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Full Length Research Paper

Non-farm activities and arbitration between food and non food consumption in rural Burkina Faso: A household level analysis

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This article analyzes the impact of non-farm activities on food and non food arbitrage of rural households in Burkina Faso. It uses Probit selection rule and AIDS model for 256 households located in four agro-ecological areas. Results indicate that there are complementary and substitutability relationships between food and non foodstuffs in the rural area; no independent relationships have been identified between these two types of goods. The analysis has shown that by practicing non farm activities of the households in the rural area are able to lessen the severity of the arbitration between the goods consumed.

Key words: Rural household, non farm activities, AIDS model, probit, food, non food consumption, Burkina Faso.

INTRODUCTION

Rural households in developing countries face substantial risk. In Burkina Faso, households are faced with several risks: rainfall, natural disasters, cricket invasions, and the volatility of the prices of farm products. These risks lead to fluctuations in agricultural income and exposure of households to consumption shocks. There has been a good deal of work in recent years that examine the effectiveness of formal and informal risk sharing and consumption smoothing arrangements (Alderman and Paxon, 1994; Fafchamps and Lund, 2003; Jalan and Ravallion, 1999; Kazianga and Udry, 2006). The overall conclusion of this research is that the rich households smooth consumption more than the poor and this situation can inhibit the possibilities to go out of poverty. Faced with these risks, the alternatives for farmers are few. Insurance is precluded because of high geographic covariance of risk, high moral hazard, and high geographic dispersion of production – that is a given area accounts for only a very small part of total production in most parts of the country, with some possible exceptions for the cotton zones. Credit is limited due to a lack of collateral: land has little value and livestock is an uncertain stock, as it can be either stolen or exterminated by disease. Credit is also limited by the paucity of lending institutions more or less suited to this type of situation. Because of the failure of these common mechanisms to combat risk, farmers rely on agent-level mechanisms, diversification, and asset accumulation for consumption smoothing, and on society-based insurance arrangements.

Previous research had found that the income from non-farm activities was essential for the welfare of rural households (Rosenzweig, 1998). In developing countries and economies in transition, between one third and half of the households generate their income from a non-farm source and the share of this type of income is between 20 and 70% of the total household income (Adams, 2001; Benjamin, 1992; Newman and Gertler, 1994; Rizov et al., 2000; Rosenzweig, 1980). Income diversification in rural areas is an important phenomenon in Burkina Faso. Research conducted by ICRISAT over the 1981 to 1985 period (in three agro-ecological zones) suggests that between 26 and 57% of the total household income come from non-farm activities (Reardon et al., 1992). Recent studies in the same zones have indicated that non-farm income represents between 22 and 40% of the total household income (Zahonogo, 2002). Zahonogo (2002) shows that non farm income help households to smooth

consumption.

In Burkina Faso, households combine two main strategies of diversification of sources of income: (i) diversification in farming and (ii) diversification outside farming. The former type of diversification consists in diversifying forms of speculation. This type of strategy ties in with that of trying to face the risk that comes with climate change. For its part, diversification outside farming consists in selling the workforce and engaging in trade activities. This strategy ties in with that of preparing to face risks that go with farming and of maximizing revenue. In this study we focus on the second type of diversification. Food needs top the expenses in rural Burkina Faso where 50% of the budget is invested (INSD, 1998). Poverty reduction requires actions to increase and stabilize this huge food consumption. Indeed, till now food insecurity constitutes a crucial issue in Africa. It is more and more obvious that poverty reduction should also aim at improving the general living conditions of the households. Other aspects related to food consumption expenses should be considered. In Burkina Faso, non food consumption represents 20 to 50% of the overall expenses of the households in the rural area, depending on whether or not we include the domestic food consumption (Kazianga, 1996; Zahonogo, 2002). Understanding the behaviour of households with regard to how they allocate income between food and non food consumption is crucial for adjusting farming and rural policies. This is all the more relevant because many economic policy instruments get focused on insulating consumption from fluctuations in income in the rural area. In this rationale, an analysis of arbitration between food and non food consumption can provide interesting and very useful information for decision-makers. First of all it enables us to understand the mechanisms to arbitrate these two big groups of goods and the relations between goods in rural area. This analysis of the case of Burkina Faso can also provide interesting elements for formulating rural poverty reduction policies, mainly in a period where Burkina Faso has evolved from macroeconomic adjustment policies towards a poverty reduction oriented policy.

This article examines the arbitrations between the food and non food consumption of rural households in Burkina Faso in the context of income diversification. It uses data collected from 256 households located in 8 villages of four agro-ecological areas during the 1999 to 2000 cropping season.

MATERIALS AND MEHODS

The analytical model

The paper provides a demand model for food and non food consumption in the rural area in the frame of an endogenous distribution sample. The sample stratification is based on the household engagement in non farm activities. This engagement is assumed to be an important arbitration criterion between the food and non food consumption. The model of analysis is therefore made up of a system of demand derived from rural households' models and a Probit selection rule which allows the endogenous distribution of the households' sample engaged in farm activities and those who are not. It is a non separable model of rural households which has been chosen rather than the separable one because much appropriate to estimate the behavior of rural households in developing countries (for the developments on rural households models, see Zahonogo, 2002).

On the basis of the tradition of the models for rural households (Singh et al., 1986), we assume that the rural household maximizes the following utility function:

$$U = U(X_a, X_m, X_l) \quad (1)$$

Where the commodities are an agricultural staple (X_a), a market-purchased goods (X_m), and leisure (X_l). Utility is maximized subject to a cash income constraint:

$$P_m X_m = P_a(Q_a - X_a) - w(L - F) \quad (2)$$

Where P_m and P_a are the prices of the market-purchased commodity and the staple, respectively, Q_a is the household's production of the staple, w is the market wage, L is total labor input, and F is family labor input.

The household also faces a time constraint; it cannot allocate more time to leisure, on-farm production, or off-farm employment than the total time available to the household:

$$X_l + F \leq T \quad (3)$$

As long as leisure is normal goods, the non satiety axiom implies:

$$X_l + F = T \quad (4)$$

The household also faces a production constraint that depicts the relation between inputs and output:

$$Q = Q(L, A, V) \quad (5)$$

Where A is the household's fixed quantity of land, V represents variables inputs used in the production process. We assume that Q(.) has the usual regularity proprieties. The three constraints can be collapsed into a single constraint. Substituting the production constraint into the cash income constraint for Q and substituting the time constraint into the cash income constraint for F yields a single constraint and the household's problem can be summarized as follows:

$$\begin{aligned} &Max U(X_a, X_m, X_l) \\ &sc \\ &P_m X_m + P_a X_a + w X_l = P_a Q(L, A, V) + wT - wL \end{aligned} \quad (6)$$

The left-hand side shows total household expenditure. The first term of the right, $\pi = P_a Q(L, A, V) - wL$ is a measure of farm profit and wT represents the opportunity cost of the household time. The regularity requirements on U (.) and Q (.) assure a unique optimum.

The problem presented has a recursive nature and the resolution helps to find out the optimal labor demand, L*, independently from the rest of the system, from the profit maximization sub problem, as a result $L^* = L(w, P_a)$. The final solution yields standard demand curves of the form:

$$X_i = X_i(P_a, P_m, w, Y) \qquad i = m, a, l \qquad (7)$$

Where Y is the « full» income of the household, incorporating components from the farming production as well from non farming sources.

To make the above model operational, we should define the mathematical forms of the functions U (.) and Q (.). This is a delicate task, because the theory is of limited utility in this choice. In this paper, we use an approach in terms of duality to derive the equations that could be estimated compatible with the problem presented. The mostly used functional form to analyze the demand remains Muellbauer and Deaton AIDS model (1980). This model was applied in Burkina to analyze the households' consumption by Savadogo (1986), Kazianga (1996) and Zahonogo (2002). The final form of the model, derived from the minimization of a cost function (Deaton and Muellbauer, 1980; Zahonogo, 2002) is as follows:

$$w_i = \alpha_i + \sum_j \gamma_{ij} Log\ P_j + \beta_i Log(Y/P) \qquad (8)$$

Where w_i is the budget share of commodity i; $\alpha_i, \gamma_{ij}, \beta_i$ are parameters to estimate; Y is the income of the consumer and P is a price index defined as:

$$Log\ P = \alpha_0 + \sum_j \alpha_j Log\ P_j + \frac{1}{2}\sum_j \sum_i \gamma_{ij} Log\ P_i Log\ P_j \qquad (9)$$

The theoretical restrictions of the model are of parametrical nature:

i) Adding up: $\sum_i w_i = 1 \Rightarrow \sum_i \alpha_i = 1,\ \sum_i \gamma_{ij} = 0,\ \sum_i \beta_i = 0$

ii) Homogeneity : $\sum_j \gamma_{ij} = 0$

iii) Symmetry: $\gamma_{ij} = \gamma_{ji}$

These restrictions can be imposed or tested. Adding up restriction is automatically satisfied when the estimation is made through the Least Squares method. The price index is non linear in the parameters. In practice, Deaton and Muellbauer (1980) suggest approximating the price index P by the Stone geometric price index P^* such as:

$$Log\ P^* = \sum_j w_j Log\ P_j \qquad (10)$$

When P* is used in the place of P, we have the linear version of the AIDS model (LAIDS).

$$w_i = \alpha_i^* + \sum_j \gamma_{ij} Log\ p_j + \beta_i Log\left(\frac{Y}{P^*}\right) \qquad (11)$$

This option proposed by Deaton and Muellbauer used to help resolve problems of non linear estimations. The advent of the computerized calculation of algorithms has made this constraint less severe and linearization is no longer unavoidable. The issue of appropriate price indicator has been recently discussed by authors such as Green and Alston (1990), Parshardes (1993), Alston et al., (1994), Buse (1994) and Moschini (1995). In particular, the use of Stone index can make the results biased on the elasticity from the AIDS model (Fischer et al., 2001). The AIDS model allows a flexible demand behavior which is translated by more complex elasticity formulas than simple models (double logarithmic or semi-logarithmic). The income-elasticity takes the following form:

Original AIDS: $\eta_{i,y} = 1 + \frac{\beta_i}{w_i}$

LAIDS :

$$\eta_{i,y} = 1 + \left(\frac{\beta_i}{w_i}\right)\left(1 - \sum_j w_j\ Log\ P_j\ (\eta_{j,y} - 1)\right)$$

The uncompensated elasticity-price has the following form:

Original AIDS: $\varepsilon_{ij} = -\delta_{ij} + \frac{\gamma_{ij}}{w_i} - \frac{\beta_i}{w_i}\left(\alpha_j + \sum_k \gamma_{kj} Log\ P_k\right)$

LAIDS : $\varepsilon_{ij} = -\delta_{ij} + \frac{\gamma_{ij}}{w_i} - \frac{\beta_i}{w_i}\left(w_j + \sum_k w_k Log\ P_k(\varepsilon_{kj} + \delta_{kj})\right)$

Where δ_{ij} is the Kronecker delta (=1 if i=j and 0 if not).

The compensated elasticity prices are deduced from these results from the Slutsky equation:

$$\varepsilon_{ij}^* = \varepsilon_{ij} + w_j \eta_{iy}.$$

The recent developments of Feenstra and Reindorf (1999) shows that Divisia index is compatible with the aggregation problem in the AIDS context. This formula has been adopted here instead of the Stone index. For a system of weighting and when we divide the observation period in three sub periods, the approximated formula of the Divisia index is as follows, in vector grading (Zahonogo, 2002):

$$Log\ P_D = \left[\frac{1}{6}w(p_0, Y_0) + \frac{2}{3}w(p_{0.5}, Y_{0.5}) + \frac{1}{6}w(p_1, Y_1)\right].\ Log\ (p_1/p_0)$$

Where w (p_t, Y_t) is a vector function giving the budget parts at the level of P price and Y income in t; p_1 and p_0 are the prices in the time 1 and 0. The demand functions which result from the use of P_D is identical to the one obtained with P*.

Econometrical considerations

We assume that the decision of a household to engage in non farm

activities is the result of profit cost calculation. ANA* means a latent variable representing the net profit (or the utility) that the household expects from this engagement. The participation of the household to non farm activities is represented by an observed binary variable, ANA defined as follows:

$$ANA=\begin{cases}1 & if \quad ANA^{*}>0\\ 0 & if \quad ANA^{*}\le 0\end{cases}$$

The latent variable ANA* is assumed to be linked to the household characteristics as follows:

$$ANA^{*} = H\Gamma + \varepsilon, \tag{12}$$

With H, socio demographic variables of the household, Γ the parameters vector to be estimated, and ε the error term, assumed to be normally distributed with a unitary variable. This latest requirement is necessary to identify the parameter vector and the efficiency of the estimating items (Savadogo et al., 1998). The demand system of the households can be described by the linear system:

$$W=X\beta+\varepsilon$$

The fundamental assumption of the model used here is that the demand system is deeply affected by the engagement in non farm activities. We assumed that the participation to non farm activities, by opening to the households some opportunities, wholly affects the regression surface through a modification of all the parameters. That assumes the partition of the sample between the households engaged and those that are not engaged in non farm activities. We adopt endogenous partition, because we assume that these are typical households' characteristics which are at the basis of the engagement or not in non farm activities. In such an environment, the variables affecting the consumption can be those affecting the participation. Estimation simply obtained after separating the two sub samples will suffer from a selection bias.

To correct this bias, we will adopt Heckman (1980) two step model. The model of demand is specified again as follows:

$$\begin{cases}W_1=X_1\beta_1+\varepsilon_1 & if \quad ANA=1\\ W_0=X_0\beta_0+\varepsilon_0 & if \quad ANA=0\end{cases} \tag{13}$$

Where the indexes are showing the 'regime' in which the observation falls. The bias included in the estimations separated from the parameters β_0 and β_1 comes from the fact that the two errors ε_0 and ε_1 are correlated, due to the ANA, the endogenous partition variable. This correlation means a non null expected value of the variables ε_0 and ε_1, such as:

$$E\left(\varepsilon_1 \;/\; ANA=1\right) = -\sigma_1 \frac{\phi(X\beta)}{\Phi(X\beta)}$$

$$E\left(\varepsilon_0 \;/\; ANA=0\right) = \sigma_0 \frac{\phi(X\beta)}{1-\Phi(X\beta)}$$

In this case ϕ and Φ respectively represent the functions of density and cumulative density of the normal standard. Heckman method consists to estimate first of all the 'Mills ratios' reverses $IRM_1 = -\phi(.)/\Phi(.)$ and $IRM_0 = \phi(.)/(1-\Phi(.))$, next to insert them in the equations to obtain:

$$\begin{cases}W_1=X_1\beta_1+\sigma_1 IRM_1+u_1 & if \quad ANA=1\\ W_0=X_0\beta_0+\sigma_0 IRM_0+u_0 & if \quad ANA=0\end{cases} \tag{14}$$

With $u_1=\varepsilon_1+\sigma_1 IRM_1$ and $u_0 = \varepsilon_0 - \sigma_0 IRM_0$

The inclusion of IRM_1 and IRM_0 implies that E (u_1) = E (u_0) =0, which makes it from now on legitimate the estimation by the Ordinary Least Squares. The preliminary estimation of ϕ (Xβ) and Φ (Xβ) by a Probit on the participation equation allows calculating the Mills reverse ratios.

This basic demand model should be modified to incorporate the effects of the demographic variables. The previous results (Savadogo, 1986; Kazianga, 1996) show that these variables are critical in the choice of the Burkinabe households. Amongst the plausible theoretical methods incorporating the effects of the demographic variables, we adopt the normalization method developed by Gorman (1976). Normalization implies that the parameters associated to the demographic variables structurally depend on the price and income parameters (Savadogo, 1986). The recent analyses (Blundell, 1988) support also that the demographic variables affect the demand through price and income. When we incorporate the demographic variables to the demand system, the final form of the system is as follows:

$$W=X\beta+\sigma IRM+\rho\Theta+\varepsilon \tag{15}$$

We assume that the same demographic variables affect both the partition rule of the sample and the behavior of the demand. The estimation of the system is made by imposing the symmetry restriction. Since the demand system is of SUR type (Seemingly Unrelated Regression) when put together with inter-equation restrictions, the efficacy of the parameters estimated can be improved by taking into account the matrix of co-variants. The Generalized Least Squares (GLS) has been the method used for the estimation. The method proposed by Zellner (1962) to estimate this type of model is a two step method. In a first time, the OLS are used to estimate the matrix of the variance –co-variance through the residual. In a second phase, the matrix variance –co-variances is used to estimate the GLS. To avoid the singularity of the system covariance matrix, an equation should be excluded before the estimation.

Data type and source

The data used in this study are from surveys conducted by the University of Ouagadougou and the Japan International Center for Agricultural Sciences (JIRCAS) on rural households in four agro-ecological areas of Burkina Faso: the Sahel area, the Sudanese area, the north Guinean area and the south Guinean area. Apart from the south Guinean area, the other three areas are former survey sites of ICRISAT (International Crop Research Institute for Semi-Arid Tropics) which has conducted some research activities in Burkina Faso from 1981 to 1985. The choice of the villages is a vise one; the study has systematically selected the villages where ICRISAT used to conduct its survey. For the villages located in the

Table 1. Annual expenses per adult equivalent in households of the agro-ecological area (in FCFA)

Type of expense	Sahelian	Sudanese	North Guinean	South Guinean	Overall
Foods	37669	34560	25508	65225	40741
Trading Food	12937	9649	16045	26895	16382
Domestic consumption	24732	24910	9462	38329	24358
Non foods	11105	13524	21736	48208	23643
Total Expense	48774	48084	47244	113433	64384

Source: Survey data.

Table 2. Breakdown of the total expenses of goods and service category per agro-ecological area (en %)

Expense	Sahelian	Sudanese	North Guinean	South Guinean	Overall
Food related expenses	77.3	71.3	52.9	55.8	64.3
Traditional cereals	44.5	34.2	10.0	4.2	23.2
Intermediary cereals	2.0	1.6	11.6	15.3	7.6
Oleaginous and leguminous	3.1	11.9	5.1	9.0	7.3
Fatty foods	6.6	5.2	12.2	4.5	7.1
Manufactured foods	21.1	18.4	14.0	22.8	19.1
Non food related expenses	22.7	28.7	47.1	44.2	35.7
Drinks and excitants	1.5	1.9	4.5	6.4	3.6
Family goods	14.6	14.5	23.7	20.3	18.3
Services	1.3	4.6	7.8	7.1	5.2
Other expenses	5.3	7.7	11.1	10.4	8.6

Source: Survey data.

south Guinean area, the main criteria of selection are the same used by ICRISAT to apply; land locking. So a landlocked and a relatively opened up village have been selected.

In each village, we conducted an exhaustive census of all the households. The households are stratified in three categories according to the level of equipment and use of the farming material because the production technology is supposed to change the household behavior. When we consider each category, the households are chosen randomly. As a result thirty two households have been selected per village and surveyed. The data collected include information on the households' socio economic characteristics, the animal and vegetal production, the food and non food consumption, the money transfer, the use of the labor force and the non farm activities practiced by the households.

RESULTS AND DISCUSSION

Socio-economic characteristics

Level of expenses

Table 1 presents the annual expenses per adult (We use the concept of adult-equivalent because the crude height is submitted to some flaws. For example, two households of height 3 are not the same if the first has 3 adults (1 man and 2 women) whereas the second has 1 adult (one woman) and 2 babies. See appendix for the Table of conversion.) equivalent for the four areas of the study. On the whole, the average adult spends 64.000 F per year, which closely corresponds to the poverty line as defined at the national level by the National Institute of Statistic and Demographic. There are strong disparities between the areas, the individual considered as average in the south Guinean area is the top in other areas.

Budget shares

The budget parts of 9 categories of goods, with 4 non foodstuffs and 5 foodstuffs are presented in Table 2. On average, the rural household invests 64% of its expenses into food and 36% for non food. These proportions vary in a significant way from one area to another one: in the Sahelian and Sudanese areas, more than 70% of the households' total expenses are invested into food whereas in the other areas, 50% of the expenses invested in the same food.

Level and distribution of the households' incomes

The average income per adult equivalent is nearly 58.000 FCFA, with a bi-modal distribution: two highest levels in

Table 3. Activities average annual income per adult equivalent and per ecological area (in FCFA)

Income	Sahelian	Sudanese	North Guinean	South Guinean	Overall
Farming income	15798.8	20929.4	28972.7	42101.9	26950.7
Farming yield	15252.2	20805.6	28552.1	40949.6	26389.9
Farming salaries	546.6	123.8	420.6	1152.3	560.8
Livestock income	12671.3	6623.1	17415.4	8862.8	11393.2
Sale of animals	12047.5	6589.8	17208.1	8843.3	11172.2
Domestic consumption	623.8	33.3	207.3	19.5	221.0
Non farming income	8381.3	7752.7	11306.1	18112.8	11388.2
Local non farming income	4697.6	7226.6	11228.0	18112.8	10316.3
Non local non farming income	3683.7	526.1	78.1	0.0	1072.0
Transfers income	2622.4	5177.9	2469.0	-2012.8	8256.4
In-village transfers	-742.1	49.2	-193.4	-3926.6	-1203.2
Outside village transfers	3364.5	5128.6	2662.4	1913.8	3267.3
Total	39473.8	40483.1	60163.2	67064.7	57988.5

Source: survey data

Table 4. Average annual income per adult equivalent per agro-ecological area according to the type of household (in FCFA).

Area	Households with ANA	Households without ANA
Sahelian	34890.99	47656.26
Sudanese	45463.76	36976.37
North Guinean	62930.32	53302.16
South Guinean	68766.46	64303.04
Overall	55223.41	46442.17

Source: Survey data

Table 5. Households' activities average income distribution per adult equivalent per agro-ecological area (in %).

Income	Sahelian	Sudanese	North Guinean	South Guinean	Overall
Farming income	40.1	53.0	47.8	65.6	51.6
Livestock income	29.4	16.2	12.2	11.7	17.4
Local non farming income	15.8	13.4	35.6	23.9	22.2
Non local non farming income	10.1	1.6	0.2	0.0	3.0
Transfers income	4.6	15.8	4.2	-1.2	5.9
Total	100.0	100.0	100.0	100.0	100.0

Source: Survey data

the Guinean area and two lowest levels in the Sahelian and Sudanese areas (Table 3). Generally, the households who are engaged in non farm activities have higher incomes as compared to those who are not (Table 4). Within all the areas the farming production is the main source. In general, it includes nearly 50% of the income share; the only exception is the Sahelian area where livestock plays an important role (Table 5). The non farm income is mainly from local source. The transfers play a vital role in the Sudanese area, with 16% of the total income.

The prices which correspond to the selected groups of goods are included in the analysis

Table 6 is showing that prices vary sensibly from one area to another one. The price of a kilogram of sorghum goes from nearly 60 FCFA in the north Guinean area to nearly 100 FCFA in the Sudanese area. This latest area

Table 6. kilogram price of the main farming products (in FCFA).

Product	Sahelian	Sudanese	North Guinean	South Guinean
Sorghum	85	99.8	66.67	60.5
Millet	97.5	103.8	66.67	70.83
Maize	100	90	65	56.25
Rice	230	230	210	150

Source: survey data

Table 7. Distribution of the size of the households per agro-ecological area (in %).

Size / area	Sahelian	Sudanese	North Guinean	South Guinean	Overall
0 to 5 persons	12.5	21.9	14.1	24.2	18.2
6 to 10 persons	56.3	43.8	37.5	36.4	43.5
11 to 15 persons	17.2	15.6	25	27.3	21.3
16 persons and more	14	18.7	23.4	12.1	17.1
Total	100	100	100	100	100.0

Source: Survey data.

Table 8. Individual distribution per age and per agro-ecological area (in %).

Age/are	Sahelian	Sudanese	North Guinean	South Guinean	Overall
0 to 5years	21.8	22.0	22.8	18.0	21.2
6 to 15 years	25.2	31.7	30.5	30.7	29.5
16 to 60 years	47.9	39.6	43.2	43.1	43.5
61 years and more	5.1	6.7	3.5	8.2	5.9
Total	100.0	100.0	100.0	100.0	100.0

Source: Survey data.

records on average the highest prices. Prices play a vital role in the way rural households behave in Burkina Faso because previous studies show that most of the households rely on the market for their supply in basic commodities (Kazianga, 1996; Zahonogo, 2002). During the surveys conducted, we found out that the prices for consumption goods are set on the market while those for non food are derived from purchasing made by the households. When we affect the purchasing value to the quantity of each product purchased per household, the price obtained has some insufficiencies, given the heterogeneity of the non food goods and the variation of the quality. The average village price is then calculated by using the average between households, which helps remove a bit the bias related to the quality.

The indexes of the prices calculated are in compliance with Divisia index used to make sure we have an approximate price index in the AIDS model. For b group made up of B category of products, the natural logarithm of the index P_b is defined as follows:

$$Log\ P_b = \left[\frac{1}{6}w_{ir}^{b}\left(p_i^r, Y_r\right) + \frac{2}{3}w_{mi}^{b}\left(p_i^i, Y_i\right) + \frac{1}{6}w_{is}^{b}\left(p_i^s, Y_s\right)\right] Log\left(p_i^s / p_i^r\right)$$

In that case b is indicating the group, s the shortage season and r the harvest season. For each group of products, we should note that only the prices for the main products are taken into account.

The socio-demographic variables selected include the size and composition of the household

The statistics of the variables are showing that the average size is of 10 people and the majority of the households are made up of between 6 and 10 people (Table 7). Besides, the results show that the population is young, the individuals aged between 0 and 15 represent more than 50% of the overall population while the individuals of 61 years and more account for only nearly 6% of the population. (Table 8).

Table 9. Specification of the explaining variables for the AIDS model.

Variables	Variables description
Pct	Price index for traditional cereals
Pci	Price index for intermediary cereals
Pcol	Price index for légumineuses et oléagineux
Pgras	Price index for fatty foods
Pind	Price index for manufactured foods
Pbois	Price index for drinks and excitants
Pequip	Price index for furniture
Income	Real income of the household
Child	Number of children in the household
Woman	Number of women in the household
Man	Number of men in the household

Source: From the author construction.

Table 10. Uncompensated elasticity price for household with non farm activities in the Guinean area.

Products	Pct	Pci	Pcol	Pgras	Pind	Pbois	Pequip
Traditional cereals	-1.191	-0.342	0.180	-0.232	-0.142	-0.542	0.131
Intermediary cereals	-0.488	-0.272	-0.485	0.924	-0.018	1.352	-0.171
Leguminous and oleaginous	0.572	-0.306	-0.261	-0.360	0.408	-1.092	0.372
Fatty foods	-0.437	0.387	-0.265	-0.807	-0.331	0.004	-0.003
Manufactured foods	-0.686	-0.030	0.979	-1.220	-1.122	0.085	0.032
Drinks and excitants	-0.448	0.317	-0.645	0.004	0.011	-1.029	0.003
Furniture	2.144	-0.308	1.185	-0.007	0.036	0.036	-0.999

Source: Surveys data.

Regression results

The explaining variables considered to estimate the demand functions are summarized in Table 9. The estimation of the Probit model allowed calculates the reverse ratios of Mills used as regressor in the AIDS demand system. The results of the demand system estimation are presented in appendix. There are these results that have been used as basis to calculate the demand elasticity price, therefore helping analyze the arbitration between goods consumed in the rural area. The relationships between goods are analyzed through elasticity-price. Prices play a vital role in the allocation of the household available resources between goods at least on the short term. A variation in prices has two effects on the household demand. The price effects are summarized in the concepts of elasticity price which are either compensated (hicksian definition) either ordinary (Marshallian definition). In this study, we use marshallian definition.

Responses

The response of a good to the variation of its own price is provided by the direct elasticity price. In most cases, the direct elasticity price of the demand is negative. This implies that the rational households tend to reduce the demand for a good when its price increases. The results included in the Tables 10, 11, 12 and 13 are showing negative direct elasticity prices for all the goods considered in the two sub groups of households, within two areas, which is in conformity with the theoretical anticipations. In the Guinean area and for each group of goods, except for furniture, the elasticity absolute value is higher for households engaged in non farm activities, showing their higher adaptability when price change occur as compared with households with poor diversified. We have less clear- cut results in the sudano-sahelian area.

Generally as these households engaged in non farm activities have much higher incomes (Table 4), these results can be theoretically justified as follows: the richer households can afford to increase or reduce their purchasing of different goods when there are prices fluctuations, while the poor households are more or less under needs constraints.

Cross relationship

The cross elasticity price which records the demand

Table 11. Uncompensated elasticity price for households without non farm activities in the Guinean area.

Products	Pct	Pci	Pcol	Pgras	Pind	Pbois	Pequip
Traditional cereals	-0.214	-0.321	0.280	-1.654	-0.187	-0.972	0.101
Intermediary cereals	-0.883	-0.176	-0.682	1.930	-0.030	0.399	-0.122
Leguminous and oleaginous	0.462	-0.410	-0.001	-0.886	0.540	-1.087	0.515
Fatty foods	-1.215	0.508	-0.385	-0.587	-0.349	0.004	-0.005
Manufactured foods	-1.007	-0.059	1.789	-2.575	-1.088	0.015	0.020
Drinks and excitants	-1.479	0.215	-0.990	0.007	0.004	-1.021	-0.004
Furniture	0.787	-0.307	2.244	-0.031	0.028	-0.014	-1.028

Source: Survey data.

Table 12. Uncompensated elasticity price for households with non farm activities in the Sudano-sahelian area.

Goods	Pct	Pci	Pcol	Pgras	Pind	Pbois	Pequip
Traditional cereals	-0.927	-0.977	-0.627	0.127	-0.130	-0.101	-0.031
Intermediary cereals	-0.015	-0.870	-0.079	-0.886	-0.069	0.457	0.072
Leguminous and oleaginous	0.007	-2.654	-1.421	-0.066	0.180	-1.316	-0.093
Fatty foods	0.008	0.401	0.013	-0.946	-0.007	-0.124	-0.013
Manufactured foods	-0.069	-0.052	1.220	0.057	-1.008	-0.328	0.047
Drinks and excitants	0.027	0.300	-0.103	-0.012	-0.009	-1.087	0.001
Furniture	-0.007	0.686	-0.200	-0.018	0.020	-0.084	-0.989

Source: Survey data.

Table 13. Uncompensated elasticity price for households with non farm activities in the Sudano-sahelian area.

Goods	Pct	Pci	Pcol	Pgras	Pind	Pbois	Pequip
Traditional cereals	-0.959	1.736	-0.538	0.739	-0.152	0.568	-0.131
Intermediary cereals	0.035	-1.670	0.046	-2.473	-0.021	-0.928	-0.049
légumineuses et oléagineux	-0.086	0.398	-1.259	0.120	0.221	-0.553	-0.189
Fatty foods	0.041	-0.723	0.024	-0.977	-0.028	-0.623	-0.057
Manufactured foods	-0.088	-0.570	0.813	-0.212	-1.007	0.086	0.151
Drinks and excitants	0.058	-0.539	-0.044	-0.081	-0.001	-1.504	0.020
Furniture	-0.013	0.268	-0.123	-0.053	0.025	-0.113	-0.979

Source: Survey data.

reaction of goods following a modification of the prices of other goods (ceteris paribus) helps to identify the relationships of substitution or complement between goods. The analysis of the relationships between food and non food is showing that the two types of goods are either complements or substitutes depending on the case. In the Guinean area, the traditional cereals (millet and sorghum) and drinks on the one part; intermediary cereals (maize and rice) and furniture on the other part are complements whereas traditional cereals and furniture; intermediary cereals and drinks are substitutes for the two types of households.

The households therefore conduct adjustments between these goods depending on the price movement. An analysis of effects scope shows a much bigger flexibility of households engaged in non farm activities as compared to those who are not. In the Sudano-sahelian area, traditional cereals and drinks; intermediary cereals and furniture are substitutes for the two sub groups of households while traditional cereals and furniture are complements.

Intermediary cereals and drinks are substitutes for households with non farm activities and complements for the households without non farm activities. The effects would be more important for the households without non farm activities. Otherwise the non farm activities help the households to mitigate the severity of arbitration between the food and non food consumption.

CONCLUSIONS AND IMPLICATIONS

Many conclusions and implications of economic policies can be drawn from this analysis. Firstly, the analysis has helped bring out some important relationships between food and non food consumption in rural Burkina Faso. These relationships are either relationships of complement or substitution; the study has failed to note down a relationship of independence between the different goods consumed. The rural consumption integrates goods which complete or substitute each other according to the situation. Because of this situation, the rural demand should be analyzed as a whole integrating both the food and non food demand. In that case, the policies of basic food prices are not sufficient to conduct a food policy in the rural area; these policies can have unwanted effects if the household sets an incompressible level of non food consumption. The integration of arbitration between food and non food is necessary when it comes to design policies on rural consumption. So we need to take into account the price of the overall goods and not to focus on basic product prices.

Secondly, there are differences between the areas in terms of arbitration between food and non food consumption. From this situation, it is indicated to integrate the regional factor when it comes to design food policies in the rural area instead of national general policies. Thirdly, the study has shown that the non farm activities helped the households to mitigate the arbitrations between food and non food consumption, we should therefore think about policies to promote non farm activities. These policies should notably aim at improving the demographic characteristics of the households, the results of the partition model has shown that these factors have a significant impact on the income generating activities practiced by these households.

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APPENDIX

Table 1. Estimations results of consumption demand functions for households with non farm activities in the Guinean area.

Independent variables	Dependent variables							
	Traditional Cereals	Intermediary Cereals	Leguminous Oleaginous	Fatty Foods	Manufactured Foods	Drinks Excitants	Furniture	Services
Pct (Log)	-4.611	-4.292**	0.626	-0.278	-0.658	-0.225***	2.613***	2.461**
	-0.383	-1.723	0.877	-0.405	-0.199	-2.382	4.112	1.956
Pci(Log)	-4.292**	2.804***	-2.241*	3.107**	0.086	5.165**	-3.641***	-1.003
	-1.723	4.667	-1.377	2.214	0.542	2.303	-2.899	-0.579
Pcol (Log)	0.626	-2.241*	3.639***	-1.147**	1.768	-2.428	1.630***	-0.322**
	0.877	-1.377	2.573	-2.174	0.192	-0.229	2.773	-1.678
Pgras (Log)	-0.278	3.107**	-1.147**	0.646***	-4.085	0.018**	-0.012	-0.031
	-0.405	2.214	-2.174	5.111	-0.394	2.173	-1.877**	-0.452
Pind (Log)	-0.658	0.086	1.768	-4.085	-2.730**	0.354***	0.756	0.674
	-0.199	0.542	0.192	-0.394	-1.907	3.726	0.164	0.556
Pbois (Log)	-0.225***	5.165**	-2.428	0.018**	0.354***	-0.072**	0.197**	0.017
	-2.382	2.303	-0.229	2.173	3.726	-1.985	1.749	0.556
Pequip (Log)	2.613***	-3.641***	1.630***	-0.012**	0.756	0.197**	0.755	0.234**
	4.112	-2.899	2.773	-1.877	0.164	1.749	1.029	1.870
Income (Log)	-1.118**	-0.818	-2.011***	0.053	-2.812***	-2.514***	3.805***	0.627
	-1.748	-0.725	-2.815	0.058	-2.556	-2.361	2.450	0.535
Child	0.332**	-0.115	0.284**	0.083	-0.009	-0.291*	0.306	0.248
	1.965	-0.548	2.088	0.487	-0.042	-1.492	1.059	1.147
Man	-0.448	0.238	-0.147	-0.373	0.494	0.284**	-0.786*	-0.099
	-1.330*	0.571	-0.541	-1.103	1.215	1.732	-1.368	-0.229
Woman	-0.323	0.645**	-0.032	-0.059	-0.037	0.351	0.394	-0.467
	-0.983	1.667	-0.120	-0.181	-0.093	0.922	0.699	-1.108
Mills	2.531**	1.346	-2.561**	0.321**	-0.032	-0.211	-0.524	0.618**
	2.239	0.726	-1.741	1.642	-1.243	-0.715	-1.326	1.845
Constant	9.579	-7.488	7.784	-2.350	-1.242	-3.290	2.274	0.674
	0.940	0.216	0.902	-2.591	-0.119	-2.276	2.880	0.639
R2	0.444	0.221	0.249	0.514	0.470	0.274	0.362	0.038

Source: Survey data. *** Significant coefficients to 1%. ** Significant coefficients to 5%. * Significant coefficients to 10%. Note: the value of the initial coefficients have been multiplied by 100 for an easy reading. Parameters in italic represent Student statistic.

Table 2. Estimations results of consumption demand functions for households without non farm activities in the Guinean area

Independent variables	Dependent variables							
	Traditional Cereals	Intermediary Cereals	Leguminous Oleaginous	Fatty Foods	Manufactured Foods	Drinks Excitants	Furniture	Services
Pct (Log)	1.798***	-2.158	1.103***	-2.946	-2.452	-3.572	1.801**	1.273
	2.486	-0.226	2.566	-0.713	1.237	-0.628	2.246	0.259
Pci(Log)	-2.158	7.925**	-2.763	3.487	-0.375**	1.492	-2.063*	-1.399
	-0.226	2.192	-0.281	0.413	-1.832	1.110	-1.351	-0.732
Pcol (Log)	1.103***	-2.763	3.988***	-1.568	7.163*	-3.998	8.988	-0.144**
	2.566	-0.281	4.686	-0.397	1.294	-0.628	1.260	-1.924
Pgras (Log)	-2.946	3.487	-1.568	0.765	-4.598	0.035*	-0.032	-0.020**
	-0.713	0.413	-0.397	1.006	-0.739	1.638	-0.452	-1.762
Pind (Log)	-2.452	-0.375**	7.163*	-4.598	-1.144*	0.076*	0.408*	-0.112
	1.237	-1.832	1.294	-0.739	-1.329	1.560	1.474	-0.847
Pbois (Log)	-3.572	1.492	-3.998	0.035*	0.076*	-0.059	-0.011	0.004
	-0.628	1.110	-0.628	1.638	1.560	-0.870	-0.156	0.118
Pequip (Log)	1.801	-2.063	8.988	-0.032	0.408*	-0.011	-0.423**	0.035
	2.246	-1.351	1.260	-0.452	1.474	-0.156	-2.001	0.652
Income (Log)	-5.379***	-6.552***	-0.376	0.008	0.163***	-0.323**	7.879***	0.072*
	-3.865	-4.011	-0.479	0.559	6.323	-2.049	4.035	1.548
Child	-0.014	0.654*	0.228	-0.002	-0.685	0.253	0.409	-0.188
	-0.042	1.549	1.248	-0.491	-1.135	0.685	0.835	-0.590
Man	0.753	1.848**	-0.577*	-1.315*	-0.898	0.609	0.241	0.938
	0.937	1.779	-1.294	-1.758	-0.610	0.675	0.201	1.201
Woman	1.306**	0.870	-0.299	-0.371	1.132	-1.380**	-1.844**	0.466
	1.821	0.953	-0.751	-0.552	1.004	-1.712	-1.742	0.672
Mills	1.023**	-2.654	1.725	3.675**	-2.053**	-1.015	4.012	2.067*
	1.935	-0.885	1.173	2.123	-1.876	-1.234	1.212	1.627
Constant	12.543	-3.609	11.692	-2.578	-8.433	-7.710	12.242	8.219
	1.209	-1.734	2.250	-0.472	-1.346	-1.887	1.269	0.068
R2	0.560	0.539	0.611	0.588	0.263	0.362	0.355	0.128

Source: Survey data. *** Significant coefficients to 1%. ** Significant coefficients to 5%. * Significant coefficients to 10%. Note: The value of the initial coefficients have been multiplied by 100 for an easy reading. Parameters in italic represent Student statistic.

Table 3. Estimations results of consumption demand functions for households with non farm activities in the Sudano- sahelian area.

Independent variables	Dependent variables							
	Traditional Cereals	Intermediary Cereals	Leguminous Oleaginous	Fatty Foods	Manufactured Foods	Drinks Excitants	Furniture	Services
Pct (Log)	4.204	-2.809	4.347	-1.144	-1.903	-0.355***	-0.040	1.132***
	0.347	-0.105	1.265	-0.846	-0.068	-2.762	-0.036	2.936
Pci(Log)	-2.809	0.710	-4.737**	1.194***	0.322	0.898	1.002	-3.766
	-0.105	0.123	-1.756	3.722	0.568	0.877	0.105	-0.756
Pcol (Log)	4.347	-4.737**	-1.837	-0.685**	2.340***	-1.349	-0.842	-0.117
	1.265	-1.756	-0.859	1.766	2.438	-0.175	-1.054	-0.234
Pgras (Log)	-1.144	1.194***	-0.685**	0.189	0.500	0.089**	-0.012***	-0.065**
	-0.846	3.722	1.766	1.046	0.104	1.995	-3.728	-1.839
Pind (Log)	-1.903	0.322	2.340***	0.500	-0.174	-0.432	0.231	-0.048
	-0.068	0.568	2.438	0.104	-0.969	-1.116	0.022	-0.577
Pbois (Log)	-0.355***	0.898	-1.349	0.089**	-0.432	0.086	-0.064	0.015
	-2.762	0.877	-0.175	1.995	-1.116	0.954	-0.791	0.128
Pequip (Log)	-0.040	1.002	-0.842	-0.012***	0.231	-0.064**	0.097	0.230*
	-0.036	0.105	-1.054	-3.728	0.022	-1.791	1.233	1.342
Income (Log)	-4.914*	0.866**	2.141	-1.700***	-5.264***	0.017**	3.159**	1.591***
	-1.592	1.791	0.974	-2.575	-3.199	1.966	1.943	2.372
Child	0.829**	-0.043	-0.665**	-0.006	0.126	0.247**	-0.134***	-0.119
	1.743	-0.310	-1.939	-0.277	0.494	1.858	-3.901	-1.143
Man	0.214	0.231	-0.717	0.331	-0.108**	0.168	0.105	0.049
	0.225	0.831	-1.048	0.795	-2.118	0.632	0.153	0.239
Woman	0.394	-0.405**	0.031	-0.039**	0.414	-0.522***	-0.316	-0.037
	0.516	-1.809	0.567	-1.739	1.012	-2.447	-0.572	-0.223
Mills	1.037	2.213**	-0.149*	0.329	0.536**	1.745	-0.369	-0.119
	1.218	1.789	-1.326	0.862	1.872	1.237	-1.124	-1.067
Constant	2.599	2.531	3.774	3.282	5.314	-5.042	-1.695	1.122
	0.121	0.544	0.682	0.369	3.556	-0.138	-0.305	2.660
R2	0.416	0.124	0.472	0.028	0.236	0.262	0.104	0.501

Source: Survey data. *** Significant coefficients to 1%. ** Significant coefficients to 5%. * Significant coefficients to 10%. Note: the value of the initial coefficients have been multiplied by 100 for an easy reading. Parameters in italic represent Student statistic.