CHAPTER 6

THE RELATIONSHIP BETWEEN COMMERCIALISATION AND HOUSEHOLD FOOD SECURITY

6.1 INTRODUCTION

The cluster analysis of the previous chapter yielded groups of households classified by food production, sales, purchases and ultimately, food availability levels. A comparative analysis of three of the groups shows the difficulty of identifying group membership by variations in socio-economic, demographic or production related variables. For example, land as an important factor of production is inconclusive as a variable distinguishing group membership.

The objectives of this chapter are twofold. It will statistically examine how food sales and other socio-economic variables affect household food availability and compare the degree of food insecurity in the three districts. To do this, logistic analysis is applied in the first section of the chapter to establish the variables that determine whether a household is food secure or food insecure and therefore household food availability. The latter section in the chapter compares the food insecure households (the degree of food insecurity) across the three districts by means of a food insecurity index.

6.2 FACTORS THAT DISTINGUISH BETWEEN FOOD SECURE AND FOOD INSECURE HOUSEHOLDS

It was earlier postulated that:

Average daily calorie per adult equivalent = f(household characteristics, production, commercialisation, non-food expenditure, wealth).

A number of variables were also earlier identified as indicators of these different factors. They include the age, gender, main occupation and education level of the head of the household, the demographic structure of the household in terms of size and dependency

ratio, the resources available for production (farm-land), income and wealth (livestock owned), and degree of commercialisation.

Logistic analysis is applied to test the main hypothesis that food availability is negatively affected by commercialisation of the food sub-sector. The dependent variable average daily calories available per adult equivalent (AVCALAE) is metric and therefore OLS would have been an appropriate tool for the analysis (Gujarati, 1995; Koutsoyiannis, 1977; Hair et al., 1998; Mukherjee, White and Wuyts, 1998). However, drawing from the objective of the study, to determine whether food sales do contribute to food insecurity, the analysis seeks to identify the factors that distinguish between households categorised as food secure and those that are food insecure. This allows for the use of the logistic analysis, which is applicable where the dependent variable is dichotomous. The sample is categorised into two groups, food secure and food insecure groups on the basis of the dependent variable, i.e., AVCALAE, which is collapsed into a categorical variable. The food secure households are those where average daily calories available, meets their minimum requirement, they take on the value 1. The food insecure households are those who on average, are not meeting the daily minimum calorie requirements. They take on the value 0.

Between OLS analysis and Logistic analysis, the log transformation in the latter reduces the problem of multi-collinearity. Although multi-collinearity is really a question of degree, the abrogation of the assumption that the independent variables are not linearly correlated, creates large variances in the estimated parameters and in so doing reduces the efficiency of the estimators, rendering their interpretation uncertain (Gujarati, 1995). Some of the explanatory variables such as children up to six years old (CHI_SIX) and the dependency ratio (DEP_RATI) and the sum of non-food income (SUMINCOM) with non-food expenditure show varying degrees of collinearity. The correlations between the variables are shown in Appendix 6.

Like OLS analysis, the explanatory variables may also be non-metric (ordinal or nominal). However, it is necessary that they be transformed by means of dummy variable coding (Gujarati, 1995; Hair et al., 1998). It is also noteworthy that Kirsten, Townsend & Gibson (1998), suggest that a low explanatory power in an OLS analysis including a relatively high number dichotomous explanatory variables could be due to a bias arising

from many dichotomous variables explaining the variation in a continuous variable. To try to avoid such a bias, Kirsten et al. (1998) applied a logit model to the same data and and found that some variables that were insignificant with an OLS analysis were significant with the Logit analysis.

OLS analysis predicts the average value of the dependent variable Y, given the explanatory variables, X's. In contrast, the logit analysis employs maximum likelihood estimates to determine the probability that an event occurs or exists given the independent variables. Its advantages were noted in the previous chapter. The Logit transformation allows for the detection of patterns where the variable of interest is rare or highly prevalent (Mukherjee et al., 1998). This further motivates the use of the logit model.

The Odds (O), is the ratio of the number of observations with the dependent characteristic to the number without,

$$O = \frac{n}{n-N} = \frac{p}{(1-p)}$$

A logit transformation:

$$\log O = \log\left(\frac{p}{(1-p)}\right) = \log p - \log(1-p)$$

However, given the limits set by the probability 0 and 1,

$$\log 1 = -\infty$$
$$\log 0 = +\infty$$

Then:

$$-\infty \leq L \leq +\infty$$

Stretching the tails of the distribution thus allows the inclusion of otherwise obscure patterns in the categorical variables.

Categorical variables in this analysis were with regard to gender, occupation, and education level of the head of the household. The use of dummies in two variables, the number of cattle and the number of children attending secondary school, otherwise continuous variables, was because of many 0 values in the data set. The positively skewed distribution due to the 0 values would have the potential of generating biased tests of significance (Mukherjee et al., 1998). The use of the dummy variable in the children who are six years old or less (CHISIX_D) is to enable a "with and without" comparative analysis.

From the focus group discussions in particular, school going children is expected to be highly positively correlated with non-food expenditure (higher with children attending post-primary school than with children attending primary school). However, because payments that are relatively substantial are often made in small instalments, getting a net reflection of the effects of costs of social services was difficult. In the absence of record keeping, the accuracy of data gathered on these items is questionable. Latt & Nieuwoudt (1988) in a study of the effects of plot size on commercialisation were faced with similar circumstances; the crop maturation period of sugar-cane exceeded the study period. For analytical purposes, they replaced the crop income variable with a dummy variable to distinguish between producers and non-producers of sugar-cane.

An additional appeal of Logisitic analysis is its simplicity and ease of interpretation.

Table 6.1 shows the averages and standard deviations or proportion in percentages of the different variables included in the model estimation. The sample size of households included in the analysis is 453.

Table 6. 1: Sample means/proportions of variables to be estimated

Variable	Definition	Variable Mean or Percentage	Standard Deviation
AVCALAE	Calories available per adult equivalent per day	2199.5	806.4
AGE_HHH	Age of the household head	45	14.3
EDU_NONE	Household head attended formal education	88%	
GEN_HHH	Gender of the household head (male)	89%	
OCC_FARM	Main occupation of household head (farming)	84%	
CHI_PS	Number of children attending primary school	2.2	1.8
CHISIX_D	Households with children six years old or less	73%	
CHISES_D	Households with children in post primary school	20%	
AVHCI	Average commercialisation ratio	23.11	22.30
SUMINCOM	Sum of non-food & cash crop income ('000 shs)	393	362
MKT_DIST	Distance to the markets commonly used (km)	4.6	4.0
LND_USED	Area of cultivated land (acres)	3.8	2.37
AVGOATS	Number of Goats	3.2	3.4
CATTNO_D	Households owning cattle	49%	

Source: Primary Survey Data

Table 6. 2: Factors distinguishing between the food secure and food insecure groups

Variable	Definition	B	Wald	Exp (B)
AGE_HHH	age of household head	-0.0140	1.6852	0.9861
EDU_NONE (1)	household head educated or not	0.2888	0.5062	1.3348
GEN_HHH (1)	gender of household head – male	-0.4475	1.1808	0.6392
OCC_FARM (1)	main occupation of head is farming	-0.4684	1.2349	0.6260
CHI_PS	number of primary going children	-0.5868	45.3439*	0.5561
CHISIX_D (1)	household has children six years or less	-0.7971	5.6917*	0.4506
CHISES_D (1)	household has post primary children	-0.8426	5.7721*	0.4306
AVHCI	average commercialisation ratio	-0.0322	11.153*	0.9683
SUMINCOM	sum of income from non-food	-0.0002	0.1235	0.9998
MKT_DIST	average distance to markets used	0.0032	0.0076	1.0033
LND_USED	cultivated land area	0.2604	13.6194*	1.2974
AVCATT_D (1)	household owns cattle	-0.0566	0.0389	0.9450
AVGOATS	average number of goats	0.0659	1.7791	1.0681
APAC_DD (1)	district is Apac	0.2254	0.4631	1.2529
MBALE_DD (1)	district is Mbale	-1.0818	5.4024*	0.3390
CONSTANT		3.7172	16.9902*	

χ^2 15 df 201.588
N 453

*Significant at 5%. Exp β is the odds of the event occurring rather than not occurring, with a unit change in the dependent variable, B.

Table 6. 3: Classification matrix of logit analysis

ACTUAL GROUP	PREDICTED		
	Group 0	Group 1	Total
Group 0 Food Insecure	**131 (72.38%)**	50	181
Group 1 Food Secure	32	**240 (88.24%)**	272
Total	163	290	**453 (81.90%)**

Values in parenthesis are percent correctly classified

The model by logit analysis makes an overall average correct prediction of about 82%. It makes a correct prediction of about 72% for the food insecure group and about 88% for the food secure group.

$$\text{The estimated } R^2_{\text{logit}} \text{ for the sample} = \frac{609.586 - 407.998}{609.586} = 0.33$$

Table 6.2 shows the factors that distinguish between the food secure and food insecure groups. The model has an estimated R^2_{logit} of 0.33. Area of land under cultivation; proportion of food sold out of that produced; number of primary school going children; whether a household has children six years old or less; and whether a household has children attending post-primary school; are the significant variables distinguishing between the food secure and food insecure households. The district variables show no significant difference between Apac and Soroti districts but Mbale District is significantly different from Soroti District.

The variable estimates defining the head of the household are all insignificant. Similarly, the proxies to wealth, i.e. cattle ownership and the number of goats owned and non-food income that in addition to wealth indicates income diversification, are insignificant to daily calories available per adult equivalent.

6.2.1 Demographic characteristics

The age of the household head, though insignificant, has a negative sign. Based on the group discussions, it was hypothesised that the younger households would be relatively more food insecure and therefore that the variable would be positive and significant. One argument made by different groups of farmers was that the younger households (both husbands and wives) are more attracted to consumer goods and therefore sell a higher proportion of food to meet these demands. However, the more common argument that the costs of education and health drive the sales of food, implies that the older households who are likely to have more children of school going age, would have to sell more food to meet the costs of social services.

The gender variable is insignificant although the sign indicates that male-headed households have less food available than female headed households. Female-headed households may have been expected to be the more food insecure given the general argument that they are relatively resource poor households. However, it was observed that rather than rely totally on the sale of food to meet their cash needs, female headed households rely predominantly on beer brewing and sales.

The education variable though insignificant, makes a positive contribution to food availability, as was hypothesised. Education reflects a gain in human capital and among others should impart the ability to better manage resources.

Farming as the main occupation of the household head and the predominant economic activity of most households, is insignificant but negative to food availability. Based on observations during the survey and on the literature, no *a prior* hypothesis was made in respect of this variable. Nonetheless, by implication of the sign of the coefficient, off-farm activities like tailoring, trade, or public service, make a positive contribution to food availability. Drawing from this, the diversification of income could positively contribute to food availability by reducing the pressure to sell food as a means of generating cash income as reflected in the conceptual framework.

6.2.2 Production

As was hypothesised, the area of farmland under cultivation contributes positively to food availability, rendering a household more food secure. With an odds ratio of 1.30, the likelihood of a household meeting its minimum requirements improves with every additional acre brought under production. As noted and in an earlier chapter, expansion in agricultural production in Uganda is mainly horizontal (acreage) rather than vertical (yields) and that in all the three districts, land is a limitation to production. As discussed in chapter four, Mbale is one of the most densely populated districts in the country and households are varyingly faced with land constraints. In Apac and Soroti districts, land is indirectly limiting because of the labour constraint. Thus, the area of land under production becomes a major determinant of production levels, and the gravity of land as a constraint to increased productivity is increased.

It is also recalled from an earlier discussion that most of the cropped land is under food crops. Where non-food cash crops are grown, they are often inter-cropped with food crops. Agriculture is characterised by low input use and is predominantly rain-fed, implying a high correlation between land and labour use and output. That land positively contributes to food availability typifies production in general, that is, strategies to improve productivity should improve food availability.

6.2.3 Commercialisation and transaction costs

The commercialisation variable, AVHCI, is statistically significant with a negative sign, as hypothesised. The food insecure households can also be distinguished from the food secure group by the proportion of food sold. A percentage increase in the proportion of food sold out of produced output, reduces the likelihood of a household being food secure and the odds ratio is 0.97. Households where food sales relative to production are high are more food insecure. Households with a relatively low aggregate output would by implication of the ratio, be more negatively affected by high food sales than households with high aggregate output.

This finding emphasises the subsistence level of production at the farm level and the relatively low levels of production. Most of the farmers produce limited surpluses

beyond their subsistence needs, which given the vagaries of nature may be better held as insurance stocks. Withdrawing these surpluses from the household to the market may, therefore, subject them to the risk of food shortages in the short term. The conceptual framework reflected this in that the more food is deducted for sale implicitly reduces that available for subsistence needs. While it could be argued that if the food system is functioning, households could purchase back food from the markets when in need, opportunities for reliable income generation remain limited. A household is more likely to be in need of food at a time when such opportunities are even more limited, i.e. before seasonal harvests.

The unavailability of food (physical and because of price) at the local markets is a problem that relying on income as a means to meeting food needs also poses. In Bumbo Sub-county, farmers told of the experiences of households who, one season, put most of their cultivated land to growing onions with the intention that part of the money generated would be used to buy maize. This was in reaction to very favourable market conditions for onions. However, when the time came, maize was not available locally, rendering them vulnerable to food shortages. It is recalled from the earlier graphical illustration of price differences between rural and urban markets that at some points during the year, (pre-harvest), prices in the rural markets may be comparative to those obtaining in urban markets, an indication of shortages in the rural areas. The predominance of subsistence production, poor storage facilities and information, and the fact that small traders can ill- afford to lock up their limited savings in holding stocks subject to many risks (market, post harvest loss and theft), are likely reasons for local unavailability. In general therefore, cash income is not a guarantee to having food when it is needed.

Between the districts, a household in Mbale District is less likely to belong to the group able to meet its minimum requirements compared with a household in Soroti District. The odds ratio is 0.34. No significant difference is found between Apac and Soroti districts.

A high correlation is found between the district and commercialisation variable. Mbale District is the most commercial of the three districts. It had an average HCI value of 44% at survey 1 and 38 at survey 3. Apac District had an average HCI of 17% and 11% at

surveys 1 and 3 respectively and Soroti District HCI values were 9% and 8% at surveys 1 and 3 respectively. It is therefore expected that because of the negative effects of commercialisation, Mbale District will have a more pronounced food insecurity problem than either Apac or Soroti districts.

Mbale District, by the size of its urban population and by virtue of its relative proximity to the large urban centres (Jinja and Kampala), has easier access to a potentially wider domestic market. In addition, it borders Kenya, Uganda's largest trading partner in the region and an important food market. Apac District borders Lira District, which is an important food market in its own right. But Lira Town is also a regional trading centre servicing the more northern districts whose production has suffered because of insecurity. Food is generally moved from Apac to Lira District. During the study, farmers in Chegere and Inomo sub-counties in Apac District (these sub-counties border Lira District) reported that traders from Lira District often bought their cassava gardens (i.e. the entire standing cassava crop). While they saved the farmer the costs of harvesting, processing and transport to the market, that traders are prepared to pay for a standing crop on the basis of an estimated output, also reflects the demand for food.

Besides the impact of commercialisation in Mbale District, the district variation is a proxy for the difference in the dominant crops cultivated in the different districts. Apac and Soroti districts, predominantly grow cassava, finger millet, sorghum, maize and sweet potatoes and a variety of pulses. In Mbale District, matooke and maize are the more widely cultivated staple foods. Cassava has a yield advantage over matooke (discussed in more detail in section 6.3) while the yields of maize, finger millet and sorghum are comparable.

As indicated in an earlier chapter, maize and beans are widely consumed domestically and in the neighbouring countries and are thus highly traded food crops. It is estimated that between 4 to 7% of maize and beans produced have been purchased by World Food Programme on an annual basis, and that 35 to 40% of maize and 25 to 30% of beans are sold on the domestic market (Uganda-Ministry of Agriculture Animal Industries & Fisheries, 1997). This excludes informal cross-border trade.

During the study, it was observed that maize and beans are fast selling crops, sold soon after harvest. Where they are the more dominant crops, there is a pronounced tendency for households to sell large amounts of food. However, the lack of storage facilities is also an important factor in the household decision making process. Post harvest losses are higher for maize and beans estimated at between 25% to 30% than they are for millet and sorghum estimated at 7% to 12%, (Uganda-Ministry of Agriculture Animal Industries & Fisheries, 1997; Uganda-Ministry of Finance and Economic Planning, 1995b). Households would be more predisposed to sell maize and beans to minimise such losses.

Matooke, a highly perishable crop, is widely consumed in urban centres and therefore highly traded. Cassava on the other hand is mainly considered a food security crop given its ability to remain in the garden with limited spoilage for a relatively long period of time where it presents no storage problem (Uganda-Ministry Agriculture Animal Industries & Fisheries, 1997). The most common response from respondents who considered themselves food secure was that they had cassava in the garden. Its food security properties therefore contribute to insuring households in Soroti and Apac districts against production and inter-seasonal fluctuations. However, after harvesting it is highly perishable and its losses are as high as 25% and this coupled with its very bulky nature renders it less traded while fresh. More of it is traded following a drying process and because of the deficits created by the cassava mosaic disease, the demand is high.

Sweet potatoes also have an important food security role. In Bumbo Sub-county, respondents reported that following pronounced food shortfalls in 1994, there was an apparent increase in the acreage of sweet potatoes cultivated. It is predominantly grown for subsistence purposes and is considered a woman's responsibility. In Soroti and Apac District, it is harvested, sliced, dried and stored to reduce spoilage in the garden. In the dried form, it is a food reserve but may be traded in limited quantities.

The average distance travelled to the markets, represented by MKT_DIST, conveys an important message despite being statistically insignificant. It is positively associated with food available per adult equivalent as was hypothesised based on the theory of transaction costs and its negative impact on commercialisation. The insignificance of the variable however, could be explained by the observation that marketing opportunities

exist right from the farm gate where traders or their agents roam the villages in search of food to buy and the existence of collection points within the villages. It was observed that many traders have collection points in the areas where a crop is concentrated. Village weekly markets and roadside sales, are the other collection points. Although farmers reported that prices offered at the farm gate are often lower than those offered in the market, the trade-off is that, they would have to pay several market dues to use the market to sell their food, i.e. their transaction costs are higher. They are also relieved of the burden of having to carry the produce to the market. See Appendix 5 for marketing channels.

The various opportunities reduce transaction costs. The market activity however tapers off after most of the immediate post harvest sales have been done and most of the transactions then take place at the market. For the majority, the most common mode of transport is walking, while the most common vehicle is the bicycle. A limit on how much can be sold at one time is set by how much an individual can carry. Boda boda (bicycle or motorcycles used on hire basis) may be hired to carry the produce to the market, at an average of 1000 shs per bag (100kgs) of produce within an average radius of less than 10 km. However, farmers complained about market dues and so it can be argued that the additional costs of transport would further reduce their profit margins.

Although not factored into this analysis, insecurity is a problem frequently mentioned by farmers as driving food sales. Indicative of its effects, in Bumbo Sub-county, some farmers argued that it is at times better to sell the food even if at relatively low prices rather than wait to lose it to food thieves. In Muyembe Sub-county, one becomes a likely target for food thieves, particularly during the scarce periods when prices are relatively better for the producer. To reduce this risk, some households will sell food despite their household needs. It was also observed that in several homesteads with traditional granaries, more often, the granaries had no food in them and a common reason was fear of theft. Farmers suggested that the readily available market and a need for money rather than a need for food, are the reasons for food thefts.

6.2.4 Income and non-food expenditure

Income effects are insignificant to food availability as shown by the variable defined as the sum of non-food income (SUMINCOM), which is negatively correlated with food availability. This may seem contradictory to the earlier argument that off-farm income generating activities could have a positive contribution to food availability. However, this is in consideration of the observation that food purchases, through which income effects would be transmitted, make a small proportion of food available for consumption. On average, they contribute about 13% in Apac District, 15% in Soroti District and 27% in Mbale District. The relatively low percentages reaffirm the importance of own production to food security.

That the variable is negatively associated with food availability could arise from two factors. Income from the traditional cash crops contributes to the variable, SUMINCOM. The cash crop mainly grown was coffee in Mbale District where it is inter-cropped with bananas. However, because it is also a common practice to inter-crop beans in the bananas and therefore coffee would compete for especially land, in Mbale District. Very few farmers grew tobacco and cotton in Apac and likewise, very few were found to be growing cotton in Soroti District.

Second, a relatively high positive correlation exists between SUMINCOM and AVNFEXP. This partly explains why income is negatively related to food availability, i.e. high expenditure matches high income. In general, the group discussions ranked education, health care, drinking alcohol, buying basic consumer goods like fuel (mainly paraffin for lighting), clothing, soap, and the need to diversify the diet, as motivating food sales. They chronicled the most cash-demanding period as starting with the festive Christmas season. The new-year then sets in with demands to meet school needs and pay taxes. The cost implications regarding wage labour and/or seed follow with the beginning of the planting season (March-April). It leads into the lean season when the demand for food is highest and most stores have been emptied. From the conceptual framework, the proportion of the food budget of the household budget, is one of the determinants of whether commercialisation would render households more or less food secure. By implication of the above discussion, more cash income is spent on non-food than on food expenditure.

From the previous chapter, it is also recalled that a comparative analysis of the different foods bought at different times of the year indicate that on average, expenditure on food shows a slight increase during the lean season (before the first season harvest as recorded during the first and second household surveys). However, the nature of foods bought, especially in Mbale district which had a relatively higher proportion of households in the least secure food clusters, make little calorific contribution to the diet (mainly green vegetables). Price data, illustrating price movements during the year and therefore interseasonal variation, (Figures 3.1a and 3.1b) are also indicative of producers facing higher prices later in the season. This should further constrain them from making purchases to bridge the shortages faced during periods of relative scarcity.

Together with this finding that non-food income is not significant to food availability, the heavy reliance on own production to meet subsistence food needs is again emphasised. A more comprehensive analysis of the seasonal variation in food availability and food purchases is therefore called for.

6.2.5 Education and health-care

As hypothesised, the number of children attending primary schools, households with children attending post-primary school or households with children who are six years old or less, negatively affect food availability. Having children who are six years old or less (the odds ratio is 0.67), having primary school going children (the odds ratio is 0.56) and having children attending post-primary education (the odds ratio is 0.66), all increase the likelihood of a household being in the food insecure group.

The effects of primary school going children could be interpreted in two ways. First, the high correlation with the number of adult equivalents (correlation coefficient is 0.78) implies that the larger the household size, the more constrained households are in meeting their minimum food needs and this negative association is expected. Second, every primary school going child could reduce food availability indirectly if food sales are undertaken to meet the costs of maintaining them in school. The latter explanation is supported by the farmer group discussions, the costs of education consistently ranked high as one of the reasons encouraging food sales in the three districts.

Even with the Universal Primary Education programme parents are still obliged to meet the costs of maintaining their children in primary school. These include providing books, school uniforms and paying non-tuition fees as stipulated by the schools and the tuition fees for those children additional to the four whose tuition fees are met by the state. Despite Government's contributions, parents still argue that the total non-tuition bill is high. This argument is supported by a poverty study in which it is reported that the costs of basic scholastic materials remain a burden on many poor families (Uganda-Ministry of Finance, Planning & Economic Development 1999). Put in perspective, the costs of an exercise book and a pencil, the most basic scholastic requirements, are less than 500 shs.

However, the higher correlation between non-food expenditure and the number of post-primary school going (0.44 compared to 0.26 between primary children and non-food expenditure) makes the variable CHISES_D, which is significant and negatively associated with food availability, a better proxy to non-food expenditure, particularly education related costs. The high positive correlation between adult equivalents per household and the number of primary going children implies household size is controlled for by the variable CHI_PS.

The costs of post-primary education are on average higher than primary education and therefore fewer parents can afford to educate their children through post primary education. This is evident in this study; on average every household has 2 primary school going children but more households do not have children attending post-primary education. If incomes from food sales contribute to meeting some of these costs, it is expected that the food availability implications of educating one primary school child are less than that for a post-primary school child. Livestock were also reportedly sold to pay school fees. Some children attending post-primary education, pay their own fees through income generating activities like brick making, petty trade, beer brewing etc.

Pre-school children aged 6 years or less (CHISIX_D) is statistically significant with a negative sign. It is also a proxy for the dependence ratio (correlation coefficient is 0.54) and health care. From earlier discussions, it is assumed that health care needs would be more pronounced among this age group. As a proxy for the dependency ratio, households with fewer "workers" relative to dependants are less food secure, as expected. By

implication, younger households, expected to have more dependants than workers compared with households in the later stages of the life cycle, would therefore be more food insecure. The group discussions suggested this, although they based their argument on higher food sales to meet demand for consumer goods.

Based on the theoretical relationship between food availability, nutrition and health, that the young children are more adversely affected, and on the argument that food was sold to meet among others health care needs, this variable estimate suggests that health care negatively impacts on food availability. A relatively low correlation is found between non-food expenditure and this variable. However, because of the observation that many bills are paid for on an instalment basis, the correlation coefficient should be higher. The finding that an additional primary school going child reduces food availability by less than a pre-school child does, favours the argument that this variable reflects additional effects beyond food needs.

Given the HIV/AIDS pandemic, it is expected that the demand for health care contribute to its costs and following the same argument, to food insecurity. On the other hand, because the most economically active age bracket is relatively more affected by the pandemic, negative externalities may arise from the effects on the labour force. However, although undoubtedly an important factor worth further research, was beyond the scope of this study.

The pressure that comes to bear on households is illustrated by the following examples. To pay off a medical bill of say 2,500 shs would require about 25 kgs of maize at an average price of 100 shs per kg, or about 10 kgs of beans at an average price of 250 shs per kg. School requirements of 10,000 shs will on average be a bag (100 kgs) of maize. One farmer in Muyembe Sub-county pointed out that the 30 bags of maize he had in store could not pay the fees of his three children in secondary school. That households with children in these defined brackets reduce daily calorie availability per adult equivalent supports the finding that food sales negate food availability in that implicitly food sales are made to meet these needs.

However, while the costs of accessing social services may bear heavily on the rural population, health costs on average make up 19% of non-food expenditure in Apac

District, 21% in Soroti District and 16% in Mbale District. Education costs make up 20% of non-food expenditure in Apac District, 15% in Soroti District and 22% in Mbale District. Of concern is the finding that alcohol and cigarette consumption combined, on average make up 30% in Apac and Mbale districts and 34% in Soroti of non-food expenditure. In Bugobero sub-county, a group of women lamented that their husbands sell all the matooke and spent most of the money on drinking with their friends. The women were particularly pained that even paying for the children's school needs, it is up to they the women to "look around".

Despite the use of these variables as indicators of the likelihood of a household being faced with relatively higher costs of accessing social services, given more reliable data on expenditure, the relationship between actual expenditure and food availability should be examined. The implications of these findings are that, food sales are in part driven by the need to meet the costs of accessing non-food goods and services.

6.2.6 Wealth

Although wealth should ease consumption smoothing, i.e. it enables a household meet its food needs both in good and bad times, there was no *a priori* hypothesis. One reason being the fact that livestock have social value in addition to the economic value and may not therefore be converted into cash income. However, the wealth proxies, i.e. the livestock owned (number of goats and whether a household owns cattle), are both insignificant. Goats make a positive contribution but cattle a negative one to food availability. Livestock could contribute to food availability indirectly through income effects if sold and directly, cattle may be used for animal traction. As for directly contributing to production, alternatives exist; it was observed that with or without oxen, reciprocal or hired labour and shared or hired oxen, are common practice. In Muyembe sub-county where maize and beans are grown on a relatively large scale, tractors were used to a small extent. Indirectly, because of the importance attached to cattle, it is not expected that the need for food would result in their sale. Other coping strategies would be adopted and if need be poultry or the smaller stock (goats or pigs), would be sold first in times of need. Hence the positive association between food availability and number of goats owned. Otherwise as wealth, therefore, livestock rarely enter the food security equation.

It is noteworthy to say that owning cattle is negative to food availability could also be due to restocking efforts particularly in areas of Soroti and Apac districts that are recovering from the effects of cattle rustling. The most common source of income is food sales and households were observed to be prioritising restocking for various socio-economic reasons.

Summarily, the scale of production is still predominantly subsistence and therefore deductions from output reduce the food available to meet subsistence needs. In addition to that, it was earlier discussed that whereas food sales do not necessarily negate food security, food purchases make a small proportion of total food that is consumed, implying own production is still the most important means to ensuring food availability.

6.3 THE DEGREE OF FOOD INSECURITY IN THE THREE DISTRICTS COMPARED

One of the objectives of the study was to compare the status of food security in the three districts. The findings so far indicate that Mbale District is the most food insecure of the three districts. Between Apac and Soroti, it is difficult to distinguish which is the more food secure or insecure. For a concise comparison of the three districts, this section generates an aggregate food insecurity index. It combines two variables, the proportion of food insecure households in a given population and the degree of food insecurity as evaluated by the "food gap". This stems from Sen's ordinal poverty index, a measure of poverty that combines the head count and the poverty gap (the income gap below a poverty line) both of which are commonly used measures of poverty (Sen, 1976).

Sen argued that the "head-count ratio" (H) the number of people with income below the poverty line to the total population, is insensitive to the degree of poverty. The head count may remain the same despite changes in the degree of poverty among the poor. The poverty gap (g) is the aggregate gap below the poverty line and it, on the other hand, is insensitive to the numbers of the poor sharing the gap.

His arguments centred around two axioms:

i) Monotonicity axiom - a reduction in income of a person living below the poverty

line increases the degree of poverty.

ii) Transfer axiom - a transfer of income from someone below the poverty line to someone better off increases the degree of poverty.

Ceteris paribus, the head-count ratio violates both axioms while the aggregate poverty gap (shortfall below the poverty line, of all the income of the poor) satisfies the monotonicity axiom but violates the transfer axiom.

He proposed a set of axioms, two of which made reference to the welfare rankings of individuals', i.e. relative equity and ordinal rank weights. First, that within an income configuration, the lower ranked are assumed to be the worse off. Second, their income gap therefore draws heavier weighting. He argued that while it is questionable that a rich but crippled person is better off than a poorer and fully able person, the third axiom, i.e. monotonic welfare, is based on the relatively crude assumption that a richer person is necessarily better off. It therefore does not take into account the totality of welfare because of the multitude of factors that would then need to be taken into consideration.

While both the head count and poverty gap should contribute to defining a poverty index, together, they still do not provide enough information on poverty. This is because neither gives adequate information on the income distribution among the poor. Assuming a special case where all the poor have the same income, then the two measures provide adequate information, i.e. the number of people affected and how poor they are, from which the last axiom (normalised poverty value) is thus drawn.

The poverty index that satisfies these axioms is defined as:

$$P = H[I + (1 - I)G]$$

Which (Sen, 1976) went on to prove, and where:

G is the Gini coefficient of the income distribution amongst the poor and is defined as:

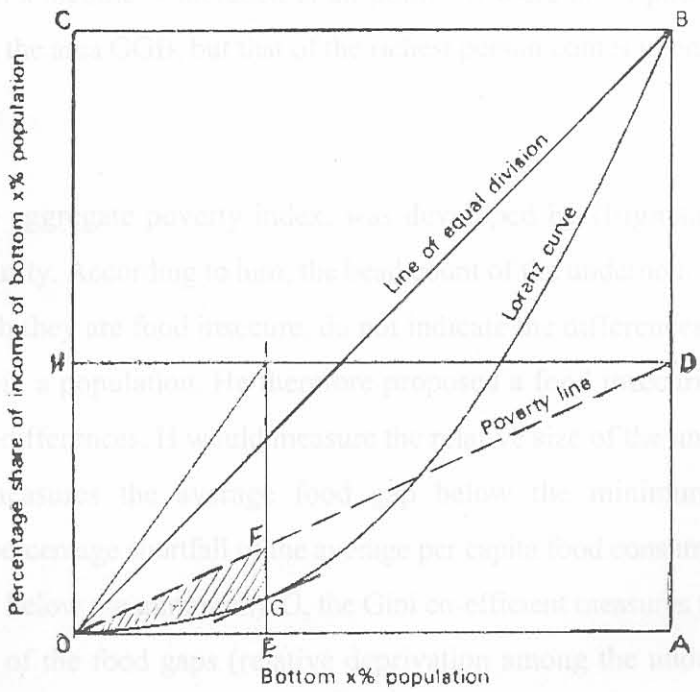
$$G = \frac{1}{2} q^2 m \sum_{i=1}^{q} \sum_{j=1}^{q} \left| y_i - y_j \right|$$

"I" is an individualised income-gap-ratio defined as;

$$= 1 + \frac{1}{q} - \frac{2}{q^2 m} \sum_{i=1}^{q} y_i (q + 1 - i)$$

$$I_{i \in S_{(x)}} = \sum \frac{g_i}{qz}$$

It is the normalisation of the aggregate poverty gap into a per-person percentage gap, the percentage of the shortfall below the poverty line of an individual's income. "I" is augmented by G, the distribution of income among the poor weighted by (1-I), the ratio of the mean income of the poor to the income level defining the poverty line, i.e. I ignores the distribution and G provides information on the distribution. Unequal distribution of income among the poor is the gini coefficient of this distribution multiplied by the mean income ratio. Thus [I + (1 - I) G] is the income gap normalised per poor person, but it does not take cognisance of the number of the poor, H.



Source: Adapted from Sen, 1976

Figure 6. 1: The relationship between P and G illustrated

OB is the line of equal division

OGB is the Lorenz curve,

The gini coefficient, G, is the area OGB/OAB,

The slope of the line OD = poverty line,

OE is the number of the poor.

The poverty measure P corresponds to the area OGF/OEI. It depends on the difference between the slope of OB (normalised mean income) and the slope of OD, (poverty line), and on the number of the poor as opposed to the whole population, OA.

From the formula above,

$$P = H[I + (1 - I)G]$$

1-G is equivalent to the area under the Lorenz curve, OGB.

The poorest person's income is included at all points. If there are n poor people, it is included n times in the area OGB, but that of the richest person comes in only once when point A is reached.

An analogy to the aggregate poverty index, was developed by (Bigman, 1993) with respect to food security. According to him, the head count of the undernourished, and the margins with which they are food insecure, do not indicate the differences between the food insecure within a population. He therefore proposed a food insecurity index that takes care of these differences. H would measure the relative size of the undernourished population. "I" measures the average food gap below the minimum nutritional requirements (the percentage shortfall of the average per capita food consumption of only the undernourished below the minimum). G, the Gini co-efficient measures the inequality in the distribution of the food gaps (relative deprivation among the undernourished). Bigman's concern over the aggregate food insecurity measure remained that it does not take into account individual differences and needs or intra-household factors that negate the attainment of individual food needs.

The analyses so far done are based on the average situation of both food secure and food insecure households. They cannot be conclusively used to compare the degree of food insecurity in the districts. An attempt is here made to apply this index to do so and determine the degree of household food insecurity. It is recalled that the daily average calories available per adult equivalent, addresses the gender and age differences within the household. This food insecurity index collapses two variables, the average daily calorie shortfalls below the minimum requirements and the proportion of households that are food insecure, into an index for the comparison of food insecurity across the three districts. An application of the aggregate measure of food insecurity across the three districts on the basis of average daily calories available per adult equivalent is here specified as:

$$FI = H_n [F_s + (1 - F_s).G]$$

$$G = 1 + (1/q) - 2 /(q^2 K_h) \sum F_i (q + 1 - i)$$

Where:

FI = District Food Insecurity Index

H_n = Proportion of households in the district that are food insecure

F_s = Average district Household food shortfall (calories) from minimum household requirements

K_h = Average daily food (Calories) available per adult equivalent amongst the food insecure households

F_I = Household food shortfall (calories) from minimum household requirements

G = The gini-coefficient of the food insecure only

Q = Total number of food insecure households in the district

I = Individual households that are food insecure

The application of the aggregate food insecurity index establishes the relative deprivation across different agro-ecological and socio-economic settings.

On average the food insecure have available to them about: 1,751 calories per adult equivalent per day in Apac District, in Soroti District they have about 1,468 and in Mbale District they have about 1,358 Calories. It is recalled that on average about 35% households have less than 80% of their minimum needs (1,935 calories) in Apac District, in Soroti District it is about 37% of the respondents and in Mbale District about 72%.

The results are as follows:

Apac District	FI = 19
Soroti District	FI = 107
Mbale District	FI = 429

By the food insecurity index, the degree of food insecurity is greatest in Mbale District, followed by Soroti District and lastly Apac District. There is a wide margin between Mbale and the other two districts. Commercialisation, as discussed earlier, is a factor that contributes to this wide variation. Other possible reasons are now discussed.

Variations in the yields of the dominant food crops cultivated and by implication consumed. The yield estimates of selected crops (tons per acre) are; cassava - 3 tons, sweet potatoes - 1.5 tons, maize - 0.6 tons, millet - 0.6 tons, sorghum - 0.6 tons, beans - 0.3 tons, and bananas - 2 tons (Uganda-Mbale Department. of Agriculture, 1998; Uganda Bureau of Statistics, 1999). Cassava has a yield advantage over bananas, sweet potatoes or the cereals. It is a dominant crop in Apac and Soroti districts while matooke is mainly cultivated in Mbale District. The grain crops maize, finger millet and sorghum do not impart any yield advantage on those cultivating either of them.

Because of the importance of own production in meeting food needs, the yield advantage of cassava in particular should impart a higher degree of food availability to those cultivating it. Although the yield of bananas is relatively high, substantial quantities are sold, and therefore less of the estimated output is available for consumption. In addition to the yield differences between the dominant food crops being cultivated, it is recalled that Mbale District is faced with a land constraint. About 21% of the sampled households cultivate less than 2 acres. In contrast, those cultivating less than 2 acres in Apac and

Soroti districts are less than 10% of the sampled households. This has a bearing on output that is mainly a function of area under cultivation.

The relatively low use of the second rains in Mbale District also contributes to the aggregate variation in food availability. In effect many households have one harvest of the main annual crop. In contrast, in Apac and Soroti districts, crop rotation patterns ensures that two harvests of the main annual crops are made. Besides the yield advantage of cultivating cassava, a second season crop of either sorghum or sweet potatoes as is practised in some of the villages in Soroti District, increases this advantage.

The influence of dietary eating habits, which are strongly ethnographic, cannot be ignored. Discussed in the previous chapter, the nature of the foods that make up an average diet in Soroti and Apac districts inherently provide more calories than the foods commonly eaten in Mbale District. Therefore knowingly or unknowingly, the choice of foods grown and consumed also influence calorie availability.

The lack of awareness was manifest in the responses of a study respondent, a licensed teacher and office bearer on the area's Local Council I executive committee. She could not relate the apparent malnutrition in her children and the diet she was feeding them. Their diet was predominantly matooke from the garden, fried cabbage/spinach and less frequently included potatoes and beans. Although they were also cultivating maize and beans, these were mainly for sale to enable them complete building their permanent house. The previous season they had sold the maize harvest to buy iron sheets. Cumulatively, the diet limits caloric consumption. In contrast, a group of women in Soroti District said they included some simsim in their vegetables, which would otherwise be bland. Simsim imparts upon the meals a higher caloric content and has a high protein content (21%).

6.7 CHAPTER SUMMARY

The chapter estimates the relationship between food availability and commercialisation and other socio-economic variables. Logistic analysis is applied to test the hypothesis that commercialisation negatively affects food availability. Secondly, a food insecurity index to compare the degree of food insecurity across the three districts is generated.

The findings of the analyses reaffirm that increased productivity, reflected by land brought under production, increases food availability. Commercialisation however, negatively affects food availability. Other variables also found to negatively affect food availability imply a constraint on household resources to meet its demands and a competition of needs. Mbale District on average is significantly more food insecure than either Apac or Soroti District. Human capital reflected by variables regarding the age, gender, formal education, or occupation of the household head, are all insignificant to food availability.

The aggregate food insecurity index focuses on inequality among the food insecure and the numbers of food insecure households and thus the degree of food insecurity. It shows that the degree of food insecurity in Mbale District is far worse than either Soroti or Apac districts. This is in support of the main hypothesis given the overall observation that Mbale district is the more commercially oriented of the three. However, the cropping patterns and land availability contribute to determining the degree of food insecurity too as some crops, i.e cassava and sweet potatoes impart a higher degree of food security by their very nature and by the fact that they are very bulky. This finding also underscores the observation that the apparent abundance of food, as seen in Mbale district in particular and Uganda in general, masks the food insecurity problems faced by many and due to a compounded relationship of a number of factors.