HUGO DE GROOTE*

Women's Income Versus Family Income as a Determinant for Food Security, an Example from Southern Mali

Abstract: The simple neo-classical household model presents a major problem — the cooperative unique household utility function might not always be appropriate. More specifically, women's and men's utility functions might be different. To accomodate the problem, this paper explores the possibility of an enlarged household model. This model also includes two other elements that have recently received major attention, credit and seasonality. The analysis of data from southern Mali indicates that, in contrast to the family's total income, the family's assets and women's income have a positive effect on the nutritional status of pre-school children in the pre-harvest season. The relationship does not hold in the period after the harvest. This indicates that the women's utility function differs from that of the family as a whole, and that the seasonality of the income is very important.

INTRODUCTION

In recent years the simple neo-classical household model (Singh, Squire and Strauss, 1986) has come under increased scrutiny. The cooperative unique household utility function might not always be appropriate to study development problems. More specifically, women's and men's utility functions might be different, which would require a new approach in development work and research (Haddad, 1993). In recent literature, evidence that a household does not constitute a unified economy has been presented and new research approaches have suggested for (Guyer and Peters, 1987; Wilk 1989; Feldstein, Poats, Cloud and Norem, 1989).

Due to a perception that traditional development projects were biased towards men, projects and policies targeted specifically at women and a new academic field 'Women in Development' have emerged. The assumption underlying this new approach is that resources entering the household are not distributed independently of the person who acquires or manages them. In other words, different individuals have different utility functions that are not necessarily in harmony with the abstract overall household utility function. A common example of this policy change is the targeting of women in order to increase food security. In many countries women are perceived to be responsible for providing food for the household. Assuming that women derive a higher utility than men from providing food to children, an increase in women's income or production would have a higher effect on food security than would a similar increase for men.

In this framework, the Freedom From Hunger Foundation (FFH) provides credit services to poor rural women in southern Mali. In a group-lending, poverty bank, system the women are provided with small loans to be paid back in weekly instalments. The repayments are organized in a group meeting in which loan management is discussed, but which also serves as a vehicle for health and nutrition education. The first loans were provided in 1989 and the program now reaches several hundred households (Lassen and

* Equipe de Systèmes de Production et de Gestion des Resources Naturelles, Mali/Royal Tropical Institute, The Netherlands.

Mknelly, 1992). The program is funded by USAID, who invited the International Food Policy Research Institute (IFPRI) to study its impact on income, production and food security. A field study was executed in 1993, and the first results are presented here.

CONCEPTUAL FRAMEWORK

In the basic agricultural household model, the household is assumed to have a unique utility function, based on the consumption of market goods, home consumption and leisure for any production cycle (Singh, Squire and Strauss, 1986). The household allocates time and assets for home production and wage labour to maximize its welfare. These relations are depicted in Figure 1. Although the allocation of time, assets, production and consumption of different individuals can play different roles and can therefore be modelled explicitly within the framework, the utility function is necessarily unique.

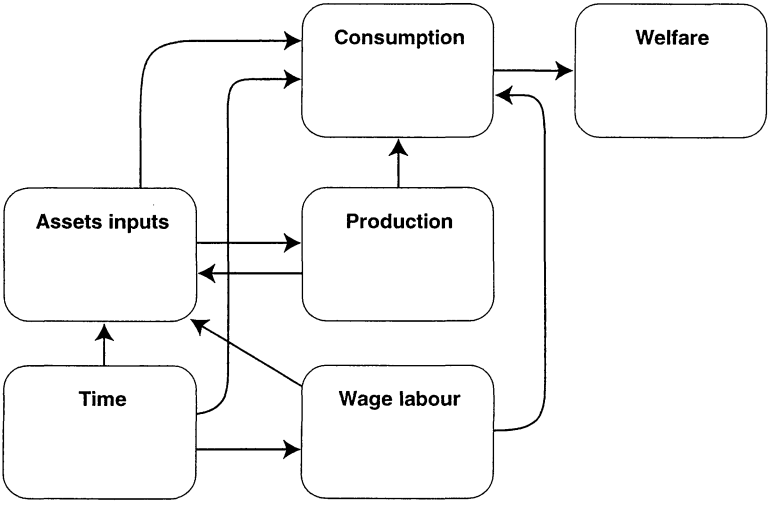

Figure 1 *The Household Model — General Conceptual Framework*

To respond to the reality in southern Mali and to reflect the problems under discussion the model needs three extensions; seasonality, credit and intra-household resource allocation. Mali has a distinct rainy season and one main harvest. This has obvious effects on agricultural production and therefore on home consumption, but also on time allocation and health (Sahn 1989). Food and income are generated in a short period after the harvest, while food, labour and other inputs are needed before the harvest especially. The direct effect of seasonality is illustrated in the bottom right corner of Figure 2, while its rippling effect is presented by undulating arrows.

Credit can alleviate the effects of this one main harvest by smoothing consumption and allowing for timely investments over different seasons, as well as over different years. It allows for an increase in inputs if so needed, but also for consumption smoothing between

seasons, while leaving assets where they are needed in the long run (Iqbal, 1986). The effects are illustrated on the top left corner of Figure 2.

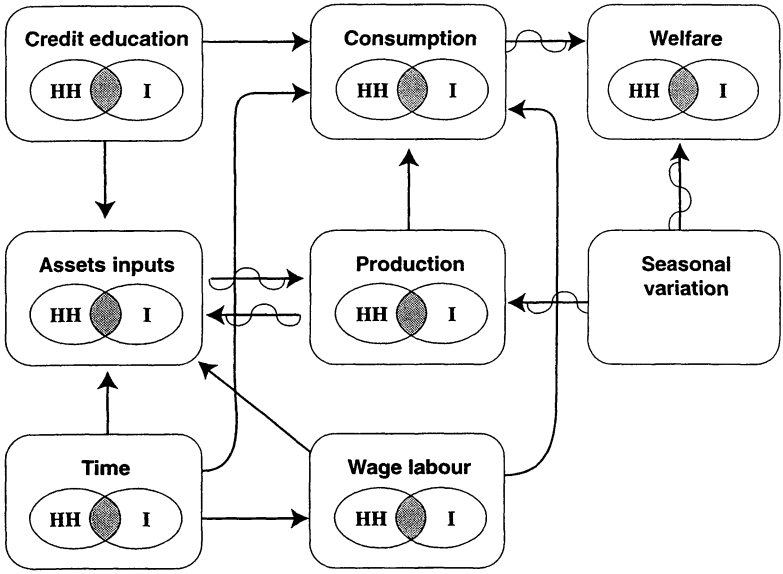

Figure 2 *The Household Model — Seasonal Variability*

Intra-household resource allocation and individual welfare effects need to be included to allow for different individual utility functions, the basic assumption in projects focused on women. Moreover, the effects of those projects have to be traced through; different allocations of resources by individuals, assets, production, consumption and time use (Haddad, 1993).

Explicitly, the household or individual household members derive utility from, among other things, health and nutritional status:

(1) $U(B,X,H,L)$ where

U = utility
B = nutritional status
X = consumption goods
H = health
L = leisure

To maximize utility, the household allocates resources according to first order conditions for demand functions as well as for production functions. Nutritional status can be seen as a health production function whose inputs are decided through those first order conditions (Behrman and Deolalikar, 1988). The basic assumption for such a function is that nutritional status is positively related to assets and income (both monetary and in-kind), through increased food consumption and better health care:

(2) $B(A, I)$ where A = assets
I = income

Thus, if women derive a higher utility from a better nutritional status of the children, and they have freedom to spend their own income, the effect of their income on nutritional status will be higher than that of family income, all other things being equal. A further assumption is that most of the income is agriculture related and earned in the post-harvest season. Due to the discounting over time in the utility function, consumption will decrease over time until the new harvest. Extra income in the pre-harvest season would then be spent on the items which deliver high utility in a period of low consumption, such as food. If indeed women's utility function differs from men's, the effect should be more noticeable in this season. The health nutrition function has to reflect time and individual differences. Income I of the health production function is therefore represented by a matrix:

$$I = \begin{matrix} I_{11} \cdots \\ \cdot I_{it} \cdot \\ \cdots \end{matrix}$$

where i = individuals or group of individuals
t = time during year

Now that the theoretical groundwork is laid out in the previous section, the hypotheses to be tested can be stated formally as follows. The family and the women's income have a positive effect on children's nutritional status. The latter has à higher effect than the former, and its effect is more pronounced in the pre-harvest season.

SOUTHERN MALI, A COMPLEX REALITY

Freedom From Hunger started its program in the district ('arrondissement') of Dogo, subregion ('cercle') of Bougouni, in southern Mali. Although recently other districts in the same subregion have been included, the IFPRI research was limited to this first district. Dogo has a population of 31 500 for an area of more than 3000 km^2 (10.5 people per km^2), dispersed over 85 villages (CMDT, 1992).

The district of Dogo is accessible from the town of Bougouni in the dry season over an unpaved road of 55 km. It is also linked all year round with an unpaved road to the excellent paved road from Bamako to Bougouni (Figure 3).

Southern Mali is situated in the wooded savannah of West Africa. Bougouni has an average yearly rainfall of 1089mm (1941–1980) spread over about seven months (Sivakumar, Konate and Virmani, 1984). The rain falls from April to October (see Figure 4), and the harvest of the principal crops follows shortly thereafter. This rainfall pattern dominates the agricultural year.

The household in Dogo, defined as a group of related people who eat and work together, is an extended family, consisting of the descendants of one male individual, and their wives. The structure is patrilocal, patrilinear and polygamous. A typical household is composed of a male head, his wives and their children. Daughters leave the household when they marry, but sons and younger brothers of the household head stay with their wives and children.

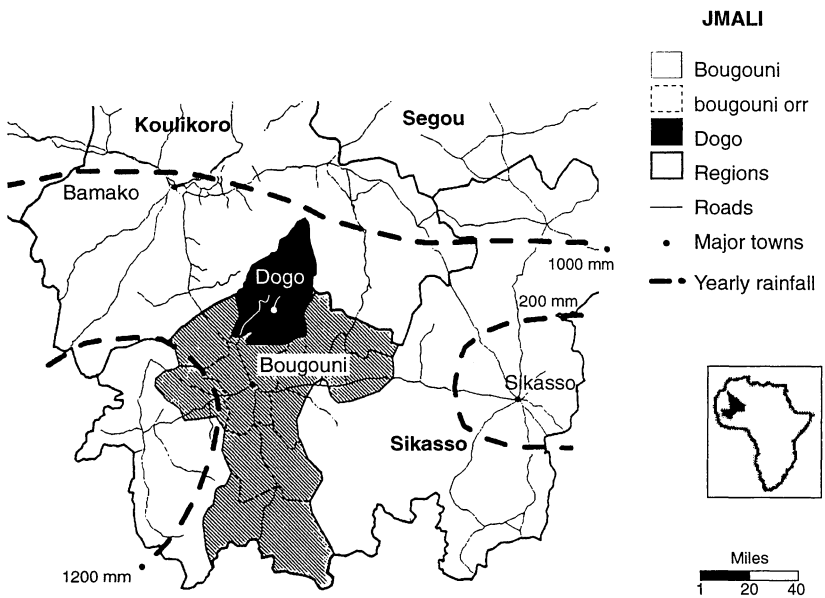

Figure 3 *Mali — IFPRI Credit and Education Survey*

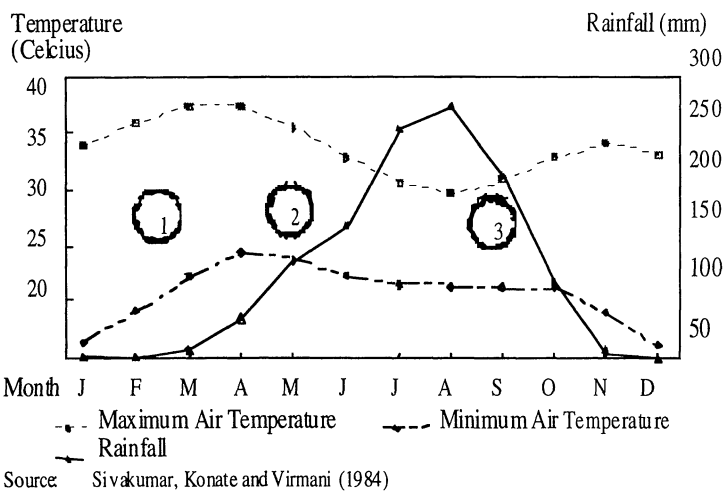

Figure 4 *Climate in Southern Mali — Average Monthly Temperature and Rainfall in Bougouni (1941–1980)*

The household has common lands, that are cultivated together, but individuals can have small personal plots and can own animals. The head of the household is in charge of

common grain production and the stocks for the year. Generally, the younger women take turns cooking for the whole household. Once women have daughters-in-law, they leave the cooking to the latter.

Thus, for the analysis of income effects on nutritional status we have to distinguish four groups of adults: head of the household, non-head men, younger women (defined here as those who prepare meals) and elder women (who no longer cook).

DATA COLLECTION

Based on a Rapid Rural Appraisal (De Groote *et al.,* 1993) and a survey optimization program (De Groote, 1993) a stratified two-stage PPS sampling design was chosen, resulting in 100 households for each of the two strata, villages with the FFH project and villages without. There were three rounds of the survey. In the first round, late February to early April 1993, the head of the household, an additional adult man, and the women who cooked the previous day were interviewed on their income, expenditure, food consumption and credit, and all women and children under 15 were measured for weight and height. Based on the experience from the first round, an older woman who no longer cooks was added to the sample for the subsequent rounds, in April-May and in August-September.

RESULTS

Family Composition, Income and Assets

Table 1 *Family Composition*

	Group	Mean	St. dev.
	Head of Household*	0.97	0.18
Male	Adults, not head of hh	3.73	4.34
	5–19 years	2.64	2.7
	0–4 years	1.55	1.89
Female	Elder (not cooking)	1.24	1.66
	Young (married, cooking)	3.11	2.81
	Unmarried, ≥ 5 years	3.71	3.8
	0–4 years	1.34	1.58
Total	Total number of hh members	18.29	
	Household members present	17.02	15.03
	Adult equivalent	11.17	9.86

Note: * 18 percent female; 91per cent illiterate, 90 per cent muslim.

The households have an average of 17 members present at the time of the interview with a maximum of 99. Besides the head, 82 per cent of whom are male, there are four other adult males on average. The average family has three younger cooking women, one older woman, six school-age and three pre-school children. The total household income (including home consumed agricultural production) is estimated at almost 500 000 FCFA (at US$1 = 260 FCFA this is roughly $2000, before the 50 percent devaluation of 1994) for a family of 17. Agriculture provides 95 percent of that income, and half of that comes

from cotton, all of which is sold. The other half comes mostly from cereals such as millet, sorghum and corn, which are primarily used for home consumption.

Table 2 *Family Income and Assets*

		Number		Value	
		Mean	St. dev.	FCFA	St. dev.
Assets	Land available	15.21	23.7		
	Land cultivated	7.7	5.99		
	Cattle	10.83	14.61	324 900	438 300
	Small ruminants	4.95		34 650	
	Animal traction	0.675		192 377	
Income	Cotton			236 248	295 204
	Other agric. income			234 386	
	Non-agric. income			26 217	53 078

Table 3 *Women's Income (1 year)*

		Production			Sales		
		Mean	St. dev.	N	Mean	St. dev.	N
Young women (who cook)							
	Crops	16 688	21 999	156	731	2198	40
	Animals	835	3720	19	649	3171	18
	Non-agr.[1]	2032	4346	135			
	Total	19 556		156	1380	3914	50
Older women (exempt)							
	Crops	14 254	16 441	156	1340	4831	40
	Animals	2238	13 960	19	920	4405	18
	Total	16 492	24 815	156	2260	6788	50

Note: [1] January-March only.

The majority of women have some private agricultural activity, valued at 17 000 FCFA per woman year, but the production goes almost completely to home consumption. Women's non-agricultural monetary income is small in comparison, 2000 FCFA for the first quarter of the year. It comes about equally from three sources; trading of agricultural products, petty trading, and the production of shea nut butter. It is for the first two activities, which take place in the local weekly markets, that the FFH credit is well suited and used.

Nutritional Status (Dependent Variables)

A common indicator for nutritional status of pre-school children (under 6 years) is the weight for height Z-score (WHZ), which is a comparison of the weight for height ratio of each child with that of a standard (US) population, expressed in standard deviations. The results show that in March the mean WHZ is –0.56, or more than half a standard deviation lower than the standard population. In September, the pre-harvest season, the mean WHZ drops to –0.74.

Table 4 *Anthropometric Measurements*

Time	Weight for Height Z			Body Mass Index		
	Mean	St. dev.	N	Mean	St. dev.	N
March	–0.56	1.34	519	20.40	2.37	607
May	–0.58	1.11	462	20.43	2.46	568
September	–0.74	0.91	254	19.45	2.62	188

The standard indicator for adults is the body mass index (BMI) which is calculated as the weight divided by the height squared. A BMI under 18.5 is generally considered a sign of malnutrition. The BMI for adult women in March is 20.4 and drops seriously in September.

Analysis

The dependent variable used in the regression is the Weight for Height Z-score for all children under the age of five years. The analysis was repeated with the same independent variables for the Z-scores of the three rounds. The following indicators of family income and assets were retained:

- household size, expressed as adult equivalent (ADEQUIV)
- household agricultural production of the previous year, in 1000 FCFA/adult equivalent (AG_FAM)
- household's number of cattle per adult equivalent (BOV_FAM).

All indicators of women's income were adjusted for family size and composition by multiplying first by the number of women in the household in the specific group (since only one woman per group was interviewed), and divided by the adult equivalent of the household. Thus, the variables used were:

- last year's agricultural production by women of the household, 1000 FCFA/adult equivalent (AG_WOM)
- young women's non-agricultural income for the household, in 1000 FCFA/adult equivalent: from January 1 to the first interview in March (NA_YW1), from March to May (NA_W2), from May to September (NA_YW3)
- older women's non-agricultural income for the household, in 1000 FCFA/adult equivalent: from January 1 to their first interview in May (NA_OW2), from May to September (NA_OW3).

The results of the regressions are presented in Table 5. In the first round only the coefficient of family size is significantly different from zero. This negative relationship shows up in every round, indicating that children suffer more malnutrition in larger families. Women's non-agricultural income has no significant effect, while women's agricultural income and family assets as measured by cattle have a positive effect, but only at the 88 per cent level.

In the second round young women's income has a clear and positive effect. The exact interpretation is as follows: if the young women's non-agricultural income of this period increases by 1000 FCFA ($4) per adult equivalent (11/family on average), the WHZ

increases by 0.042. The women's agricultural production has a surprising negative effect, while older women's income has no effect. Family's assets as measured by cattle have a strong positive effect. In the third round only the young women's non-agricultural income of the second period has a significant effect, while family size keeps its negative effect. No effect of agricultural production is positive in this shortage period.

Table 5 *Regression of Weight-for-Height Z-scores of Pre-schoolers on Income Variables*

	First round		Second round		Third round	
	b	*t*	*b*	*t*	*b*	*t*
NA_YW1	0.068	0.956	–0.015	–0.272	–0.065	1.141
NA_YW2		0.042	1.949	0.033	1.878	
NA_YW3	0.290	0.235				
NA_OW2		0.215	1.017	0.092	0.443	
NA_OW3	0.001	0.353				
AG_WOM	0.012	1.579	–0.016	–1.969	–0.010	–0.995
AG_FAM	0.001	0.630	0.001	0.582	0.003	1.465
BO_FAM	0.087	1.585	0.090	1.817	–0.091	–1.349
ADEQUIV	–0.010	–1.830	–0.006	–1.054	–0.011	–1.646
Constant	–0.649	–3.689	–0.611	–3.675	–0.582	–2.732
N	0.423		0.340		0.201	
R^2	0.031		0.028		0.068	
S	1.330		1.120		0.892	

CONCLUSIONS AND IMPLICATIONS

Younger women's non-agricultural income does have a significant effect on children's nutrition in the pre-harvest season, while no such effect is obtained for older women or for younger women in the post-harvest period. Women's agricultural income, on the other hand, has at most an effect in the post-harvest season. Family agricultural production does not seem to have any effect, but family's size has a clear negative effect.

The major result of the study is that the season in which income is generated and the gender of the provider are important. The significant variable, women's non-agricultural income in the pre-harvest season, has both a gender and a seasonal component, which can not yet be distinguished here. Projects are, however, justified in promoting this kind of income generation, since it does have a positive impact on the nutritional status of pre-school children. Further analysis of the data should show how an increase in women's income influences expenditure on food and other items.

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DISCUSSION OPENING — Benon Gazinski *(Agricultural University, Poland)*

In the past, economists neglected the importance of factors other than pure economics, particularly items that were, by nature, difficult to measure and include in the cost equation. They ignored the fact that the human being not always acts as a Homo economicus. Non-economic motivations of the human behaviour, the heritage of culture, in which people grow up, the structure of values they follow; all these have a significant impact on the framework of economic relations.

A strong call for change arose from the natural environment, facing the prospect of disaster. Modern, high-input, intensive agriculture has more and more resembled a sportsman doped by drugs. In sharp contrast, the idea of organic farming has been developing, emerging not only from the environmental concern but from philosophical reflection on the cultural message related to agricultural activities and representing a shift in lifestyle.

A failure of a concept of direct technology transfer from developed countries to the third world and a realization that development is not a commercial commodity contributed to the change from the typical style of thinking of the economists. It has become evident that the cultural factors and structures of human populations have to be considered for effective solutions to the issues of economic and social development to be worked out.

Let's turn from such a broad perspective to the paper of Hugo De Groote, considering the issue of womens' incomes in relation to the nutritional status of the family. As evidenced by the experiment in Southern Mali, some economic questions can not be solved without insight into the mechanisms and links which regulate the functioning of communities.

The author argues that it is not enough to treat the family as a coherent and uniform unit in the fulfilment of development projects. Differences in individuals' utility functions have

to be considered. It is argued in the paper that an increase in womens' income would have a more pronounced effect on the food security of families than would a similar increase for men — because women have the role of assuring the daily food for the families. The econometric results support that argument.

I suggest that findings in the paper suggest three broad areas of further investigations and discussions. The first concerns the relationship between the model and reality. A coherent and well-designed model may still misrepresent the performance of the real system. The question is not only how to improve the model's performance but how to improve the interpretations of the outcome. Second, what lessons can be drawn from the paper for the practice of international and aid programmes? Is a strategy to increase womens' incomes sufficient or too simplified and mechanistic. Is there a danger of external action damaging the coherence of the family? How can harm be avoided while assisting the development? Third, how can De Groote's experiences and approach be applied to other areas and issues of development of local communities. Finally, does contemporary economics constitute an enemy or an ally in preserving the great heritage of cultures of nations all over the world?