Determinants of Farm Household Food Expenditure: Implications for Food Security in Rural Nigeria

Joseph C. Umeh and Benjamin C. Asogwa

Abstract—This paper investigated the determinants of farm household food expenditure and its implications for food security in rural Nigeria. Data collected on 214 households from Benue State were analysed using multiple utility level Engel function. The study revealed that household income is significant in determining food and non-food expenditure at 5% level. The share of the household budget spent on food decreased as the household income increases. In contrast the expenditure share on non-food has shown increasing tendencies. However, measures leading to the release of the “educational-financing burden” from farm households should be addressed at the policy level. The options available could include the provision of bursaries, scholarships and/or long-term serviceable loans for needy households. There is also the need to look into the possibility of diversifying asset ownership away from land in order to solve the farm-land scarcity problem in order to increase income from farming in rural Nigeria.

Keywords— determinants, farm households, expenditure, food security, income, rural Nigeria, Engel function

I. INTRODUCTION

There are more than 925 million people suffering from chronic food hunger globally [1]. Sub-Saharan Africa (SSA) has a bigger share of those facing hunger i.e. from 168 million in 2000 to more than 239 million by 2010. Household budget surveys across Africa consistently show basic foods to be the main consumption expenditure item in rural areas. In their study, [2] reported that up to 50% of total calories consumed in some African countries come from roots and tubers. To this end, having such a high share of food consumption in Africa implies that exogenous rural income growth has great potentials to pull underutilized resources into the food sector [3]. A study by [4] in southwestern Nigeria showed that the earnings of wives were low relative to those of husbands. The income of wives came mostly from informal sector activities (petty trading, craft etc.). On the average, female income accounted for about 40 percent of the household monetary income. Furthermore, household expenditure pattern in the study area showed that about 70 percent of total household expenditure was on food with both male and female contributing to this expenditure, but with husbands contributing more than wives. Furthermore, estimates of expenditure elasticity for food and non-food categories suggested that there was increased food expenditure on higher qualitative foods (protein based diet) and basic necessities of household (clothing and education) as household income rose.

According to Njimanted [5], poverty in developing countries takes various forms including low nutritional status, low level of education, decline in spending on social services, high percentage of household income spent on food, low level of savings, low level of investments and low level of productivity. A study by [6] showed the coefficient of total household income to be positive and significant so that increasing household income increased expenditures on food consumption.

In a study of income/consumption among households in Agege Lagos, Nigeria, [7] found that majority of the households either fails to save at all or save less than 10% of their income. His regression results showed education, sex, age and income as determinants of monthly or annual households’ per capital expenditure on basic needs. Furthermore, his results on expenditure distribution of the household in the study showed that 2 percent of the households controlled just 0.30 percent of the total expenditure, 57% of the households controlled less than 33% of the total expenditure of the area, while the remaining 43% of the households controlled almost 70% of the total expenditure of the area which means less than half of the households controlled over two-third of the wealth of the region.

There is a conceivable danger of exacerbation of food insecurity among the food poor population due to reduced productivity and production and the increased negative effect these would have on food entitlements. According to Engel’s Law, the household budget spent on food decreases as income increases. There is also a higher propensity of households experiencing increasing income to spend a bigger proportion of the food budget on a diversified diet thus improving the nutritional status of the household members. The reasons that
trigger food and nutritional insecurity situation are manifold. As pointed out by [8], the purpose of expenditure analysis is to inform policy regarding the nutritional status of the population for proper targeting as well as streamlining demand and production.

The objective of this study therefore is to investigate the determinants of farm household food expenditure and its implications for food security in rural Nigeria. The null hypothesis that the specified explanatory variables do not significantly influence farm household expenditure in rural Nigeria was stated and tested.

II. METHODOLOGY

A. The Study Area

For this study, farm level data were collected on 214 farm households in Benue State. Benue State is one of the 36 states of Nigeria located in the North-Central part of Nigeria. The State has 23 Local Government Areas, and its Headquarters is Makurdi. Located between Longitudes 6° 35'E and 10°E and between Latitudes 6° 30'N and 8° 10'N. The State has abundant land estimated to be 5.09 million hectares. This represents 5.4 percent of the national land mass. Arable land in the State is estimated to be 3.8 million hectares [9]. This State is predominantly rural with an estimated 75 percent of the population engaged in rain-fed subsistence agriculture. The state is made up of 413,159 farm families [10]. These farm families are mainly rural. Farming is the major occupation of Benue State indigenes. Popularly known as the “Food Basket” of the Nation, the State has a lot of land resources. For example cereal crops like rice, sorghum and millet are produced in abundance. Roots and tubers produced include yams, cassava, cocoyam and sweet potato. Oil seed crops include pigeon pea, soybeans and groundnuts, while tree crops include citrus, mango, oil palm, guava, cashew, cocoa and Avengia spp.

B. Sampling Technique

In this study, the multi-stage random sampling technique was used for sample selection. Benue State is divided into three (3) agricultural zones viz: Zone A, Zone B and Zone C. Zone A and Zone B are made up of seven Local Government Areas each while Zone C is made up of nine Local Government Areas. Using a constant sampling fraction of 45%, three Local Government Areas were randomly selected from Zone A and Zone B while four Local Government Areas were randomly selected from Zone C under the guide of Benue State Agricultural Development Programme workers. From each of the selected Local Government Areas, one rural community was randomly selected. Finally, from each community, households were randomly selected on the basis of the community’s population size using a constant sampling fraction of 1% in order to make the sampling design to be self-weighting thereby avoiding sampling bias [11]. Based on the foregoing, 214 farm households were randomly selected for the study.

C. Data Collection

Data were collected mainly from primary sources. The primary data were obtained through the use of a structured questionnaire, copies of which were administered to the selected 214 farm households in Benue State.

D. Analytical Technique

The objective of the study was analysed using the multiple utility level Engel curve and the double logarithm regression model.

E. Model Specification

Theory of demand and smallholder household expenditure

The most crucial connection to the study of the demand aspect in this study is its relation to Engel’s Law, which states, “the proportion of consumer’s budget spent on food declines with income,” [12]. An analysis within the food sector reveals a demand shift for certain types of foods as income changes. In the rural Nigeria context, an increase in income is likely to lead to a reduction of a diet comprising of predominantly maize, yam and cassava to an increase of more nutritious foods such as beans, rice, meat, fish, fruits and vegetables.

Following De [13] the utility function of a representative consumer can be written as: 
\[ u = u(q, z) \] (1)

Where \( q \) stands for a vector of quantities of \( n \) commodities on which consumption decisions are supposed to be made whilst \( z \) indicates individual household characteristics. The household has a limited amount of money \( y \) from its various sources of income to expend, thus having to make do with a budget constraint. Accordingly the budget constraint is:
\[ pq = y \] (2)

Where \( p' \) is a vector of prices in \( n \) dimensions.

With reference to consumption, the consumer has the objective of maximizing utility represented by \( q \), given the budget constraint \( pq = y \). This leads to the equation:
\[ \max u(q, z) + \lambda (y - p'q) \] (3)

Where \( \lambda \) is a Lagrange multiplier. This leads to the solving of the maximization problem through a set of \( n \) demand equations.

\[ q_i = q_i (p, y, z), i = 1, ..., n \] (4)

The econometric regressions generate income slopes and income elasticities due to restrictiveness of the sample data where variations in prices were not observed. In this study, the data on income and expenditure are cross-sectional and do not contain variations in prices. In such a situation, Engel curves are quite applicable, particularly due to the objective of this study to highlight the role of income variations in contributing to food consumption expenditure within the household. Thus:

\[ q_i = q_i (y, z), i = 1, ..., n \] (5)

Where, \( q_i \) is quantity purchased of good \( i \), and \( y \) is total expenditure per capita (income) and \( z \) stands for the household characteristic.

However, because we are interested in multiple levels of utility that are comparable at different expenditure levels, it is appropriate to use the budget share of each good and not the absolute quantity purchased or the total price. Consequently, the following equation was estimated:
where, \( w_i \) is the budget share of the \( i \)th good; the rest as discussed in the equation above.

Based on the foregoing, the model used in this study is adopted from [14] where they used the same approach to evaluate the impact of physical and human capital and other demographic factors on the intra-household allocation and expenditure. The model was specified as follows:

\[
wi = wi (y, z) \quad \text{.................................(6)}
\]

Where:

\( w_i \) = the budget share of the \( i \)th good;

\( \text{lnpcincome} \) = the natural logarithm of total per capita income;

\( \text{lnexp} \) = the natural logarithm of total per capita expenditure;

\( \text{Ln household size} \) = the natural log of household size in adult equivalent;

\( \text{lntransfer} \) = the natural log of household transfer income;

\( \text{lnpcincome} \) = the natural logarithm of total per capita income;

\( \text{Ln Age (Years)} \) = the natural logarithm of age of household head;

\( \text{lncredit} \) = the natural logarithm of access to credit;

\( \text{lnHMS} \) = the natural log of household members in school;

\( \text{lnHMW} \) = the natural log of household members working;

\( \text{lnfarmaccount} \) = the natural log of household membership of farmer association;

\( \text{lnfarmsize} \) = the natural log of household farm size; and

\( v_i \) = the error term, whereas;

\( a_i, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7, \beta_8, \beta_9, \beta_{10} \) are parameters to be estimated.

The food commodity expenditure share results could also be interpreted with respect to the per capita household expenditure (or budget) in order to be interpreted as elasticities [15].

III. RESULTS AND DISCUSSION

A. Determinants of Household Food Expenditure

The result in Table I shows that at 5% level of significance, the hypothesis that the specified (selected) explanatory variables have no significant influence on farm household food expenditure is rejected by the result of the F-test, suggesting that there is a significant cause and effect relationship between farm household food expenditure and the selected explanatory variables. The model has a good fit to the data. For example, the coefficient of determination (\( R^2 \)) is 0.6924, suggesting that the model has a high goodness of fit. This indicates that 69.24% variation in farm household food expenditure is accounted for by variations in the selected explanatory variables, suggesting that the model has high explanatory power on the changes in farm household food expenditure among the respondents. The adjusted \( R^2 \) also supported the claim with a value of 0.6501 or 65.01%. This implies that the selected explanatory variables explain the behavior of farm household food expenditure among the respondents at 65% level of confidence. The calculated F-statistic value of 168.80 is greater than the critical value of 1.49 at 5% level of significance implies that there is a significant cause and effect relationship between farm household food expenditure and the selected explanatory variables.

### Table I

<table>
<thead>
<tr>
<th>Explanatory Variables</th>
<th>Food Expenditure</th>
<th>Non-food Expenditure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Food Expenditure</strong></td>
<td><strong>Non-food Expenditure</strong></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>1.5511476</td>
<td>1.5695617</td>
</tr>
<tr>
<td>Ln Per capita income</td>
<td>-0.0127750</td>
<td>0.0145710</td>
</tr>
<tr>
<td>(Naira)</td>
<td>(-1.508)*</td>
<td>(1.613)*</td>
</tr>
<tr>
<td>Ln Per capital</td>
<td>-0.3125874</td>
<td>0.3646735</td>
</tr>
<tr>
<td>expenditure (Naira)</td>
<td>(-1.959)*</td>
<td>(2.613)**</td>
</tr>
<tr>
<td>Ln Household size</td>
<td>-0.1376154</td>
<td>0.9513381</td>
</tr>
<tr>
<td>(adult equivalent)</td>
<td>(-2.909)**</td>
<td>(2.186)**</td>
</tr>
<tr>
<td>Ln Transfer income</td>
<td>0.0713560</td>
<td>-0.0836067</td>
</tr>
<tr>
<td>(Naira)</td>
<td>(0.295)</td>
<td>(-0.343)</td>
</tr>
<tr>
<td>Ln Age (Years)</td>
<td>-0.2958005</td>
<td>0.3828724</td>
</tr>
<tr>
<td>(2.569)**</td>
<td>(2.186)**</td>
<td></td>
</tr>
<tr>
<td>Ln Access to credit</td>
<td>-0.0875723</td>
<td>0.3713372</td>
</tr>
<tr>
<td>(0-1)</td>
<td>(-2.446)**</td>
<td>(2.242)**</td>
</tr>
<tr>
<td>Ln Household</td>
<td>-0.9388128</td>
<td>0.4509137</td>
</tr>
<tr>
<td>members in school</td>
<td>(-4.665)**</td>
<td>(3.784)**</td>
</tr>
<tr>
<td>(Number)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ln Dependency ratio</td>
<td>-0.9377187</td>
<td>0.6767380</td>
</tr>
<tr>
<td>(-2.689)**</td>
<td>(2.734)**</td>
<td></td>
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<tr>
<td>Ln Household</td>
<td>0.4462967</td>
<td>-0.0328582</td>
</tr>
<tr>
<td>members working</td>
<td>(0.519)</td>
<td>(-0.838)</td>
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<td>(Number)</td>
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<tr>
<td>Ln Household</td>
<td>-0.9005295</td>
<td>-0.8319255</td>
</tr>
<tr>
<td>membership of</td>
<td>(-0.358)</td>
<td>(-0.544)</td>
</tr>
<tr>
<td>farmer association</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(0-1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ln Farm size</td>
<td>-0.8632615</td>
<td>0.9322235</td>
</tr>
<tr>
<td>(Hectare)</td>
<td>(-6.107)**</td>
<td>(2.494)**</td>
</tr>
<tr>
<td>R-square</td>
<td>0.6501</td>
<td>0.7599</td>
</tr>
<tr>
<td>Adjusted R-square</td>
<td>168.80**</td>
<td>2669.22**</td>
</tr>
<tr>
<td>F-statistics</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Source:** Field Survey, 2011.

( ) Figures in parenthesis are heteroscedasticity consistent t-ratios
<table>
<thead>
<tr>
<th>*t-ratio is significant at 1%</th>
<th>**t-ratio is significant at 5%</th>
</tr>
</thead>
<tbody>
<tr>
<td>F-statistics is significant at 1%</td>
<td></td>
</tr>
</tbody>
</table>

The coefficient of total per capita income with regard to food expenditure is significant and negative at 5% level of confidence, indicating that the higher the income the higher is the propensity of expenditure shares on food to be reduced. [16] pointed out that an increase in per capita household income does not necessarily translate into increasing calorie intake at the household level. [17] noted that poor households spend large share of their incomes on necessities. However, as their household income rises, spending on these necessities rises, but the proportion of income spent on them falls. This is because they would prefer to spend the increments to income on higher quality necessity goods and services. [18] observed...
that in addition to financial savings, the poor tend to spend additional income on improved nutrition, education for their children, improvements in housing conditions, and other expenditures that, especially at poverty levels, represent investments rather than consumption.

The coefficient of total per capita expenditure with regard to food is significant and negative at 5% level of confidence. The higher the per capita expenditure the higher is the propensity of expenditure shares on food to be reduced. This is as a result of the impact of increased per capita income on the expenditure of individual household member, which is directed towards meeting other higher quality necessity goods and services.

As the number of household members increases the share of household expenditure on food reduces. This is interpreted by the negative and significant sign (5% level) of the household residents and is in conformity with the literature findings of expenditure and household size [12, 19]. This finding is linked to the presence of dependants in the household. The presence of dependants (aged between one and 18 years) generally decreases the share of expenditure on food. A bigger share of income expenditure is spent on the education of most dependants in lieu of household food.

As the age of household head increases the share of household expenditure on food reduces. This is as a result of the need to spend on other social services thereby reducing the share of household expenditure on food. Similar result was reported by [7]. As access to credit increases the share of household expenditure on food reduces. This is as a result of the impact of credit on income generation and hence spending on other social services thereby reducing the share of household expenditure on food.

The coefficient of Household members in school with regard to food is significant and negative at 5% level of confidence. This is because as much income is committed to education it reduces its (income) availability for food expenses. The coefficient of dependency ratio with regard to food is significant and negative at 5% level of confidence. The presence of dependants generally decreases the share of expenditure on food. This could be because a bigger share of income expenditure is spent on the education of most dependants in lieu of household food. As Farm size increases the share of household expenditure on food reduces. This is as a result of the impact of farm size on income generation and hence spending on other social services thereby reducing the share of household expenditure on food.

B. Determinants of Household Non-Food Expenditure

The result in Table I further shows that at 5% level of significance, the hypothesis that the specified (selected) explanatory variables have no significant influence on farm household non-food expenditure is rejected by the result of the F-test, suggesting that there is a significant impact between farm household non-food expenditure and the selected explanatory variables. The model has a good fit to the data. For example, the coefficient of determination ($R^2$) is 0.7999, suggesting that the model has a high goodness of fit. This indicates that 79.99% variation in farm household non-food expenditure is accounted for by variations in the selected explanatory variables, suggesting that the model has high explanatory power on the changes in farm household non-food expenditure among the respondents. The adjusted $R^2$ also supported the claim with a value of 0.7599 or 75.99%. This implies that the selected explanatory variables explain the behavior of farm household non-food expenditure among the respondents at 76% level of confidence. The calculated F-statistic value of 2669.22 which is greater than the critical value of 1.49 at 5% level of significance implies that there is a significant impact between farm household non-food expenditure and the selected explanatory variables.

The share of non-food expenditure is significantly influenced by per capita income as is the case in food expenditure. The sign is, however, positive implying an incremental correlation between per capita household income and share of non-food expenditure (such as expenses on housing, clothing, education, health, farming, and other extra-social services). The coefficient of total per capita expenditure with regard to non-food expenditure is significant and positive at 5% level of confidence. The higher the per capita expenditure the higher is the propensity of expenditure shares on non-food to be increased. This is as a result of the impact of income on the expenditure of individual household member, which is directed towards meeting higher needs other than food.

The same trend can be observed with regard to household size where the higher the number of household size the higher is the likelihood that the household will apportion a bigger share of its expenditure on non-food items at a 5% significant level. The coefficient of dependency ratio bear a positive sign with regard with non-food expenditure implying an increase of the non-food expenditure share as the number of household dependants increases. As the age of household head increases the share of household non-food expenditure increases. This is as a result of the need to spend to meet other social needs other than food. As access to credit increases the share of household non-food expenditure increases. This is as a result of the impact of credit on income generation and hence increased spending on social services other than food.

The coefficient of household members in school with regard to food is significant and positive at 5% level of confidence. This is because as household members in school increases much income is committed to education thereby increasing expenses on social services.

The coefficient of dependency ratio with regard to food is significant and positive at 5% level of confidence. The presence of dependants generally increases the share of expenditure on non-food needs. As Farm size increases the share of household non-food expenditure increases. This is as a result of the impact of farm size on income generation and hence increased spending on other social services other than food.

The result of the study showed that a unit increase in the number of household members in school (-0.9388128) generated the highest fall in household food expenditure among the respondents. This suggests that increase in the number of household members in school (which depicts committing of much income to education and reducing its (income) availability for food expenses) has the highest tendency to decrease household food expenditure among the respondents.
respondents. This is closely followed by dependency ratio (-0.9377187). The policy implication of the foregoing finding is that any policy that is directed towards measures leading to the release of the “educational-financing burden” from farm households would no doubt improve food security among the respondents.

On the other hand, a unit increase in the household size (0.9513381) generated the highest rise in household non-food expenditure among the respondents. This suggests that increase in the number of household residents (which depicts increase in the presence of dependants in the households and higher likelihood that the household will apportion a bigger share of its expenditure on non-food items such as education of dependants, in lieu of household food) has the highest tendency to increase household non-food expenditure among the respondents. This is closely followed by farm size (0.9322235). This is as a result of the impact of farm size on income generation and hence increased spending on other social services other than food. The policy implication of the foregoing finding is that any policy that is directed towards measures leading to increase awareness among rural women in using family planning to reduce fertility would go a long way to improve food security among the respondents.

From the foregoing findings, it is evident that the rural farm households in Nigeria are pursuing multiple objectives in allocating expenditure on various goods and services. There seem to be the altruistic characteristics of some household members forfeiting current consumption and investing more household income in (non-food) social services such as education of (younger) household members for posterity reasons. [20] observed that households in the lower earning echelons assign a smaller share of their income on education compared to the higher income households.

IV. CONCLUSION

The findings of the study have revealed the significance of household income in determining food and non-food expenditure. The share of the household budget spent on food has been proven to decrease as the household income increases. In contrast the expenditure share on non-food has shown increasing tendencies.

The increase of non-food budget share as the number of household members in school increases, amidst food insecurity is a pointer to the pursuit of a multiplicity of consumption objectives by households leading not necessarily to entitlement failure but to food entitlement forfeiture. The apparent paradox of a reduction in the budget share on food with a corresponding increase in the number of household residents is particularly linked to dependants, where their increased presence in households reduces the budget expenditure on food but increases the share expended on the youngsters’ education.

Policy measure for improving the food and nutritional security of farm households in rural Nigeria should be linked to their ability to expend their income on enough food for healthy lives. This is clearly linked to policy instruments that improve income such as increased farm production and productivity, non-farm and off-farm employment.

The non-affordability of more nutritious foods such as beans could be tackled by intensified extension measures on appropriate intercropping of various crops, such as beans, maize and vegetables as well as creation of orchards for increased production to safeguard sources of nutritious foods. The need by farm-households in rural Nigeria, as in other parts of the country, to provide appropriate formal education for younger members is commendable. However, measures leading to the release of the “educational-financing burden” from farm households should be addressed at the policy level. The options available could include the provision of bursaries, scholarships and/or long-term serviceable loans for needy households. There is also the need to look into the possibility of diversifying asset ownership away from land in order to solve the farm-land scarcity problem in order to increase income from farming in rural Nigeria.

REFERENCES


