# Willingness to pay for fresh milk and associated marketing services

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**ABSTRACT**

The study assesses willingness to pay for fresh milk and associated services among some potential consumers (students on the University of Ghana Campus) in Accra, Ghana. Students were sampled using multi-stage stratified random sampling procedure. In the first stage, one hall was selected from two categories of halls - rent paying and non-rent paying halls. In the second stage, respondents were sampled randomly from each of the two halls. The double bounded contingent valuation method was used to analyse willingness to pay. The results show that while price does not significantly influence willingness to pay, one's perception of fresh milk consumption as a health risk, and income status significantly influence willingness to pay. The estimated marginal effects also reveal that a unit increase in the perception of fresh milk consumption as a health risk precipitates a 14 per cent decrease in willingness to pay for fresh milk brought to the local market, and 11 per cent increase in the willingness to pay for milk delivered to the doorstep. Consumers in the more endowed income group have a 32 per cent more willingness to pay for fresh milk brought to the local market or delivered at the doorstep. The results provide empirical basis for market strategy formation in the peri-urban milk marketing.

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## Introduction

A number of attempts have been made at increasing the productivity of milk of cow and, therefore, total milk production in the peri-urban areas of Ghana. The donor community, through feeding, health, and marketing interventions, have supported some of these attempts financially (Okantah *et al*., 2005; Oddoye *et al*., 1999;

Okantah *et al*., 1999a; Okantah *et al*., 1999b; Okantah *et al*., 1997; Aning *et al*., 2002; Alhassan, 2004; Ameleke *et al*., 2007 ). Nonetheless, the consumption of fresh milk in Ghana is almost restricted to cattle herdsmen and their families, and people in moslem communities. Demand for local fresh milk is also low because of the perception that it is produced under unhygienic conditions and, therefore, is unsafe for consumption (Karikari *et al*., 1998). Hence, production in the peak (rainy) seasons could outstrip demand and lead to milk glut.

Attempts have been made to promote the consumption of fresh milk, and milk processing, in order to reduce glut and post-harvest losses, especially in the peak production seasons. However, in order to increase fresh milk consumption, new consumers (non-traditional consumers) of fresh milk may have to be attracted. Yet, it is not clear how they will react to the produce. Will they be willing to patronise the product? Given that the cost of marketing services like transportation, may increase the cost of the produce, will they be willing to pay for it? Will they be willing to pay for additional services like home delivery?

It is imperative that answers are found to these questions to aid in the marketing of milk. Thus, the primary objective of the study was to estimate the willingness of consumers to pay for fresh milk and associated marketing services. The specific objectives of the study were (1) to estimate the mean willingness to pay for fresh milk and associated services, and (2) to estimate the effect of relevant factors like income, price, and perception of fresh milk consumption as a health risk on willingness to pay for fresh milk and some associated marketing services.

Few studies have dealt with local milk consumption in Ghana, and these have focused on the characteristics of farm households, the kind of milk product consumed, and differences in consumption of these products among districts (Okantah *et al*., 1999a; Okantah *et al*., 1999b). This study, therefore, contributes to the literature on milk consumption and demand in Ghana by providing estimates of the aforementioned factors on willingness to pay for fresh milk and associated marketing services.

## Materials and methods

*Theoretical foundations*

The contingent valuation method was employed to study willingness to pay. Several approaches have been used for contingent valuation including the single bounded dichotomous choice, double bounded dichotomous choice and, lately, the multiple bounded polychotomous choice methods (Kimenju & De Groote, 2008). The single bounded approach has been found to be less efficient than the double bounded approach (Hanemann *et al*., 1991). Though the multiple bounded polychotomous choice method could improve willingness to pay estimates and allow for the capturing of uncertainty, the approach is not free from bid design effects (Alberini *et al*., 2003). More research is been conducted to throw more light on aspects of the multiple bounded approach that are not very clear yet, including the assumptions that make it possible to capture uncertainty in the approach (Kimenju & De Groote, 2008). At the time the survey, which provided data for this study, was conducted the multiple bounded choice model was still being developed. Hence, the use of the double bounded choice model to elicit response on willingness to pay, as was the case for Kimenju & De Groote (2008).

The double bounded approach involves presenting a bid to a prospective consumer and asking whether he is willing to pay that price to consume a good. Depending on his answer, the bid is either lowered or raised. Thus, when the respondent says no to the first bid it is lowered, but when he says yes it is raised. To these follow-up questions, he could respond yes or no. Consequently, four possible responses could be obtained: no-no, no-yes, yes-no, and yes-yes (Hanemann *et al*., 1991; Nunes, 1998; Kimenju & De Groote, 2008). This was done so as to refine

estimates of willingness to pay.

A no-no response means that both bids are greater than the respondent's maximum willingness to pay, a no-yes response means that the follow-up bid is less or equal to the maximum willingness to pay, but the first bid is greater than the maximum willingness to pay. A yes-no response means the first bid is lower or equal to the maximum willingness to pay, whereas the follow-up bid is more than the maximum willingness to pay. A yes-yes response implies that the two bids are lower than the maximum willingness to pay.

Following Hanemann *et al.* (1991), let the initial, lowered and raised bids be $b_o$, $b_l$ and $b_h$, respectively. Also, let the maximum willingness to pay for the $i^{th}$ respondent be $WTP_i$. Then the likelihood of the no-no, no-yes, yes-no, and yes-yes outcomes ($\pi_{nn}$, $\pi_{ny}$, $\pi_{yn}$, and $\pi_{yy}$) can be written as follows:

$$\pi_{nn}(b_0, b_l) = \text{Prob}(b_0 > WPT_i < b_l) = F(b_l, \lambda)$$

$$\pi_{ny}(b_0, b_l) = \text{Prob}(b_0 > WTP_i \geq b_l) = F(b_0, \lambda) - F(b_l, \lambda)$$

$$\pi_{yn}(b_0, b_h) = \text{Prob}(b_0 \leq WTP_i < b_h) = F(b_h,) \lambda - F(b_0, \lambda)$$

$$\pi_{yy}(b_0, b_h) = \text{Prob}(b_0 \leq WTP_i \geq b_h) = 1 - F(b_h, \lambda)$$

where F(*) denotes some cumulative density function and $\lambda$ is a vector of parameters. F(*) is also the cumulative density function of the individual's true maximum WTP. The log-likelihood function, summed over N respondents, is given as:

$$L = \Sigma \{r_{nn} \text{In}[F(\alpha - \beta b_l + \delta z_i)] + r_{ny} \text{In}[F(\alpha - \beta b_0 + \delta z_i) - F(\alpha - \beta b_l + \delta z_i)] + r_{yn} \text{In}[F(\alpha - \beta b_h + \delta z_i) - F(\alpha - \beta b_0 + \delta z_i)] + r_{yy} \text{In}[1 - F(\alpha - \beta b_h + \delta z_i)]\}$$

where $r_{nn}$ $r_{ny}$ $r_{yn}$ $r_{yy}$ are dummy variables (Hanemann *et al.*, 1991).

It is assumed that its cumulative density function is logistic, and it is also hypothesised that

$$WTP_i = \alpha - \beta b_i + \delta z_i + e_i,$$

where $\alpha$ is a constant, $\beta$ and $\delta$ coefficients, $b_i$ is the bid faced by the $i^{th}$ individual, and $e_i$ is an error term. In the empirical model $z_i$ comprises income, level of risk associated with fresh milk consumption, and gender.

Let $WTP_i = F(K_i)$, and $K_i = X'_i\lambda$, where $X_i$ is the vector of variables $b_i$ and $z_i$, and $\lambda$ denotes the vector of parameters $\alpha$, $\beta$ and $\delta$. Then the effect on willingness to pay due to a unit change in an explanatory variable is given as:

$$\delta WTP/\delta X = (\delta F/\delta K_i)(\delta K_i/\delta X_i) = f(K_i)\lambda = [e^{zi}/(1+e^{zi})^2]\lambda$$

where $WTP_i = F(K_i) = e^{zi} / (1+e^{zi})$

$K_i = X'\lambda, -\infty < Z_i < \infty$

and $f(K_i)$ is the logistic density function (Young & Shumway, 1991).

The mean willingness to pay is calculated as $-\alpha/\beta$ (Li *et al.*, 2003; Hanemann *et al.*, 1991).

*The contingent valuation*

In order to measure willingness to pay, a scenario was presented to the respondents to enable them appreciate the decisions that they would make. They were informed that fresh milk could be produced in the rural and peri-urban areas. To bring the produce to consuming centres in urban areas would require someone to perform the function of transporting the produce, as a result of which price of the produce would increase. Therefore, the question was posed: would you be willing to pay x cedis for fresh milk and associated transportation cost if it is brought to a place in Accra? If the respondent answered in the affirmative, the x amount was increased and he was asked if he would pay that amount. If he answered no, the x amount was reduced and he was asked if he would pay that price. The same line of questioning was used to obtain responses for willingness to pay for fresh milk delivered at their residences. Five different sets of prices (bids) were presented to respondents, randomly, for each of the two commodities and services (Table 1).

TABLE 1

*Alternative Bids for Fresh Milk Transported to a Local Market (LM) or Delivered at Home (HD) in Cedis (1GH¢: ¢10,000)*

| *Local market bids (cedis)* | | | *Home delivery bids (cedis)* | | |
|---|---|---|---|---|---|
| *Initial* | *Higher* | *Lower* | *Initial* | *Higher* | *Lower* |
| 3000 | 3500 | 2500 | 3500 | 4500 | 3000 |
| 3500 | 4000 | 3000 | 4000 | 5000 | 3500 |
| 4000 | 4500 | 3500 | 4500 | 5500 | 4000 |
| 5000 | 6000 | 4000 | 5500 | 6500 | 5000 |
| 6000 | 7000 | 5000 | 6500 | 7500 | 6000 |

*The survey*

A sample of students on the University of Ghana Campus, Legon, Ghana was taken. The multistage stratified sampling technique was used. At the first stage, two halls were selected, one each from two categories of halls. The categories were the new hostels where students had to pay much higher fees for accommodation, and the traditional (old) halls where students did not pay rent. One hostel was chosen randomly from three (Jubilee , International and Ghana hostels. The second hall was chosen from the second category of four traditional halls (Akuafo, Sarbah, Legon, Commonwealth and Volta halls. The first three traditional halls were mixed and to maintain this feature Commonwealth and Volta Halls which were solely male and female halls, respectively, were combined as the fourth hall). Respondents from the recently built, rent paying hostels, were regarded as more endowed. Fifty respondents were to be selected from each of the halls to make a total of 100. However, 30 respondents were obtained form the more endowed hostels and 49 from the traditional halls, making a total of 79 respondents. They were interviewed using structured questionnaires. The survey was carried out in December 2003.

*The variables*

Questions were asked to obtain data on respondents' perception of risk, wealth endowment, milk consumption and other socio-demographic variables. For example, income was represented by a dummy variable, which took a value of 1 when the respondent belonged to the more endowed hall and 0, for the less endowed hall. The level of risk associated with fresh milk consumption was measured on a likert scale of 1-5, where 1 was very low and 5 very high. The bids were the ultimate prices faced by the respondents.

## Results and discussion

*Socio-demographic characteristics of respondents*

There were 79 respondents in total, comprising 39 males and 40 females. Thirty respondents were from the more endowed category and they comprised 14 males and 16 females. Forty-nine respondents came from the traditional halls and of these 24 were females while 25 were males. Overall, respondents were about equally distributed between the sexes both in the different categories of halls and in total. All the respondents were students at the tertiary level. The respondents were also of various nationalities: 58 Ghanaians, 10 Nigerians, 4 East/South Africans, and 7 non-Africans (Table 2).

TABLE 2

*Nationality of Respondents*

| *Country* | *Frequency* | *Percentage* |
|---|---|---|
| Ghana | 58 | 73.4 |
| Nigeria | 10 | 12.7 |
| USA | 5 | 6.3 |
| Uganda | 2 | 2.5 |
| Malawi | 1 | 1.3 |
| Australia | 1 | 1.3 |
| Britain | 1 | 1.3 |
| Zambia | 1 | 1.3 |
| Total | 79 | 100.1 |

*Perception of milk consumption as a health risk*

Overall, respondents associated low level of risk with milk consumption. Forty-two per cent of respondents considered fresh milk consumption as being of very low or low risk, while 35 per cent considered it as having average risk. However, 16 per cent of the respondents considered it as having high or very high risk. About 6 percent of respondents had no comments (Table 3).

TABLE 3

*Perception of Milk Consumption as Health Risk*

| *Level of risk* | *Frequency* | *Percentage* |
|---|---|---|
| Very low | 7 | 8.9 |
| Low | 26 | 32.9 |
| Average | 28 | 35.4 |
| High | 7 | 8.9 |
| Very high | 6 | 7.6 |
| No idea/No response | 5 | 6.3 |
| Total | 79 | 100 |

*Regression results*

Maximum likelihood estimation of the model indicates that while price does not significantly influence willingness to pay for fresh milk and transport cost, income level and risk perception of the product as a health hazard do (at the 5% level). In addition, the income and risk variables have the expected positive and negative effects. Thus, increases in income increase willingness to pay, and increases in perception of fresh milk consumption as a health risk decrease willingness to pay (Table 4). The estimated marginal effects show that individuals in the higher income group have a significantly higher willingness to pay for fresh milk and associated transport costs (32 %) than those in the lower income group. A unit decrease in the level of risk perception (measured on a scale of 1 to 5) will precipitate an increase of 14 per cent in willingness to pay.

Fu *et al*. (1999) also found a negative relationship between the degree of perception of pesticide residues on vegetables as unsafe (measured on a Likert scale) and willingness to pay, though this was not statistically significant. The log-likelihood ratio and the pseudo $R^2$ are both 0.15. It has been noted that the pseudo $R^2$ is not likely to be close to 1, because binary choices are involved. Again, any particular numerical value of the pseudo $R^2$ is difficult to interpret, though this value gives one some measure of how much is gained by the addition of new variables to the model (Pindyck & Rubinfield, 1991).

In the model explaining willingness to pay for fresh milk delivered at one's door step, the price variable is not significant and has a positive sign which is not expected. Also, the income and risk variables have the expected signs (positive and negative, respectively) and are significant at the 5 per cent levels (Table 5). This means that willingness to pay increases with income but decreases with increases in the level of perception of fresh milk consumption as a health risk. The log-likelihood ratio and the pseudo $R^2$ are both 0.11.

The marginal effects of changes in income and risk variables on willingness to pay for milk delivered at ones door-step are also shown (Table 5). The estimates show that a unit change in the level of perception of milk as a health risk will precipitate 11 per cent change in willingness to

TABLE 4

*Maximum Likelihood Estimates for Factors Affecting Consumers' Willingness to Pay for Fresh Milk and Services that will Bring the Produce from the Farm-Gate to Purchasing Centres Close to Consumers*

| *Variable* | *Coefficient* | *t-Statistic* | *Slope* | *t-Statistic* |
|---|---|---|---|---|
| Bid | 0.000273 | 1.36 | 0.0000667 | 1.37 |
| Income | 1.59** | 2.85 | 0.32** | 3.29 |
| Risk | -0.58* | -2.42 | -0.14* | -2.42 |
| C | 0.035 | 0.03 | - | - |
| Log likelihood | -54.24 | | | |
| Pseudo R2/LRI | 0.15 | | | |

TABLE 5

*Maximum Likelihood Estimates for Factors Affecting Consumers' Willingness to Pay for Fresh Milk and Services that will Get the Produce Delivered at the Consumers' Home*

| *Variable* | *Coefficient* | *t-Statistic* | *Slope* | *t-Statistic* |
|---|---|---|---|---|
| Bid | 0.000193 | 1.01 | 0.000048 | 1.01 |
| Income | 1.35** | 2.61 | 0.32** | 2.86 |
| Risk | -0.45* | -1.98 | -0.11* | -1.98 |
| C | -0.24 | -0.21 | - | - |
| Log likelihood | -54.75 | | | |
| Pseudo R2/LRI | 0.11 | | | |

pay for fresh milk and delivery. Also, individuals in the more endowed group have a greater willingness to pay (32 %) than their counterparts in the less endowed group. As the constant ($\alpha$) and the coefficient of the price variable ($\beta$) are both not significant, the mean willingness to pay was not calculated.

## Conclusion

It has been verified that consumers' perception of fresh milk as a health risk and income levels significantly influence willingness to pay for fresh milk if they become available in the urban centres. The price of the commodity, however, did not significantly influence willingness to pay for fresh milk. The changes in the probabilities for willingness to pay, given changes in perception of fresh milk as a health risk and improvement in income levels are quite high. As part of marketing strategy, producers and traders will have to work at removing this perception, as well as target more consumers in the higher income brackets.

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