

HOUSEHOLD EXPENDITURE ON DAIRY PRODUCTS IN ADAMAWA STATE, NIGERIA

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ABSTRACT

Household expenditures for four dairy products were estimated using the Almost Ideal Demand System (LA/AIDS) model. Factors influencing the demand for the dairy products include own price, household food expenditure, household expenditure on dairy products, household size, education of household head, child dependency ratio as well as the location of the household. Own price elasticity ranged from 0.99 (yoghurt) to 1.53 (Imported dairy). The expenditure elasticities were between 1.00 and 1.82. There are evidences of price-cross effects. It is recommended that demographic factors be taken into account in planning process. Also, measures that will protect the local dairy producers should be put in place.

KEY WORDS: Household, Expenditure, Dairy, LA/AIDS, Elasticity

INTRODUCTION

The dairy industry represents an important component of the agricultural sector of the economy with great economic, nutritional and social implications (Yahuza, 2001). In fact, the industry provides a means of livelihood for a significant proportion of rural pastoral family in the sub humid and semi-arid ecological zones of Nigeria.

Improving the standard of living of the Nigerian populace has been one of the major concerns of the various governments as evident in the various national plans. This has prompted the various governments at different times to establish dairy farms with local and imported breeds of cattle. In addition, several dairy processing plants were also established in several places such as Jos, Lagos, Ibadan, Kaduna, Minna, Maiduguri, Ilorin and Kano, to mention but a few. In these places, milk collection centres as well as mobile collection points were also established just to be able to meet the protein requirements of the people. However, many Nigerians are still being plagued with protein deficiency in their diets despite the high potentials of the indigenous dairy industry.

Over the years, imported dairy products have been the major source of meeting the growing demand for dairy products in West Africa in general and Nigeria in particular (Okoruwa, 1996). The dairy demand and supply for the country in the year 2005 has been estimated to be 1,120,005 tonnes and 606,827 tonnes respectively, (Yahuza, 2001). There is a very big demand and supply gap, which is likely to be bridged by import if something strategic is not done. But Oguntade and Bamire (1996) projected that Nigeria can meet its demand for modern dairy project locally.

Previous studies of the dairy industry had focused on cattle distribution, milk processing, beef production (Nyako et al, 1992, Igwe and Yakubu, 2000, Yakubu, 1997) and some are on milk marketing and consumption (Agyemang et al, 1996, Oguntade and Bamire, 1996; Hailu et al, 1996; Holloway et al, 2000). The rapid population growth (3%) and urbanization is still creating a strong demand for the dairy products. Hence, a study of the demand for dairy products will enable policy makers to know the economic as well as the demographic variables influencing the demand for the commodity.

The objectives of this study are:

- (1) To examine the factors influencing the demand for dairy products in Adamawa State.
- (2) To determine the responsiveness of household expenditure on dairy products to product prices and income.

METHODOLOGY

The study was conducted in Adamawa State in the Northeastern geo-political zone of Nigeria. The primary data used for this study were collected through the aid of well-structured questionnaires administered by well-trained enumerators under the supervision of the researcher. A multistage random sampling technique was employed in the selection of the respondents. The first stage involved the random selection of 6 LGAs from the state. The selection of settlements constituted the second stage. A proportionality factor was used to select eleven settlements in the study area. The proportionality factor is expressed as follows:

$$S = n/N \times 11$$

Where S is the number of settlements sampled from a local government area.

n is the number of settlements in a local government area

N is the sum of the settlements in all the selected local government areas

11 is the target number of settlements to be selected

In addition to the 11 settlements selected as described above, three urban centres in the study area were purposively selected. These were, Yola, Jimeta and Numan. The last stage involved the selection of households. A total of 151 households were, selected using a modified forms of random sampling called the random walk method (Udoh, 2000).

Model Specification

The most Ideal Demand System (AIDS), developed by Deaton and Muellbauer. (1980a) is a popular framework for estimating price and income elasticities when expenditure or budget data are available. (Abdulai et al, 1999). The AIDS model is theoretically a superior demand system model (Mergos and Donatos, 1989) and it permits a fairly simple interpretation of the estimated coefficients (Fulponi, 1989). The model hypothesizes that the proportion of total expenditure that accrues to a particular commodity (or budget share) is related to prices and income as follows:

$$w_i = \alpha + \sum \gamma_{ij} \log P_j + \beta_i \log M/P^* \quad i = 1, 2, 3 \dots n \quad (1)$$

Where n is the number of commodities included, w_i is the budget share of commodity i, m is the total expenditure on all goods, and p_j is the price of the jth good: p^* is a price index defined as: $\log p = \alpha_0 + \alpha_1 \log p_1 + \frac{1}{2} \sum \sum \gamma_{ij} \log P_i \log P_j$ (2)

The price index in (2) allows the AIDS (2) to be 'flexible' i.e. to model wide ranges of preference (Savado and Brandt, 1988.)

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Using the price index however makes the system of equation non-linear and therefore we employed the stone price index in this study. The AIDS model using stone's price index i.e. $\log P = \sum w_i \ln p_i$ (3) is termed the Linear Approximate Almost Ideal Demand System (LA/AIDS).

The method adopted in this study is to represent the consumer food expenditure allocation problems in two stages. In the first stage, the consumer determines the allocation of his total food expenditure between various eight food groups. It is assumed that the eight food groups are weakly separable from all the other commodities demanded by the consumer. In the second stage, the dairy food expenditure is allocated among four dairy commodities i.e. raw local milk, local yoghurt, mai shanu and imported milk.

The first stage demand relation is not estimated in this study, as the aim of the study is based on dairy products, it therefore deals with the second stage of the two stage budgeting process.

Following Abdulai et al (1999) demographic effects are incorporated in the model by allowing the intercept in (1) to be a function of demographic variables

$$\alpha_i = P_{i0} + \sum p_j d_j \dots\dots\dots(4)$$

Where d_j is the j th demographic variable of which there are nine in the model. The model now becomes:

$$w_i = P_{i0} + \sum p_j d_j + \sum y_{ij} \log p_j + \beta \log (M/P^*) \dots\dots\dots(5)$$

The demographic variables and their descriptions are listed in Table 1.

Table1: Description of Demographic Variables

Variables	Description
SEX	Gender of the household head
AGE	Age of the household head
MAS	Marital Status of the household head
HHSZ	Household size
EDY	Educational level of the household head
LOCAT	Location of the household
PRI	Primary occupation of the household head
CDR	Child dependency ratio
ADR	Adult dependency ratio

Elasticities in AIDS model were computed from the estimated parameters with the following formulae (Mdafari and Brorsen, 1993, Abdulai et al, 1999).

- (i) Expenditure / Income Elasticity = $\eta_i = 1 + \beta / w_i$ (6)
- (ii) Own Price Elasticity = $\epsilon_{ii} = -1 + Y_{ii} / w_i - \beta_i$ (7)
- iii) Cross price elasticity $\epsilon_{ij} = Y_{ij} / w_i - \beta_i (w_j / w_i)$(8)

RESULTS AND DISCUSSION

Household Expenditure on various Dairy Products (Sub-Group)

As shown in Table 2, the highest proportion of household budget share to different dairy products goes to local yoghurt (44%) This is the mostly consumed among the local dairy products. The next share goes to local raw milk with 22 percent. Eighteen percent and 16 percent respectively go to local butter and imported dairy products.

Table 2 Household Expenditure on Dairy Products

Dairy Products	Percentage
Local raw milk	44.00
Local Yoghurt	22.00
Local butter	18.00
Imported Dairy Products	16.00
Total	100.00

Source: Survey Data, 2002

Determinants of Household Demand for local Raw Milk

The model for the demand for raw milk is significant at 1 percent level as shown in Table 3. This indicates that the model is a good fit. It also has an adjusted R² value of 0.78 implying that 78 percent of the variations in budget share allocated to raw milk by households are explained by the variables included in the model. Moreover, coefficients of six variables are significant in the model, namely, the coefficients of imported dairy prices, total household expenditure on dairy, marital status of head of household, household location, primary occupation of head of household and household expenditure on food.

The table shows that the coefficients of average price of imported dairy products, household total expenditure on dairy and primary occupation of the household head are positive, indicating that these variables are directly related to the budget share allocated to local raw milk. On the other hand, the coefficients of marital status of the household head, location of the household and total household expenditure on food are inversely related to the budget share allocated to local raw milk.

The variables that did not significantly affect the budget share allocated to local raw milk include: average prices of raw milk, price of local yoghurt, price of local butter, gender of the household head, age of the household head, household size, education of the household head, adult and child dependency ratios.

Table 3: Coefficient of Household Demand for Local Raw Milk.

Variable	Coefficient	t-ratio
CONSTANT	0.285 ***	5.104
RAWMPR	-0.292 E - 04	-0.422
LOYPR	-0.156 E - 04	-0.226
LOBUPR	-0.235 E - 04	-1.205
IMPDP	0.457 E -04 ***	3.219
TEXDAR	0.674 E - 04***	3.526
SEX	0.101 E - 01	0.363
ACRE	0.914 E - 04	1.250
MAS	-0.157 E - 03***	-2.287
HHS2	-0.997 E - 03	-0.332
EDY	0.577 E - 03	0.318
LOCAT	-0.761 E - 01***	-3.223
PRI	0.440 E - 01*	1.886
CDR	0.881 E - 01	0.983
ADR	-0.170	-0.776
THHDEX	-0.220 E - 05**	-1.990

Source: Computer Print out of AIDS Model Analysis.

*** Significant at P < 0.01

** Significant at P < 0.05

* Significant at P < 0.10

Adj R2 = 0.78*** F = 35.17

Determinants of Household Demand for Local Yoghurt

As shown in Table 4, coefficients of six variables are significant. These are, the coefficients of average price of raw milk (at 1%), average price of imported dairy products (1%), total expenditure on dairy products (at 1%), gender of the household head (at 10%), marital status of the household head (at 10%) and household size (at 10%). The factors that are positively related to the budget share allocation to local yogurt include, gender of the household head, marital status of the household head and household size. On the other hand, the average prices of imported dairy products, total expenditure on dairy products and the average price of local raw milk are inversely related to the budget share allocated to local yogurt.

Table 4: Coefficients Of Household Demand for Local Yoghurt.

Variable	Coefficient	t- ratio
CONSTANT	0.266*	1.862
RAWMPR	-0.113 E-03***	-4.091
LOYPR	0.177 E-02	1.368
LOBUPR	0.187 E-05	0.060
IMP DPR	-0.172 E-03***	-7.542
TEXDAR	-0.149 E-03 ***	-4.985
SEX	0.756 E-01*	1.720
AGE	-0.128 E-03	-1.099
MAS	0.212 E-02*	1.937
HHS2	0.887 E-02*	1.881
EDY	-0.492 E-03	-0.171
LOCAT	-0.280 E-01	-0.739
PRI	0.127 E-0	0.341
CDR	0.939 E-01	-0.665
ADR	0.238	0.680
THHDEX	0.248 E-05	1.406

Source: Computer Print out of AIDS Model Analysis.
 *** Significant at P< 0.01 ** Significant at P< 0.05
 *Significant at P< 0.10 Adj R² = 0.55 *** F=12.45

Determinants of Household Demand for Local Butter

The model for the household demand for local butter is shown in Table 5. As indicated in the table, five variables are significant. These are, the average price of local butter, the gender of household head, the education of the household head, and location of the household and child dependency ratio. The average price of local butter is positively related to the budget share while the gender of household head, education of the household head, location of the household and child dependency ratio are inversely related to the budget share allocated to local butter.

Table 5 Coefficients of Household Demand for Local Butter

Variable	Coefficient	t- ratio
CONSTANT	88.223	0.988
RAWMPR	0.182 E-01	0.749
LOYPR	0.352 ***	3.603
LOBUPR	-0.826 E-01	-0.301
IMP DPR	-0.316 E-01	-1.542
TEXDAR	-0.221 E-02	-0.083
SEX	-69.205 *	-1.718
AGE	-0.674 E-01	-0.651
MAS	0.137 E-01	0.143
HHS2	2.740	0.653
EDY	4.332*	1.693
LOCAT	-70.821**	-2.119
PRI	24.592	0.748
CDR	-278.403***	2.222
ADR	-62.522	-0.196
THHDEX	0.113 E-02	0.724

Source: Field survey, 2002
 *** Significant at P< 0.01 ** Significant at P< 0.05
 * Significant at P< 0.10 Adj R² = 0.22 *** F=3.64

Determinants of Household Demand for Imported Dairy Products.

The model for the imported dairy products is highly significant at 1 percent level showing that the model is in good fit. Moreover, it has an adjusted R² of 0.664 indicating that 66 percent of the variability in budget share allocated to imported dairy products is accounted for by the variables in the model (Table 6). As shown in the table, the coefficients of six variables are significant. These include the average prices of local raw milk, local yogurt, local butter, household size, education of the household head and child dependency ratio. The table shows that, the coefficients of the educational level of the household head, and child dependency ratio are positive, implying that the variables are directly related to the

budget share allocated to imported dairy products. That is, an increase in the values of these variables will lead to an increase in the budget share allocated to imported dairy products and vice versa. On the other hand, the coefficients of average prices of local raw milk, local yogurt, local butter and household size are inversely related to the budget share which means that an increase in the value of these variables will lead to a decrease in the budget share allocated to imported dairy products.

Table 6 Coefficients of Household Demand for Imported Dairy Products

Variable	Coefficient	t- ratio
CONSTANT	0.427 ***	4.266
RAWMPR	-0.734 E-04**	-3.326
LOYPR	-0.254 E-03***	-2.873
LOBUPR	-0.134 E-03***	-5.354
IMP DPR	-0.153 E-03	-1.118
TEXDAR	0.361 E-04	1.507
SEX	-0.753 E-02	-0.212
AGE	0.116 E-03	1.242
MAS	0.304 E-04	0.350
HHS2	-0.123 E-01***	-3.237
EDY	0.470 E-02**	2.007
LOCAT	-0.950 E-02	-0.314
PRI	0.135 E-02	0.045
CDR	0.135 E-02*	-1.785
ADR	-0.354	-1.264
THHDEX	0.484 E-06	0.341

*** Significant at P< 0.01 ** Significant at P< 0.05
 *Significant at P< 0.10 Adj R² = 0.66 *** F=19.49

Expenditure Elasticities

As indicated in Table 7, all the dairy products have positive expenditure elasticities meaning that they are normal goods. Out of all, the imported dairy products have a very high elasticity, indicating that there is the expectation of higher rate of increase in the consumption of imported dairy products in the future as consumers' incomes increase.

Table 7 Expenditure Elasticities for dairy products (Sub-Group)

Commodity	Elasticity
Local raw milk	1.00
Local Yoghurt	1.00
Local butter	1.00
Imported Dairy	1.82

Source: Computer from AIDS model Result.

Own Price Elasticities for Dairy Products

As indicated in Table 8., the own price elasticities for the various dairy products are of the expected signs, which is the normal expected reaction of consumers to change in food prices. Local raw milk and local butter have own price elasticity of 1 each respectively while local yoghurt has an own price elasticity of 0.99. The most price elastic of all is the imported dairy product with an own price elasticity of 1.53, meaning that a 10 percent change in the price of imported dairy products will result in about 15 percent change in the demand.

Table 8: Own Price Elasticities for Dairy Products (Sub Group)

Commodity	Elasticity
Local raw milk	-1.00
Local Yoghurt	-0.99
Local butter	-1.00
Imported Dairy Products	-1.53

Source: Computer from AIDS model

Cross-Price Elasticities of Dairy Products.

As shown in Table 9, the cross - price elasticities of demand for raw milk show complementarity with all the other dairy products. That of local yoghurt shows substitutability with raw milk and local butter and complementarity with imported

dairy meaning that local yoghurt can easily substitute for raw milk while raw milk cannot. The cross-price elasticity of imported dairy products however shows complementarity with all other commodities.

Table 9: Cross - Price Elasticities of Dairy Products

Variables	Raw Milk	Local Yoghurt	Local butter	Imported Dairy
Raw milk	-	-0.71 E-03	-0.49 E-03	-0.35 E-04
Local Yoghurt	0.89 E-04	-	0.94 E-03	-0.49 E-03
Local Butter	-0.12	0.98	-	-0.26
Imported Dairy	-0.11E-02	-0.28 E-02	-0.16 E-02	-

Source: Computer Print out of AIDS Model Analysis.

SUMMARY AND CONCLUSION

This study has analyzed the dairy expenditure pattern for households in Adamawa state, using household survey data of 2002. The results indicate that price of imported dairy products and household expenditure for dairy products are directly related to the budget share allocated to raw milk. The variables that are negatively related to the budget share of local raw milk are household location and total household expenditure on food.

The study also indicates that the gender of the household head, and household size affect the budget share of local yoghurt positively while price of raw milk, and price of imported dairy products are inversely related to the budget share. The price of local butter is positively related to the budget share allocated to it while gender of the household head, education and location of the household head as well as child dependence ratio are inversely related to the budget share allocated to local butter.

Moreover, the budget shares allocated to imported dairy products are positively influenced by education of the household head and child dependency ratio. On the other hand, average prices of raw local milk, local yoghurt, local butter and household size are inversely related to the budget share allocated to imported dairy products. All the dairy products have positive expenditure elasticities with the imported dairy products having the highest. The own price elasticities of various dairy products have expected signs. All of them are elastic with the exception of local yoghurt which is slightly inelastic. The imported dairy product is the most elastic of all. The cross - price elasticity revealed that the imported dairy products show complementarity with all other dairy products.

Finally, the results suggest that demographic variables play an important role along with household expenditure (proxy for income) in determining the dairy products' demand in Adamawa state. Therefore such factors should be taken into account in the planning process. Also, measures that will protect the local dairy producers should be put in place. Family planning should be emphasized as household size has negative influence on the budget share allocated to some of the dairy products.

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