it was offered at a low price (50 MWK).

As regards the results of the estimation of the Probit model, we will first mention and discuss the factors that were found to positively affect respondents' decision of choosing the UHT milk. We then focus on those factors that were found to negatively affect this decision. The results show that respondents, who said to mainly buy milk because it is good for the growth of their children (FOR-CHILDREN), are more likely to choose UHT milk. We also

found that respondents who reported to be consumer of powdered milk (CONS-PM) are more likely to choose UHT milk, probably due to the similarity between UHT milk and powdered milk in terms of high retail prices, degree of processing and safety level. Respondents who revealed to consume pasteurized milk (CONS-PAST) were also found to be more likely to choose UHT milk than raw milk.

As expected, the results show that respondents who are used to purchasing milk mainly from mini-supermarkets (MINISUPER) are more likely to choose UHT milk. This makes sense because we noticed that in Lilongwe and Blantyre, supermarkets and mini-supermarkets only sell pasteurized and UHT milk but not raw milk. Furthermore, the results show that respondents who are used to buying condensed milk (BUY-CM), butter (BUTTER), spread (SPREAD) and infant milk (INFANT-MILK) are more likely to choose UHT milk. Interestingly, we found that respondents who revealed to be willing to pay a price premium for the UHT milk (WTP-UHT) have a higher probability to choose UHT milk instead of raw milk.

Regarding the effect of respondents' socio-demographics, we found that respondents with high level of education (university studies) (EDUCATION) are more likely to choose UHT milk. This result could be explained by the fact that consumers with high level of education are expected to be more knowledgeable about the importance of safety and are more likely to have a well-paid job which in turn allows them to buy relatively expensive dairy products. Finally women (GENDER) were found to be more likely to choose UHT milk instead of raw milk, probably because of their crucial role in looking after their children and preparing food for the family. This makes them more aware about the importance of consuming safe foods.

As regards to the determining factors that were found to negatively affect the probability of choosing UHT milk, the results show that respondents who buy and consume milk mainly because it is a nutritious food product (NUTRITION) are less likely to buy UHT milk. This could be explained by the fact that some consumers think that ultra-pasteurizing milk significantly reduces its nutritive value. Respondents who said to mainly purchase and consume milk to prepare coffee and other foods (FOOD-PREP) were also found to have a lower probability to choose UHT milk, probably because they think that the milk will be pasteurized (i.e. boiled) anyway when it is used to prepare foods, hence there is no need to buy UHT milk. Furthermore, respondents who are consumers of raw milk (CONS-RM) and condensed milk (CONS-CM) were found to have a lower probability to choosing the UHT milk. Particularly, respondents who are used to consume raw milk (CONS-RM) may know by experience that consuming raw milk is safe if it is boiled thus, paying a significantly higher price for UHT milk is unnecessary just to guarantee the safety of milk. The results also show that respondents who revealed to buy milk once a week (NOTDREQ-BUY) were found to be less likely to choose the UHT milk.

Interestingly, we found that respondents who said that the locality of food products is a key determinant of their decision about which milk to buy are less likely to choose the UHT milk. This makes sense because nine out the eleven brands of UHT milk sold in urban areas in Malawi are imported. Respondents who revealed to consume yogurt (YOGURT) were found to have a lower probability to buy the UHT milk instead of the raw milk. Finally, the results show that older respondents have a lower probability of choosing UHT milk, may be

due to their lower level of awareness of the risk of consuming unsafe foods and probably their lower familiarity with pasteurized and ultra-pasteurized milk compared with younger generations.

4.3. *Respondents' willingness to pay for safer milk*

As regards to respondents' WTP, the majority of respondents reported a WTP significantly higher than the retail price for both raw and UHT milk, being 448 MWK/litre for raw milk and 628 MWK/litre for UHT milk. Nonetheless, respondents' WTP for powdered milk (1980 MWK/kg) and condensed milk (1186 MWK/kg) were found to be significantly lower than the actual retail price. The average of the price premium that respondents revealed to be willing to pay for UHT milk with respect to raw milk is 106 MWK, while the average retail price premium is 304 MWK. This significant difference is partially explained by the high WTP of respondents for raw milk.

The determining factors of respondents' price premium for UHT milk are displayed in Table 5. As in the previous section, we first start by presenting and discussing the factor that were found to positively affect respondents' price premium for UHT milk. The results show that respondents who chose to buy UHT milk instead of raw milk (CHOICE) reported a higher price premium for UHT milk (61.54 KWM more). We also found that respondents who said they buy milk because it helps with the growth of their children (FOR-CHILDREN) were found to be willing to pay an additional 51.45 MWK price premium for the UHT milk compared with the rest of respondents. Furthermore, respondents who revealed to only buy pasteurized milk (ONLYPAST) reported a higher price premium for the UHT milk. Respondents who revealed to mainly purchase milk in supermarkets and mini-supermarkets were found to be willing to pay a higher price premium for the UHT milk compared with the rest of respondents. The results also show that respondents who reported to buy powdered milk (BUY-PM) and butter milk (BUTTERMILK) are willing to pay a higher price premium. Interestingly, we also found that respondents who mentioned safety (SAFETY) as the most important food attribute to them reported a higher (46.78 MWK) price premium for UHT milk.

With regards to the effect of respondents' socio-demographics, the results show that respondents with children (CHILDREN) were found to be willing to pay 18.58 MWK more than those respondents without children. Compared to male respondents, female respondents (GENDER) reported a higher price premium (47.02 MWK) for UHT milk. Finally, respondents whose household's income is higher than the average household's income in Malawi (i.e. 80,000 MWK) were found to be willing to pay the higher value of 54.14 MWK for UHT milk than for raw milk.

Regarding the factors that were found to have a negative effect on respondents' price premium for UHT milk, the results show that respondents who revealed to consume milk frequently (DAILY and FREQUENT) are willing to pay a lower price premium. This could be explained by the fact habitual consumers of milk may find it expensive to satisfy all their demand through buying exclusively UHT milk. In fact we found that 71% (61%) of respondents who revealed to buy raw milk (pasteurized and UHT milk) consume milk daily or at least three days a week. Furthermore, respondents who revealed to be consumers of

pasteurized milk (CONS-PAST) and also respondents with higher consumption of powdered milk (QUANTBUY-PM) and condensed milk (QUANTBUY-CM) were found to be willing to pay a lower price premium for UHT milk. This result could be explained by the fact that pasteurized milk is probably perceived by these respondents as a cheaper and safe alternative to UHT milk. Also in the eyes of these respondents, powdered milk, although it is more expensive, has the advantage of being easily stored without being refrigerated. The results also shows that respondents who said to buy milk from rural shop (RURALSHOP) reported a lower price premium for UHT milk.

Finally, respondents with relatively low level of education (i.e. at most some secondary studies) reported a lower price premium for UHT milk compared with respondents with higher level of education. Therefore, investing in improving the educational level of the population in developing countries does not only improve their chances of having a better life as a result of getting a better job but education is also essential to increasing the population's knowledge and awareness about vital issues such food safety.

5. Conclusion

The consumption of unsafe food products is still a major cause of foodborne diseases, especially in developing countries such as Sub-Saharan Africa. Increasing consumers' awareness on how to safely manipulate fresh foods and improving the availability and affordability of safe foods (e.g. UHT milk vs. raw milk) could significantly decrease the devastating health and economic consequences of the consumption of unsafe foods. To set up an effective strategy to increase consumers' demand for safer foods, it is crucial to understand consumers' preferences and values for these foods; particularly, that industrially treating foods to make them safer often ends up making them more expensive.

This study is an attempt to contribute to the very scarce literature on consumers' preferences and WTP for safer foods in Sub-Saharan Africa with the focus on Malawi. The results showed that urban consumers in Malawi prefer to buy and consume safer milk (i.e. pasteurized or ultra-pasteurized milk). Even respondents who said they buy raw milk revealed that they always boil the milk before consuming it. We also found that respondents are willing to pay a price premium for UHT milk that is higher than the average retail price premium. This is a positive signal that can be passed upstream to Malawian milk processors (e.g. Lilongwe dairy and Dairibord Malawi) who started investing in the production of UHT milk. Furthermore, previous studies on the demand for dairy products in sub-Saharan Africa focused on retail prices and household income as the major drivers of milk consumption in these countries. This study showed that in addition to these two factors, consumers' attitudes and habits as well as their socio-demographics such gender, education level and the presence of children (in the household) are also key determinants of consumers' preferences and demand for safe milk. It is crucial to take into account all these determining factors when preparing strategies that intend to improve the demand for safe milk.

As aforementioned, the objective of this study was to gain new insights on consumers' preferences and WTP for safer milk in Malawi and not to produce country-wide estimates. Therefore, practitioners should take this limitation into account when using our results. Furthermore, future research on the same topic in developing countries are recommended to

use a large sample size that also includes rural consumers if their objective is to produce inferable and comparative results.

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Figure 1: The choice set showed to respondents

Attributes	Option 1	Option 2	Option 3	No-choice option
Milk type	Raw milk	Raw milk	Ultra-pasteurized milk	None
Safety level	Soured milk (not safe)	Safe if boiled	Safe	of the three
Price	50 MKW	150 MKW	700 MKW	options
	⬭	⬭	⬭	⬭
Please indicate your most preferred option (mark your choice)				

Table 1: Respondents' socio-demographic characteristics

Gender (%)	Female	38
	Male	62
Education (%)	Primary studies	5
	Secondary studies	78
	University studies	18
Age (years)		33
Household size		5
Household income (MWK)		85,632

Table 2: Description of the independent variables used in the estimation of the Probit model

Independent variables	Descriptions
NUTRITION	Dummy variable that takes the value 1 if respondent revealed to consume milk because it is a nutritious food; and 0 otherwise.
FOOD-PREP	Dummy variable that takes the value 1 if respondent revealed to buy milk because he/she used it to prepare coffee and other foods using milk; and 0 otherwise.
ENERGY-SOURCE	Dummy variable that takes the value 1 if respondent revealed to consume milk because it is a good source of energy; and 0 otherwise.
FOR-CHILDREN	Dummy variable that takes the value 1 if respondent revealed to consume milk because it helps with the growth of children; and 0 otherwise.
FREQUENT	Dummy variable that takes the value 1 if respondent revealed to consume milk three days a week; and 0 otherwise.
NOT-FREQUENT	Dummy variable that takes the value 1 if respondent revealed to consume milk once every two weeks; and 0 otherwise.
CONS-RM	Dummy variable that takes the value 1 if respondent consumes raw milk; and 0 otherwise.
CONS-PM	Dummy variable that takes the value 1 if respondent consumes powdered milk; and 0 otherwise.
CONS-CM	Dummy variable that takes the value 1 if respondent consumes condensed milk; and 0 otherwise.
CONS-PAST	Dummy variable that takes the value 1 if respondent consumes pasteurized milk; and 0 otherwise.
QUANT-PM	Continuous variable that takes a value equal to the quantity of powdered milk consumed by respondent
QUANT-CM	Continuous variable that takes a value equal to the quantity of condensed milk consumed by respondent
NOTPREQ-BUY	Dummy variable that takes the value 1 if respondent revealed to buy milk once a week; and 0 otherwise
MINISUPER	Dummy variable that takes the value 1 if respondent used to buy milk in mini-supermarket; and 0 otherwise
FARMER	Dummy variable that takes the value 1 if respondent used to buy milk from farmers; and 0 otherwise
BUY_RM	Dummy variable that takes the value 1 if respondent purchases raw milk; and 0 otherwise.
BUY_CM	Dummy variable that takes the value 1 if respondent purchases condensed milk; and 0 otherwise.
WTP_UHT	Continuous variable that takes the value of respondent' WTP for UHT milk

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Table 2 (cont.): Description of the independent variables used in the estimation of the Probit model

Independent variables	Descriptions
ORIGIN	Dummy variable that takes the value 1 if respondent ranked the origin of milk as the most important food attribute to consider when buying milk; 0 otherwise.
BUTTERMILK	Dummy variable that takes the value 1 if respondent buys and/or consume buttermilk; and 0 otherwise.
MARGARINE	Dummy variable that takes the value 1 if respondent buys and/or consume margarine; and 0 otherwise.
BUTTER	Dummy variable that takes the value 1 if respondent buys and/or butter; and 0 otherwise.
SPREAD	Dummy variable that takes the value 1 if respondent buys and/or spread; and 0 otherwise.
YOGURT	Dummy variable that takes the value 1 if respondent buys and/or yogurt; and 0 otherwise.
CHEESE	Dummy variable that takes the value 1 if respondent buys and/or cheese; and 0 otherwise.
INFANT-MILK	Dummy variable that takes the value 1 if respondent buys and/or infant milk; and 0 otherwise.
AGE	Continuous variable that takes a value equal to respondent's age in years
EDUCATION	Dummy variable that takes the value 1 if respondent has at least some undergraduate studies; 0 otherwise
INCOME	Dummy variable that takes the value 1 if respondent's annual household income is more than 80,000 MWK and 0 if it is less than 80,000 MWK
GENDER	Dummy variable that takes the value 1 if respondent is female and 0 if respondent is male

Table 3: Determinants of consumers' preferences for UHT milk

Variables	Estimates from the Probit model	
CONSTANT	0.7546	
NUTRITION	-3.252	*
FOOD-PREP	-5.003	**
ENERGY-SOURCE	1.9998	
FOR-CHILDREN	4.18	*
FREQUENT	-1.518	
NOT-FREQUENT	-5.247	
CONS-RM	-3.969	**
CONS-PM	3.0996	**
CONS-CM	-4.478	**
CONS-PAST	0.3757	*
QUANT-PM	-2.131	
QUANT-CM	1.2135	
NOTPREQ-BUY	-2.479	*
MINISUPER	6.3522	***
FARMER	0.8388	
BUY_RM	1.4355	
BUY_CM	4.6471	***
WTP_UHT	0.01	**
ORIGIN	-4.549	**
BUTTERMILK	-2.075	
MARGARINE	-1.025	
BUTTER	2.6149	**
SPREAD	3.556	**
YOGURT	-3.007	**
CHEESE	-1.604	
INFANT-MILK	2.5107	**
AGE	-0.204	***
EDUCATION	2.2511	**
INCOME	-1.481	
GENDER	1.9693	*
Number of Observations	104	
Log likelihood	-21.03	
Chi Square	96.52	
P-Value	0.000	

*** (**) (*) denote statistical significance at 1% (5%) (10%) level

Table 4: Description of the independent variables used in the estimation of the Tobit model

Independent variables	Descriptions
CHOICE	Dummy variable that takes the value 1 if respondent chose option 3 (UHT milk) in the choice set; and 0 otherwise.
FOR-CHILDREN	Dummy variable that takes the value 1 if respondent's reason for buying milk is because it helps with the growth of children; and 0 otherwise.
DAILY	Dummy variable that takes the value 1 if respondent revealed to consume milk daily; and 0 otherwise
FREQUENT	Dummy variable that takes the value 1 if respondent revealed to consume milk three days a week; and 0 otherwise
ONLYRM	Dummy variable that takes the value 1 if respondent revealed to consume only raw milk; and 0 otherwise.
ONLYPAST	Dummy variable that takes the value 1 if respondent revealed to consume only pasteurized milk; and 0 otherwise.
QUANT-PAST	Continuous variable that takes a value equal to the quantity of pasteurized milk consumed by respondent
DAILY-BUY	Dummy variable that takes the value 1 if respondent revealed to purchase milk daily; and 0 otherwise
SUPERMARKET	Dummy variable that takes the value 1 if respondent used to buy milk in supermarket; and 0 otherwise
MINISUPER	Dummy variable that takes the value 1 if respondent used to buy milk in mini-supermarket; and 0 otherwise
RURALSHOP	Dummy variable that takes the value 1 if respondent used to buy milk in rural shops; and 0 otherwise
BUY-PM	Dummy variable that takes the value 1 if respondent purchases powdered milk; and 0 otherwise.
QUANTBUY-PM	Continuous variable that takes a value equal to the quantity of powdered milk purchased by respondent
QUANTBUY-CM	Continuous variable that takes a value equal to the quantity of condensed milk purchased by respondent
SAFETY	Dummy variable that takes the value 1 if respondent ranked the safety of milk as the most important food attribute to consider when buying milk; 0 otherwise.
ORIGIN	Dummy variable that takes the value 1 if respondent ranked the origin of milk as the most important food attribute to consider when buying milk; 0 otherwise.
BUTTERMILK	Dummy variable that takes the value 1 if respondent purchased and/or consumed buttermilk; and 0 otherwise.

Table 4 (cont.): Description of the independent variables used in the estimation of the Tobit model

Independent variables	Descriptions
AGE	Continuous variable that takes a value equal to respondent's age in years
CHILDREN	Continuous variable that takes a value equal to number of children living in respondent's household
GENDER	Dummy variable that takes the value 1 if respondent is female and 0 if respondent is male
EDUCATION	Dummy variable that takes the value 1 if respondent has at most some secondary studies; 0 otherwise
INCOME	Dummy variable that takes the value 1 if respondent's annual household income is more than 80,000 MWK and 0 if it less than 80,000 MWK

Table 5: Determinants of consumers' price premium for UHT milk

Variables	Estimates from the Tobit model	
CONSTANT	-160.1	***
CHOICE	61.541	***
FOR-CHILDREN	51.45	**
DAILY	-73.7	***
FREQUENT	-62.33	**
ONLYRM	84.877	
ONLYPAST	110.98	**
CONS_PAST	-20.67	***
DAILY-BUY	81.069	**
SUPERMARKET	80.217	***
MINISUPER	84.695	***
RURALSHOP	-130.4	***
BUY-PM	84.629	***
QUANTBUY-PM	-23.65	**
QUANTBUY-CM	-26.82	**
SAFETY	46.776	**
ORIGIN	39.139	
BUTTERMILK	43.806	*
AGE	0.3257	
CHILDREN	18.582	**
EDUCATION	47.024	**
INCOME	-59.66	**
GENDER	54.138	**
Number of Observations	104	
Log likelihood	-475.1	
Chi Square	78.36	
P-Value	0	

*** (**) (*) denote statistical significance at 1% (5%) (10%) level