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Implications of Household Health Status on Farm Income, Food Insecurity and Rural Poverty in Nigeria

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Abstract: The study examined the effects of farm household health status on farm income, food insecurity and rural poverty in Oyo state, Nigeria. A multi-stage sampling technique was used in data collection. The household production function was proxied by a Farm Household Income function. The estimated Income function showed that all the measures of household health status had negative significant effects on household farm income. These results tend to confirm the adverse effects of illnesses and diseases on farm output, productivity and household welfare especially food insecurity and poverty. The Discriminant function identified 8 significant variables distinguishing food insecure households from food secure households. Seventy percent of the households were correctly classified by the function. The Discriminant function for the poor and non-poor households identified 12 discriminating variables for the groups. Some 7% of the households were correctly classified in the model. The food insecure households constituted 57% of the sample. Hence, 43% of them were found to be food secure. The poverty decomposition measures showed that 68% of the sampled households were poor. The implication of this finding is that 11% of the food secure households were classified as being poor. Hence, being food secure does not necessarily mean escape from poverty while food insecurity is a characteristic of rural poverty. Provision of health facilities, farm income improvement measures and farm productivity enhancing policy were therefore recommended.

Key words: Household health status, farm income, food insecurity, rural poverty, Oyo State, Nigeria

INTRODUCTION

Two thirds of the Nigerian labour force is engaged in the agricultural sector (CBN, 2003). This sector is conceptualized within the orbit of a rural economy as rural agriculture. Most rural places lack the basic physical, institutional and social (education and health) infrastructures necessary to make life more comfortable, productive and poverty reducing. Social capital is known to significantly contribute to sustainable development (Collier, 1998).

Health security is recognized as integral to any poverty reduction strategy (Jutting, 2004). This is due to the role that social risk plays in the life of the poor (Holzmann and Jorgenson, 2000). Health risks pose the greatest threat to the lives and livelihoods of rural dwellers especially farmers. Within their households, labour is often the dominant household resource. This is allocated to several competing activities required for survival, sustenance and possibly to generate income. A health shock within this setting leads to direct expenditure for medicine, transport and treatment (Jutting, 2004). It also leads to indirect costs related to a reduction in labour supply (quality and quantity) and productivity (Asfaw, 2003).

A strong link is known to exist between health and income at low-income levels. Since the Nigerian agricultural sector is characterized by low income (Ojo, 1991), any health shocks in the farming household affects the welfare of the members (CMH, 2001; Morrison, 2002). There is thus the research need to examine the effects of household health status on household farm income, food insecurity and rural poverty in this setting. More so, the adverse effect of illness on household and community welfare is known to be considerable because of the production forgone as labour is reallocated to nurse and mourn the victims; declining farm productivity as assets and working capital are sold to pay medical bills and rising dependency burden.

Problem statement: The poor state of health facilities is more pronounced in rural Nigeria (Gureje, 2005). Yet better health is known to contribute to higher labour productivity while higher productivity leads to higher

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incomes, improved household welfare and rural poverty reduction (Strauss, 1993; Strauss and Thomas, 1993). Labour productivity thus plays an important role in the development process whether inside or outside agriculture (Van den Broom *et al.*, 1997). Diseases such as Malaria, HIV/AIDS, Tuberculosis and others are classified as high cost illnesses. They have adverse effects on life expectancy and productivity of the labour force. These diseases can harm food security, agricultural production and household welfare. As many as 2 billion people about 40% of the world population live in areas where malaria is endemic. This disease that is mainly rural is a major health problem in Africa (Egan, 2001). Each year 300-500 million people develop malaria and 1.5-2.7 million die. Ninety percent of this mortality is in Africa. It strikes during the rainy season when farmers' productivity needs to be at its highest. Nigeria alone spends about $132 billion currently on malaria. These diseases thus affect the health status of the labour force. The health status of the agricultural labour force is critical and of importance in Nigeria. More so the sector is labour intensive such that shortages in labour input could have a disastrous effect on food supply and food security targets of the nation.

That agriculture depends on muscle power/human labour underscore, the problem posed by the disease-factor in agricultural production and labour supply, food self-sufficiency, food security and poverty. Already it is estimated that agricultural productivity will have to double over the next few decades to keep up with population growth (Kerry and Warnan, 2004). Hence, the health status of the work force has an immediate and direct impact on the nation and the worldwide economies. As a result, economic losses due to diseases, illnesses, sicknesses and injuries need to be minimized, as they constitute a serious burden on economic development (Fact Sheet, 1999). While, according to Strauss (1986), nutritional/health status may affect income and employment (labour supply), we believe that the effect of income and employment on nutritional/health status is bigger (Kyereme and Thorbecke, 1991).

Objectives of the study: The major objective of this study is to model the effects of health status on farm output/income, household food security and rural poverty in Southwestern Nigeria. The specific objectives are to: Examine the effects of health status indices on farm household income, identify the determinants of household food insecurity vis-à-vis its health status, identify the factors determining rural poverty vis-à-vis the health status of the households, estimate the household`s povrety profile and establish a link between food security and rural poverty vis-à-vis the health status of the households.

MATERIALS AND METHODS

Area of study: Oyo State is located in South-western Nigeria is selected for this study. It lies within latitudes 7°5 and 9°10'N of the equator and longitudes 2°38 and 4°35'E of the Greenwich Meridian. Farming is the main occupation of majority of the people in the state. The state is thus strictly agrarian and rural based.

Southwestern Nigeria has an admirable record in human resource development in Nigeria. Free Primary Education was introduced into the area in 1955 by the then regional government. Years later in 1979, Universal Primary Education (UPE) was launched in the area again at the regional level. In 1999, the federal government of Nigeria introduced a nation-wide education programmes called Universal Basic Education (UBE). The efforts of the past and the current impetus call for the quantification of the effects o these programmes on the health status, food insecurity and poverty of the people in this state.

Based on the fore-going, albeit pertinent, information, a multistage random sampling technique was used in collecting the data required for this study. Oyo state is divided into eight agricultural zones. These are the Eruwa (Ibarapa), Iseyin, Kishi, Saki, Okeho, Oyo, Ibadan and Ogbomoso. These are taken as the sampling units and constitute the first stage of sampling. In the second stage of sampling, the list of all the villages within each zone was obtained from the Oyo state, Ministry of Local Government, Secretariat, Ibadan. In each of the zones, 5 villages were also randomly selected. Forty villages were thus selected for the study. Ten households were randomly selected in each village as a third stage of sampling. Four hundred households were thus sampled. Data collected covered the outputs, inputs, health status and other socio economic variables relevant to the analysis to be carried out and the stated objectives of the study.

Methods of data analysis: The tools of analysis for the study comprised the production function and discriminant analysis.

The production function: The production function is specified as:

$$Q = AX_1^{b1} X_2^{b2} X_3^{b3} X_4^{b4} X_5^{b5} e^{\theta 1Z1+\theta 2Z2+\ldots+\theta 5Z5} \qquad (1)$$

Where,

Q_i = Output of crops.
X_1 = (Farm size) in hectare.
X_2 = Male labour in hours.
X_3 = Female labour in hours.
X_4 = Capital (assets).

X_5 = Cost of other inputs or farm operating capital (hired labour, chemicals etc).

The health indices are:
Z_1 = Number of household members attacked (both workers and dependents).
Z_2 = Number of hours lost by farm workers due to attacks.
Z_3 = Medical bills.
Z_4 = Number of episode per year.
Z_5 = Type of illness if high cost = 1, otherwise = 0.

The effects of the health status indices are expressed as powers of an exponential. The advantage of this functional form is that the logarithm of the output also depends on the health status indices in addition to the logarithms of the inputs. This is compatible with the relationship usually estimated in microeconomic studies (Bloom *et al*., 2004; Rahman and Khandker, 1994).

Income model: The factors that affect farm outputs are likely to affect the farm income. This is because poor health status as conceptualized cannot only lead to reduction in farm output and productivity but also to decreased income. Hence, an income function is specified and estimated in this study. The model adopted for this study is similar to the value-added function used by Tang (1997), though in this case it is specified as an Income Function (Rahji, 2001). The estimating equation is:

$$LnY = lnA + a_1 lnX_1 + a_2 lnX_2 + a_3 lnX_3 + a_4 lnX_4 + a_5 lnX_5 + \theta_1 Z_1 + \theta_2 Z_2 + \theta_3 Z_3 + \theta_4 Z_4 + \theta_5 Z_5 \quad (2)$$

Where,

$$Y = P_1Q_1 + Q_2 + Q_3 + \ldots + PmQm$$

Discriminant analyses

Discriminant function for household food insecurity/ security: The Discriminant function is specified as

$$d_1 = b_1W_1 + b_2W_2 + \ldots + b_3W_3 \quad (3)$$

where, d_1 = dependent dummy variable if food insecure = 1 otherwise = 0. no, bi's are parameters to be estimated. Wi's are the explanatory or discriminating variables. Discriminant analysis was used to classify the households and identify the factors that determine the household food insecurity/security status. The food security line is measured as a ratio of the actual calorie and protein consumption to the daily-recommended level of calorie and protein which are 2260 Kcal and 65 g, respectively (Olayemi, 1998).

$$\text{Food security index (S)} = \frac{\text{Household daily per capita Calorie/protein consumed}}{\text{Household daily per capita Calorie/protein required}} \quad (4)$$

Thus for a household to be food secure, S must be greater than one (S>1). If S is less than one (S<1), then the household is food insecure. The quantity of crops produced and purchased will be converted into kilogram and then to calorie and protein. This will be divided by the household size and 355 days to obtain the calorie and protein consumed per day per household.

Discriminant function for household poverty: A discriminant function was used to categorize the households into poor and non-poor. Based on the poverty line constructed below. Thereafter factors separating the 2 groups were identified. The model is specified as:

$$d_2 = d_1Y_1 + d_2Y_2 + \ldots + {}_{16}Y_{16} \quad (5)$$

The Food Energy Intake (FEI) equation (Greer and Thorbecke, 1986; Okurat *et al*., 2002) was used to obtain the poverty line in this study. The line is represented as:

$$Z = e^{(a+bk)}$$

Where,
Z = The poverty line.
K = The recommended daily calorie/protein intake.
a and b = Are parameters to be estimated.

These parameters are estimates derived from

$$InEi = a + b\,Ci$$

Where,
Ei = Total food expenditure per adult equivalent in the household.
Ci = Total calorie consumption per adult equivalent valuein the household.

Total calorie consumption of households was estimated following Oguntona and Akinyele (1995). World Bank (2001), observed that provided the information on consumption from household survey is detailed enough, consumption will be a better indicator of poverty than income as consumption is more permanent while income may include transitory elements. The daily per capita household food energy intake recommended by the

World Bank for the study of poverty of 2350 kcal was then used in calculating the poverty line (Z). Households below this line are classified as being poor.

The Foster *et al*. (1984) class of poverty measures was estimated to indicate the household poverty profile. This gave the percentage of the households that are poor.

RESULTS AND DISCUSSION

Table 1 presents the results of the estimated income function for the households. The explanatory power of the estimated model is about 73%. The joint effect of the explanatory variables is significant at the 1% level. As expected, all the measures of household health status have negative significant effect on household farm income. These results tend to confirm the adverse effects of illnesses on farm output and productivity. By extension the adverse effects will be translated into reduction in household and community welfare. The effects most expectedly will be reflected in food insecurity and an aggravation of the poverty level of the households. By these results the first objective of this study is attained.

As a first step towards the meeting of the second objective of this study, the food security/insecurity of the households was determined. Table 2 presents the summary of the calculations indicating the food insecurity/security status of the households. Only 43% of the households were food secure based on the criterion used of having 2867.32 kcal and 72.85 g of protein. These values are higher than the standard 2260 kcal and 65 g. Some 57% of the households fell short of these values at 2084.95 kcal and 48.76 g. These are classified as the food insecure households in the sample.

In the discriminant analysis performed on the sample of 386 farm households as a second step in attaining the second objective, the binary grouping variable used is food insecure household = 1 and food secure household = 0. To distinguish between the 2 groups, thirteen variables were chosen representing the socio-economic and health characteristics of the households. The step-wise procedure was used to select the best discriminating variables.

The results indicated that eight of the variables-farm size (W_1), crop diversification (W_2), household size (W_3), household food expenditure (W_4), level of agric commercialization (W_5), household asset (W_6), dependency rate (W_7) and household health status (W_8) were significant. Five variables which are age of head (W_9), sex of head (W_{10}), non-farm income (W_{11}), education of head (W_{12}) and farm income (W_{13}) were dropped during

Table 1: Results of the estimated household farm income function

Variable	Parameters	t-values
$\ln x_1$	0.5916***	2.8643
$\ln x_2$	0.2138**	2.3785
$\ln x_3$	0.4257***	3.6417
$\ln x_4$	0.0342	1.3892
$\ln x_5$	0.2563	1.5466
H_1	-0.3104**	2.4322
H_2	-0.4523***	2.6576
H_3	-0.6684***	4.3115
H_4	-0.2192**	2.2679
H_5	-0.5471***	4.5431
K	4.3582	

Source: Field survey, 2006. N = 386. R^2 = 0.7285, $\bar{R}^2$ = 0.7213

Table 2: Food security/insecurity status of the households

Variables	Food secure	Food insecure
Mean household size	5 (5.12)	7 (6.81)
Household daily energy availability Kcal	14,680.68	14,198.51
Household daily protein availability (gm)	372.99	332.06
Household daily per capita energy availability (k ka^{-1})	2867.32	2084.95
Household daily per capita protein availability (g)	72.85	48.76
Number of households	166	220
Percentage of households (%)	43	57
Head count ratio	0.43	0.57

Source: Field survey, 2006

the step-wire procedure because their values were too low less than 0.10 (Yapa and Mayfield , 1978). The estimated Eq. is:

$$d_1 = -0.735W_1 - 0.463W_2 + 0.309W_3 - 0.643W_4 - 0.226W_5 - 0.814W_6 + 0.057W_7 + 0.362W_8 \quad (6)$$

The sign of the coefficients shows the direction in which the dependent variable moves as the independent variables change. It follows that an increase farm size, crop diversification, household food expenditure, level of agricultural commercialization and household assets decreases the probability of the household being food insecure. Increase in household size, dependency ratio and re-classification of household from low cost illness to high cost illness status will increase the probability of the households been food insecure. The absolute values of the discriminant coefficients indicate their relative importance and contribution to the household food insecurity status. Hence, the coefficient can be interpreted like the beta coefficient of multiple regressions.

The eigen value and the canonical correlation associated with the function are 0.296 and 0.34, respectively. This indicates a high degree of effectiveness in separating food insecure households from food secure households. The high resolution is most evident from the distance between the 2 centroids that is equal to 1.065. The group centroids are 0.359 for food insecure and -0.706 for food secure households.

The Wilk's lambda criterion and the standardized canonical discriminant function both confirmed that the variables identified by the model were significant discriminating variables. The validity of the model was further derived from the classification results for the two groups. The classification routine was able to identify 72% of the food insecure and 68% of the food secure households. On the average, 70% of the households were correctly classified by the estimated discriminant function. In this way, the second objective is achieved.

Discriminant analysis was also used to distinguish between poor and non-poor households. The dependent variable in this instance is poor household = 1 and non-poor households = 0. To separate the two groups, sixteen discriminating variables were used representing the determinants of household poverty.The step-wise procedure used accepted sex of head (Y_1), household size (Y_2), non-farm income (Y_3) farm size (Y_4), crop diversification (Y_5), level of agric commercialization (Y_6), medical expenses (Y_7), expenditure on schooling (Y_8), household assets (Y_9), use of informal credit (Y_{10}), dependency ratio (Y_{11}) and farm income (Y_{12}). Four variables-age of head (Y_{13}), education of head (Y_{14}), index of male social capital (Y_{15}) and index of female social capital (Y_{16}) were dropped from the model because their values were low less than 0.10. The estimated equation is:

$$d_2 = 0.702Y_1 + 0.485Y_2 - 0.337Y_3 - 0.513Z_4 - 0.362Y_5 - 0.314Y_6 + 0.432Y_7 + 0.586Y_8 - 0.397Y_9 + 0.243Y_{10} + 0.328Y_{11} - 0.651Y_{12}. \qquad (7)$$

The results of the estimated discriminant function imply that increases in non-farm income, farm size, level of crop diversification, level of agricultural diversification and farm income decreases the probability of the household being poor. However, a reclassification of the household from male-headed to female headed household, (Bates, 1971), increases in household size, medical expenses, schooling cost of household children, use of informal credit and dependency ratio increase the likelihood of the household being poor. The absolute values of the discriminant coefficients indicate their relative importance and contribution to the poverty status of the household. In this care they can be interpreted as the beta coefficients multiple regression analysis (Cooley and Lohnes, 1971; Morrison, 1974; Greer, 1971).

The eigen value of 0.325 and canonical correlation of 0.478 indicate a very high degree of effectiveness of the variables in separating the groups. This high resolution is evident in the distance between their centroids that is 1.116. This indicates a high degree of resolution. The centroids are 0.681 for the poor households and -0.435 for the non-poor households.

Table 3: Showing the estimated household poverty measures

Measure	Symbol	Value	(%)
Poverty incidence	Po	0.68	68.0
Poverty gap	P_1	0.37	37.0
Poverty severity	P_2	0.14	14.0

Source: Field survey, 2006

The Wilk's lambda of 0.362 and the standardized canonical Discriminant function also confirmed that the variables identified by the step-wise procedure were significant discriminating variables. In addition, the validity of the estimated function was further confirmed by the classification routine. This was able to identify 75% of the poor households and 70% of the non-poor households. It showed an overall degree of correct classification of 73%. and so the third objective is met.

The poverty profile of the households was measured through the FGT (1984) procedure. Table 3 shows that 68% of the households were classified as being poor. This measures poverty incidence, which is the same thing as the head count ratio. Hence, 236 households were classified as being poor. The poverty gap of 37% denotes the proportion of the gap that the average poor household will require to get to the poverty line or become non-poor. The severity of poverty is 14%. This means that the poorest of the poor constitute 14% of the sampled households i.e., 54 households These results help in meeting the fourth objective.

The linkage between food security and poverty is examined in this section as a way of achieving the last objective of this study. Some 43% of the households are food secure. This implies that 57% of the households are food insecure. But 68% of the households are poor. The implication is that all the food insecure households and some of the 43% of the food secure households (about 11%) are classified as being poor. Hence, some 14% of the households are food secure and poor while only 29% of the food secure are non-poor. Two things are discernable from these results. One, being food insecure generally implies a state of household poverty. Two, that a household is food secure does not necessarily mean that it is non-poor. In summary, it can be stated that household food security does not guarantee escape from poverty and that household food insecurity is a component or defining characteristics of household poverty.

CONCLUSION AND RECOMMENDATIONS

Diseases and illnesses have adverse effects on productivity of the farm labour force. A strong link is known to exist between farm household health status, household income and household welfare. Agricultural growth will prove essential for improving the welfare of the vast majority of the rural and urban poor. As consumers, they will count heavily on farmers, since farm productivity and production costs are fundamental determinants of the prices of basic foodstuffs that accounts for 60-70% of total consumption expenditure by low-income groups. Consequently, significant reductions in poverty will hinge in large part on the collective ability of farmers, governments and agricultural specialists to stimulate and sustain broad-based agricultural growth through productivity increases.

In the light of this, provision of accessible health facilities to farmers is a necessary step in the right direction to combating diseases and illnesses in the rural areas where the bulk of agricultural produce comes from. In addition to this, farm income improvement measures are also required. Above all, farm productivity enhancing policies must be put in place. These recommendations are proffered with the hope that they will help to turn things around. Already it has been estimated that agricultural productivity will have to double over the next few decades to keep up with population growth in Africa.

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