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FOOD PRIORITIES AND POVERTY IN UGANDA

Nicky Pouw

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ABSTRACT[a]

Standard consumption theory assumes the maximisation of a consumer's utility function as a function of the quantity of goods consumed. As such, the theory suggests that utility maximisation results in an interior solution. However, there is strong evidence to believe that this is not true. The present paper explores food consumption patterns among the rural smallholder farmer population in Uganda, to see whether these suggest useful ways of welfare rankings, and the extent to which alternative rankings are consistent. The logic of this approach is that by looking at what is consumed and what is not, one has an alternative for the money-metric, which has its own comparative advantages, not least transparency.

[a] This paper draws on my forthcoming PhD thesis, on *The Characterisation and Monitoring of Poverty in Uganda,* conducted at the Institute of Social Studies (ISS) in The Hague, The Netherlands. The author is grateful for the guidance and comments given by her supervisors Prof. G. Pyatt and Prof. R. Vos (ISS) and to Peter de Valk for his comments. Any omissions or errors in this paper are entirely my own responsibility.

CONTENTS

1 INTRODUCTION

Being poor means not having enough to eat; "not being able to provide for your family or yourself".[1] Food consumption is a critical indicator of well-being to the poor. Engel (1895) already proved the robustness of a welfare measure based on people's consumption behaviour. His method assumed that households have a similar welfare level if they have the same budget share for food, or some composite of "necessities". Later, it was Rowntree (1901) who developed the well-known primary food poverty index. His contemporary Booth (1889-91, 1892-97), was the first to systematically survey people's food consumption behaviour on a large scale, and who found that the number of different food items consumed increases with welfare.[2]

The current standard approach to measuring living standards based on food consumption, uses household food expenditure, or the cost equivalent of the food consumed, as a proxy for living standards. Another strand of literature focuses on the nutritional values of the food consumed and the minimum level of caloric requirements per adult equivalent needed to survive. A variant of this approach focuses on the consumption of one particular food item, or a basket of food items and the cost of obtaining this.[3] It links back to the notion of a "wage good", which was defined in early distribution theory as the "necessaries" that comprised the subsistence of workers, and which distinguished them, as a separate class, from capitalists and landowners who consumed luxuries and conveniences. Either way, a monetary value is assigned to the quantity of food consumed. The question is whether a much simpler approach based on which items are consumed without reference to how much is consumed, may be interesting and/or more accurate.

In the present paper, utility maximisation is set up in a way that allows for corner solutions. If the non-negativity conditions of consumption theory are recognised, the solution of the model can be mixed; i.e. $q_i=0$ (a corner solution) for

[1] Quote from a local farmer in Kabukose village, from the pilot study in Kabarole District, in February-March 2000.

[2] Booth divided the London population in seven welfare classes: A. Lowest class, vicious, semi-criminal; B.Very poor, casual labour, chronic want; C. Poor, 18-21 shillings a week for a moderate family; D. Mixed, some comfortable, others poor; E. Fairly comfortable, good ordinary earnings; F.Well to do, middle class; G. Wealthy, upper middle and upper classes (Booth, 1896). On the basis of his survey data, he found that, on the whole, the number of food items consumed varies from 10 to 35. By welfare classes it rises from 19 in class B to 27 in class E. From: Booth (1902) *Life and Labour of the People in London. Part I,* p. 140.

[3] For example, in Indonesia, Sayogyo (1975) proposed to measure poverty in terms of rice purchasing power.

some food items and $q_i>0$ (an interior solution) for other food items. This is the case, for example, when the relative price of one commodity is too high in relation to other prices and consumer's preferences, so that consumers end up spending all of their income on other commodities. In a context where poverty is widespread it is likely that no food items are inferior, and typically the number of food items bought will increase as total expenditure increase for a household of a given size. This is a realistic assumption, given that most poor people would like to buy more of different kinds of food items rather than less at increasing income levels.[4] As a result, one would expect to find a monotonic relationship between the number of different food items consumed and per capita expenditure (including imputed values), for a household of given size living at or below subsistence level.

In terms of practice, this implies that the starting point of our poverty analysis will be to consider the diversity of people's diet in terms of the number of different food items consumed, and, within that number, people's choices of types of food. By considering food consumption patterns in this way we try to see if they suggest useful ways of ranking (groups of) people to their well-being, and the extent to which alternative rankings are consistent. The logic of this approach is that by looking at what is consumed and what is not, one has an alternative for the money-metric, which has its own comparative advantages, not least transparency.

The focus of the analysis in this paper will be on the rural smallholder farmer population in Uganda, and based on the data collected through three pilot field-surveys. The surveys have been conducted in the year 2000 in Kapchorwa, Kabarole and Mpigi district, with a total sample size of 938 households.[5] The remainder of the paper is organised as follows. First, in section 2 the food consumption patterns by the rural smallholder population is presented and discussed. The focus of our interest is

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[4] This comes close to what post-Keynesian authors have written about in relation to consumer choice, for example, Lancaster (1966), who stated that consumers have preferences regarding attributes or characteristics of commodities. Ironmonger (1972) modelled the diffusion of new consumer goods as logistic curves. Other authors, including Pasinetti (1981) stated that: "…at any given level of real income, there exists a hierarchy of needs. More precisely, there exists a very definite order of priority in consumers' wants, and therefore among groups of goods and services, which manifest itself as real incomes increase" (p.73); and, Eichner (1986) who wrote: "Consumer preferences are,…, lexicographically ordered…A household's consumption pattern, at any given point in time, thus reflects the lifestyle of the households that constitute its social reference group" (p.159-160). As in Lavoie (1992, p.63-64).

[5] More information on the data collection and sample selection method is provided in the thesis of the author, yet to be published, entitled 'The Characterisation and Monitoring of Poverty in Uganda', Pouw (2005).

on the variety of foods consumed, rather than the quantity. In section 3 the relationship between the number of different food items consumed and household expenditure is explored. In particular, we try to answer the questions to what extent there is an economy of scale effect and/or inferior goods in the food consumption patterns of poor smallholder farmers. In section 4 a ranking and testing procedure is developed to map out people's relative food priorities in a hierarchy. This 'hierarchy of menus' forms the basis for selecting a limited set of food indicators representing the different levels of welfare within the hierarchy in section 5. A pragmatic procedure is designed to select the most robust indicators. The selected indicators give input into the further welfare analysis contained in section 6. The main conclusions are drawn in section 7.

2 FOOD CONSUMPTION BY THE RURAL POOR

In Uganda, food crops account for more than two thirds of agricultural GDP, and almost one third of total GDP. Livestock production accounts for another 23 percent of agricultural GDP, and fisheries for 8 percent. Most of the livestock and fisheries production is for food consumption, but some is exported. Traditional cash crops such as coffee, tobacco, tea and cotton are the principal export crops. However, the share of traditional cash crops in total exports has declined from 96.0 percent in 1985 to 38.3 percent in 2001. This dramatic fall is mainly ascribed to the collapse of world coffee prices and failure to add value to the cash crops as well as the high dependence on a few export commodities. The share of non-traditional export products (e.g. horticultural products, fish, maize, hides and skins) has increased because of trade liberalization and an aggressive export promotion campaign by the government – see also the government's *Plan for the Modernization of Agriculture (PMA)* (GoU 2000c). Total food production makes up close to 47 percent of GDP, and expenditure on food are about 50 percent of total expenditures for the average household. It is estimated that only one third of total food production is marketed and that 56 percent of total agricultural GDP is subsistence production for own consumption (IFPRI 1998). Despite a declining share in total GDP, the agricultural sector is still considered the 'backbone' of the Ugandan economy with the majority (60 per cent) of the working population employed in this sector. Around 3 million smallholder subsistence farmers derive a livelihood from agricultural production and over 70 percent of Uganda's export earnings are from agriculture. The main food crop of Uganda is bananas (*matooke*), which accounted for 28 percent of the total cropped area in 2000, followed by cereals, root crops, pulses and oilseeds with 25 percent, 17 percent, 14 percent and 8 percent of the area, respectively. Cash crops, livestock, fish and forestry accounted for 8.9 percent, 6.9 percent, 4.6 percent and 4.3 percent in 2000. Other food products like wheat and rice are imported to cater for the population in the urban areas (FAO 2001).

Although, Uganda is self-sufficient in food in absolute terms food consumption is highly unequal in relative terms. Smallholder farmers produce nearly 100 percent of the food crops in Uganda. The majority of smallholder farmers produce at or below subsistence level. As a result, this is a sub-group of the population that is particularly prone to poverty and destitution. The smallholder farmers run the risk of food shortage quickly in times of drought or heavy rainfalls, pests and diseases, insecurity or other misfortune. The small size of the landholdings and continuing erosion of the soils is another cause of rural household food insecurity. Food shortage is frequently reported as an acute problem among the rural poor. Table 1 below shows that more than 65 per cent of the sample population in Kapchorwa and Mpigi, and more than 40 per cent in Kabarole district experienced food shortage at least once in the past year. These findings are in line with other findings on household food security in Uganda, for example: Bahiigwa (1999), who found that at any point in a season, at least 40 per cent of the households do not have enough food to feed themselves; and P. Okiira Okwi (1995) who found, on the basis of the *IHS 1992* data set, that more than 80 per cent of the households in all regions of Uganda fail to meet a minimum caloric requirement of 2,200 calories per adult equivalent per day.

TABLE 1
Percentage of people reporting food shortage in the past year (n=938)

Food Shortage	*Kapchorwa (n=298)*	*Kabarole n=300)*	*Mpigi (n=340)*
At least once in the past year	65.1%	40.4%	67.2%
No shortage in the past year	34.9%	59.6%	32.8%

Source: field-survey data (2000).

TABLE 2
Per capita types of food/beverage items consumed by district

Food Items	*Kapchorwa*[6]		*Kabarole*[7]		*Mpigi*[8]	
	past 24 hrs.	*past 7 days*	*past 24 hrs.*	*past 7 days*	*past 24 hrs.*	*past 7 days*
Salt	296	296	292	294	338	340
Cooking oils (incl. *ghee*)	280	284	142	209	208	257
Tea	272	278	276	283	308	313
Sugar	266	277	208	248	275	292
Maize	262	280	73	176	49	64
Beans	255	278	258	274	248	286
Tomatoes	212	257	219	256	204	260
Green vegetables	200	242	156	216	161	227
Matooke (cooking bananas)	184	225	171	210	174	249
Onions	181	214	206	246	226	261
Meat or poultry	169	237	67	212	58	165
Milk, and other dairy products	142	179	180	217	160	187
Local brew	123	135	52	76	40	58
Fruits	88	112	118	179	195	254
Eggs	86	117	36	84	60	108
Coffee	82	94	16	55	67	76
Groundnuts	81	120	70	160	69	144
Chapati or bread	81	111	67	120	104	173
Fish (fresh and dried)	78	121	12	52	88	197
Soft drink	75	109	23	94	24	57
Rice	72	117	50	149	60	147
Potatoes (Irish and sweet)	68	109	160	223	255	314
Yams	66	91	105	151	55	91
Cassava	42	53	188	235	155	209
Sorghum or millet	16	23	57	80	2	3
Total number of people	n=298		N=300		n=340	

Source: field-survey data (2000).

Table 2 lists the food and beverage items consumed by the smallholder farmers over the past 24 hours and past seven days in each of the three districts covered in the survey.[9] The count data in table 2 show that there are different consumption patterns across the three districts in the field-survey. These variations point to differences in taste, culture, and agricultural production patterns (e.g. there

[6] Kapchorwa: of the respondents, 63.8% was the household head (either a woman or men), 32.2% his/her spouse, 2.7% an adult child and 1.3% another adult relative who is resident member of the household.
[7] Kabarole: of the respondents, 64.3% was the household head, 19.7% his/her spouse, 13.0% an adult child, 3.0 % another adult relative, who is resident member of the household.
[8] Mpigi: of the respondents, 50.3% was the household head, 27.1% his/her spouse or partner, 15.3% an adult child, 6.9 % another adult relative, who is resident member of the household, and 1.5% another adult non-related household member.
[9] The food and beverage items included in the field-survey have been selected as follows: During the two pilot studies prior to the field-survey, the list of 27 food and beverage items that were part of the *IHS 1992/93* was taken as the starting point of our survey questionnaire, which in addition included an open question about "any other food items consumed". After running the pilots, it was found that a number of food items on this list could be combined into one, or combined variables needed separating out or re-definition instead. Eventually, this has resulted in a list of 25 food and beverage items.

are seven agro-ecological zones in Uganda, with each having specific (combination of) farming systems).[10]

From the frequency distributions in figure 1 below, we learn that people consume different quantities of food and beverages, and that these differences remain to exist across different time-intervals - 24 hours *versus* 7 days. The comparison of consumption patterns over two different time intervals shows that the sign of the differences between food and beverage items consumed remains the same.

The average and median number of different food items consumed per capita (over the past seven days) in table 3 suggest an increase in the diversity of items

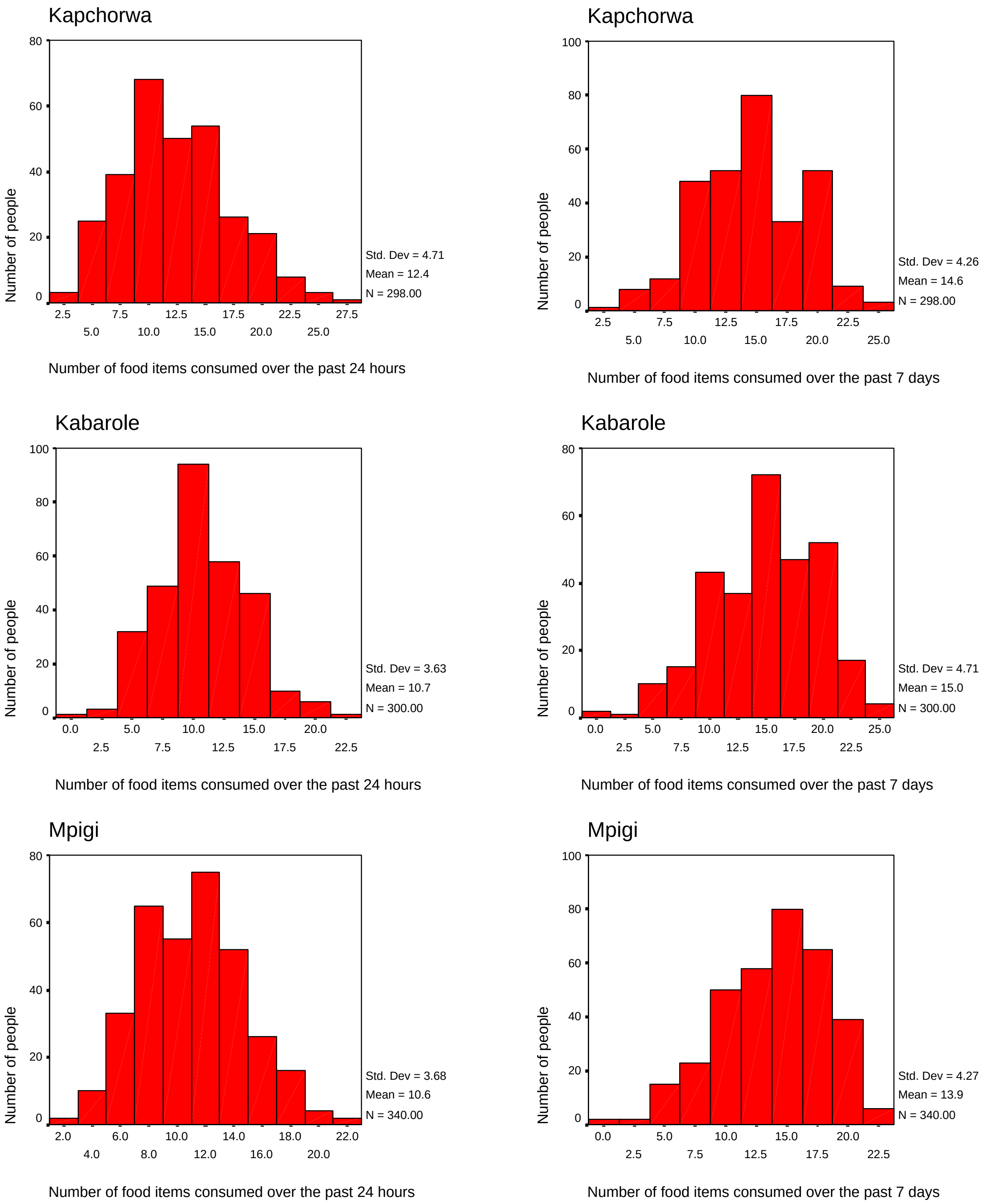
TABLE 3
Per capita number of different food items consumed over past 7 days by household size

				KAPCHORWA				
Household size:	**1**	**2**	**3**	**4**	**5**	**6**	**7<10**	**10 and over**
Number of food items:								
Mean	13.2	14.1	15.6	14.0	14.7	15.0	14.7	14.0
Quartiles:								
25	10.5	10.0	13.0	10.3	10.0	12.0	12.0	11.0
50	13.5	15.0	15.5	14.0	15.0	14.5	15.0	14.0
75	16.5	17.0	18.3	17.8	19.0	20.0	18.0	16.0
Number of households	6	14	30	44	45	50	83	26
				KABAROLE				
Household size:	**1**	**2**	**3**	**4**	**5**	**6**	**7<10**	**10 and over**
Number of food items:								
Mean	9.6	15.4	14.0	15.8	15.4	14.7	15.0	16.2
Quartiles:								
25	7.0	13.5	9.5	14.0	12.0	12.0	11.0	12.3
50	10.0	16.0	13.0	16.0	16.0	15.0	15.0	16.0
75	12.5	18.0	17.5	18.0	19.0	17.0	19.3	20.0
Number of households	9	13	45	41	45	31	78	38
				MPIGI				
Household size:	**1**	**2**	**3**	**4**	**5**	**6**	**7<10**	**10 and over**
Number of food items:								
Mean	11.3	10.9	12.6	14.6	14.0	14.3	13.9	15.9
Quartiles:								
25	7.3	7.0	11.5	12.0	11.3	11.8	11.0	13.0
50	9.5	10.0	13.0	14.0	15.0	14.5	14.0	16.0
75	17.5	16.0	15.0	17.0	17.0	17.3	17.0	19.0
Number of households	12	23	33	46	44	34	95	53

Source: field-survey data (2000).

[10] At the time of the survey, in February and March, it was coming to the end of the dry season. Although, in the South *matooke*, sweet potatoes and cassava are planted and harvested throughout the year, in the North and East the first crops are not be harvested until August/September. This means that, for example in Kapchorwa, at the time of the survey, there was still food left from the last harvesting period, but food stocks already started to dwindle. Food shortage reaches its peak in July, in particular in the drier North.

FIGURE 1
Per capita distributions of number of different food items consumed by district



Source: field-survey data (2000).

consumed by members of bigger sized households.[11] This could be explained by either a difference in taste factor, or an economy of scale effect. We apply the *Chi-square* test to assess the difference between the mean number of different food and beverage items consumed by household size (according to the groups defined in table 3). The calculated χ^2-*statistic* generates insignificant results for the households in Kapchorwa and Kabarole, but a small significant result in Mpigi at $\alpha=0.05$.

3 THE NUMBER OF FOOD ITEMS CONSUMED *VERSUS* HOUSEHOLD EXPENDITURE

The number of different food and beverage items consumed is an indicator of the diversity of people's diet and variability in food consumption is desirable from a nutritional point of view. An increase in the diversity of food items consumed would thus imply a welfare gain.[12] The next step in our analysis will therefore be to explore the relationship between food diversity and expenditure on food. The field-survey underlying much of the present research has not collected income or expenditure data: however, we can test this relationship by using existing formal household survey data for Uganda available to us: the *Integrated Household Survey (IHS) 1992* and two of the four *Monitoring Surveys, MS-1 (1993/94)* and *MS-2 (1994/95)*. The *IHS* collected expenditure data for 27 different food and beverage items consumed by the household (head), with a reference period of 30 days.[13] The *MS* used different numbers of food items and a reference period of 7 days. Again, we disaggregate the data for households of different sizes, to see if bigger households consume more or the same number of different food items (see table 4). This time the Chi-square test does point to a significant difference in the average number of food items consumed per household size at $\alpha=0.05$. This is mainly caused by a difference in taste factor

[11] The time-interval taken here is 7 days, in order to be able to compare with the formal household surveys of Uganda.

[12] Kabeer (1994) pointed out in the case of Indian rural communities that: 'A great deal can be learnt about household poverty by comparing the source, frequency and content of meals.' She specifically points to the diversity of people's diet as an indicator of well-being and distinguishes between 'luxury' or 'status' foods and 'famine' or 'poverty' foods as the two extremes on a scale (pp.144-5).

[13] Food items included in the calculation of total household food expenditure are: *matooke*, sweet potatoes, Irish potatoes, cassava, yams and other tubers, rice, maize, bread, sorghum/millet, simsim, other cereal products, meat, poultry, fish, milk, dairy products, eggs, other food, oils, fruit, vegetables, tomatoes, onions, beans, nuts, sugar, beverages - tea, coffee, and others (cocoa, etc.).

between one-person households and households of bigger size. However, also between households consisting of two members and more, the difference in the variety of food items consumed is still significant at $\alpha=0.05$.

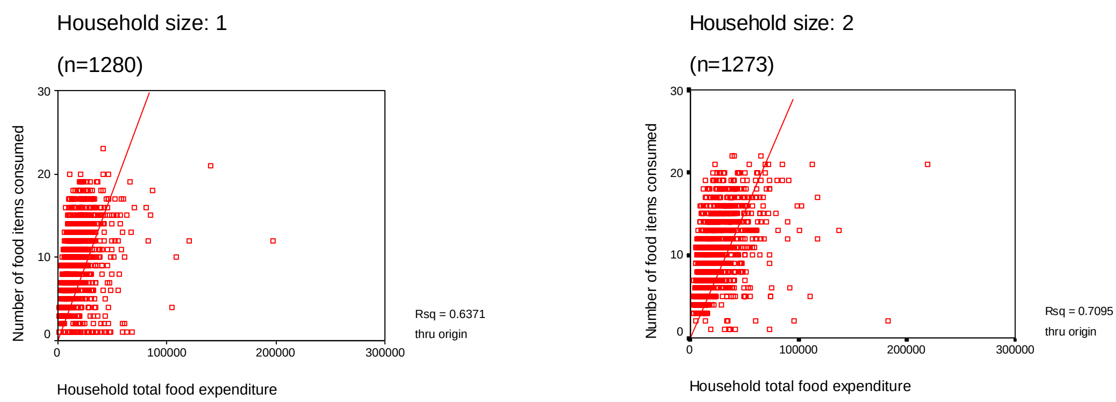
TABLE 4
Number of different food items consumed by household size

Household size:	**2**	**3**	**4**	**5**	**6**	**7<10**	**10 and over**
Number of food items:							
Mean	10.7	11.1	11.2	11.3	11.1	11.5	12.9
Quartiles:							
25	7.0	8.0	8.0	8.0	8.0	8.0	10.0
50	11.0	11.0	11.0	11.0	11.0	11.0	13.0
75	14.0	14.0	14.0	14.0	14.0	15.0	16.0
Number of households	1273	1400	1386	1295	1023	1671	358

Source: own calculations, based on *IHS 1992/93*.

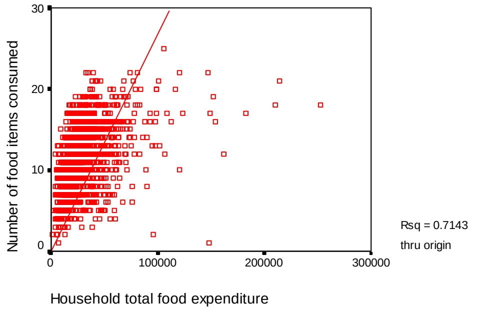
Given that the number of different food items consumed varies by household size (see also figure 1 in appendix 1), we need to look closer at the possible explanations. In the scatter plots in figure 2 below, the number of different food items consumed is set against total household expenditure on food, given household size. Since we assume the number of different food items consumed to be proportional to household food expenditure, the trend line is forced through the origin. For each household size, a positive correlation seems to exist between the two variables. This is according to what we would expect; namely, that at higher expenditure levels people can afford a more varied diet in terms of taste and nutrition.

FIGURE 2
Number of different food items consumed versus household food expenditure (n=9912)



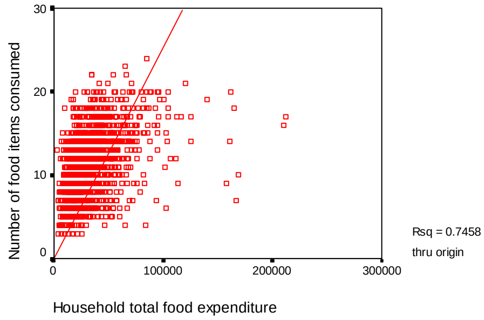
Household size: 3

(n=1400)



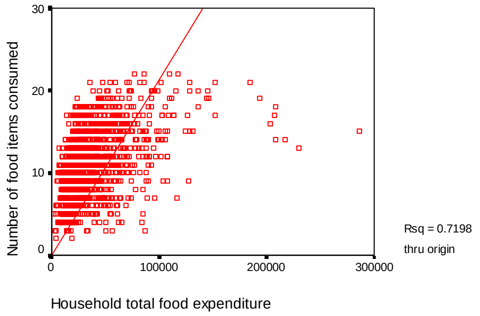
Household size: 4

(n=1386)



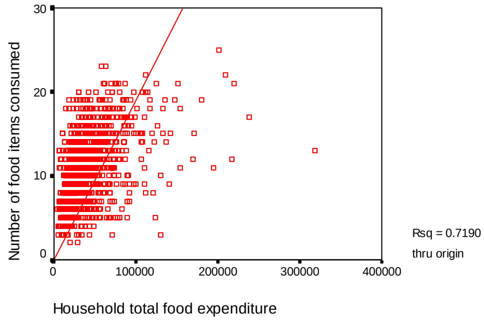
Household size: 5

(n=1295)



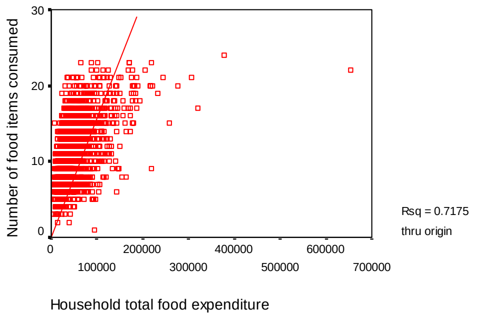
Household size: 6

(n=1023)



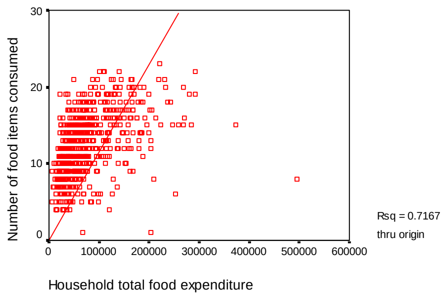
Household size: 7<10

(n=1671)



Household size: 10 and over

(n=584)



Source: own calculations, based on *IHS 1992/93.*

Since, we ultimately want to find out whether the number of different food items consumed is a good proxy for per capita expenditure on food, with or without some allowance for economies of scale; we need to look in greater detail at the nature of the relationship. The basic idea underlying this regression model is that variety in food consumption drives the utility function. This is comparable to what Dixit and Stiglitz (1977) presumed with regard to market competition and optimum product diversity. Tests for economies of scale are usually based on demand for food in terms of per capita expenditure on food and therefore, implicitly on quantities of food consumed (e.g. Deaton 1997). For example, Lanjouw and Ravallion (1995) found that even poor households face economies of scale in food consumption. However, we propose to look at the variety of foods consumed to see if households of bigger size generate economies of scale with regard to the number of different food items consumed. This implies that in the regression model we set the variety of the diet against household food expenditure. The number of different food items consumed *(Y)* is regressed on per capita food expenditure (X_1) and household size (X_2), while transforming all variables into their natural logarithm. The positive sign of the two regression coefficients confirms that the number of different food items consumed increases both with per capita food expenditure and household size. Jointly, the independent variables explain 22.4 per cent of the variance in the number of different food items consumed (see table 5).

TABLE 5
Regression of number of food items on per capita food expenditure and household size

$Pred.LN(Y) = \alpha + \beta_1 LN(X_1) + \beta_2 LN(X_2) + \in$	
Unstandardised coefficients	
Constant term (α)	-0.693
(st. error)	(0.059)
Per capita food expenditure (β_1)	0.298
(std. Error)	(0.006)
Household size (β_2)	0.259
(std. Error)	(0.006)
Test statistics	
F-statistic	1433.56
t-statistic (α)	-11.82
t-statistic ($Beta_1$)	49.07
t-statistic ($Beta_2$)	40.69
R-squared	0.224

Source: own calculations, based on *IHS 1992/93.*

In order to assess the economies of scale effect in determining the variety of foods consumed, we need to test the difference between the two regression coefficients in the above model. Since, if

$$LN(Y) = \alpha + \beta_1 LN(X_1) + \beta_2 LN(X_2) + \in \qquad (1)$$

Then it follows that,

$$LN(Y) = \alpha + \beta_1 LN(X_1 \cdot X_2) + (\beta_2 - \beta_1) LN(X_2) + \in \quad (2)$$

So, if $\beta_1 = \beta_2$, then the number of food items depends on $(X_1 \cdot X_2)$, which stands equal to total food expenditure. However, it is likely that there are other variables explaining the variety of the consumption bundle, as is indicated by the rather low value of *R-squared*. The difference between $\beta_2 - \beta_1 = -0.039$, which implies that the variety of food items consumed does *not* increase with household size. In order to test whether this difference is significantly different from zero, we run a second regression based on equation *(2)*. The outcome of this regression is that the difference between β_2 and β_1 is insignificantly different from zero, with the *t-statistic* being equal to (5.92), and thus smaller than the critical value of $t_\alpha = 1.96$ for $\alpha = 0.05$. The coefficient to the household total expenditure on food variable is not so strong, but highly significant. The number of food items consumed varies by 0.298 by total household expenditure on food. The conclusion is that there is no evidence found of an economy of scale effect, in the form of increased variety of consumption for households of bigger sizes. Regression analysis of the two *Monitoring Surveys* generates similar results in the case of the *MS-1*, but there appears to be a small economy of scale effect in the case of the *MS-0032.*[14] The above regression results lead us to conclude that, although bigger households tend to consume a slightly more varied diet, this is caused by a difference in taste between household members, rather than an economy of scale effect. The regression results show that the number of different food items consumed depends only on total food expenditure. Therefore, we will make no adjustment for economies of scale in our subsequent analysis of food consumption patterns.

Finally, we wish to consider whether all food items can be considered normal goods or become inferior at some point. Overall, in Uganda there is wide substitutability among the primary food staples, so that households will switch from one food staple to another with relative price changes, which is a characteristic of poor households. This was also found to be the case in Uganda by Mijumbi (1999) in his study on regional demand elasticities of food. Whether a food item is a normal or an inferior good depends on the preference pattern of the consumer. A particular food

[14] See table 2: *MS-1* Regression of Number of Food Items on Total Food Expenditure and Household Size and table 3: *MS-2* Regression of Number of Food Items on Total Food Expenditure and Household Size, included in appendix 1.

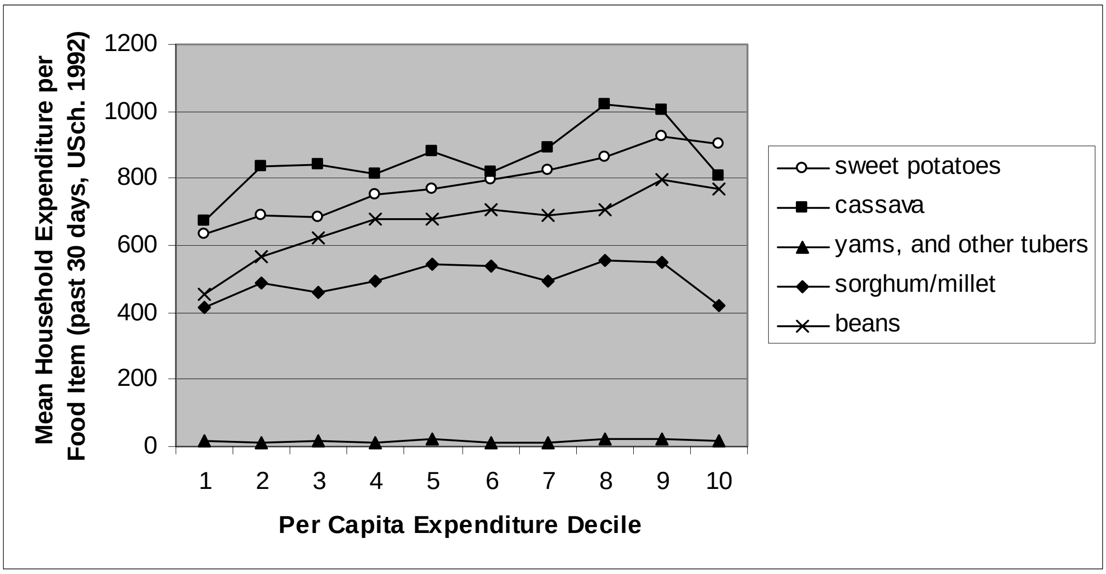
item may be a normal good within a certain range of income, and an inferior good within another range. Usually, the staple foods are normal goods or even a Giffen good to the very poor – at least, they are not inferior. A normal good is a good with an income elasticity greater than one. A Giffen good is a good for which the demand increases as its price rises. For example, when the price of cheap staple foods rises, the poor are no longer capable of complementing their diets with the more nutritious and expensive food stuffs and increase their demand of staple foods. This happens when there are only few substitute foods available.

Therefore, we consider household expenditure on the food items consumed, in relation to total household expenditure.[15] For this purpose, we restrict ourselves to the *IHS 1992/93* data, because it is the only survey available to us which covers an entire year, and therefore does not suffer from seasonal differences. From the *IHS* survey data it appears that expenditure on sweet potatoes, cassava, yams and other tubers, sorghum and millet, and beans, which are all among the primary food staples of Uganda, increases with total household expenditure. For the majority of the population, these food items are thus normal goods. Only in the ninth and tenth decile (figure 4.3) is there a slight fall in the consumption of these items, but the differences are only significant for sorghum/millet and cassava.[16] Cassava is actually the cheapest starchy staple food in Uganda (and Africa). However, the cross elasticities of demand among cereals and root crops are known to be high, so substitution between cassava and sweet potatoes for example, is not difficult and common practice when either one is scarce. For these reasons, and because we assume to have included the poorer rather than the richer part of the population in our sample, it seems plausible to assume there are no inferior food items within the given set of food items. The poor are expected to spend a larger share of additional income on cheap staple foods. It is only in the highest expenditure deciles that people seem to start supplementing their diets with more costly sources of calories and spend a smaller share on staple foods.

[15] Including estimated household consumption of home-produced foods.

[16] The statistical test performed is a one-way ANOVA test, with $\alpha = 0.05$ and the critical value of F=3.86. The calculated F-values are: F=0.79 for sweet potatoes; F=1.87 for yams, and other tubers; F=4.42 for sorghum/millet; F=0.24 for beans; and, F=6.68 for cassava.

FIGURE 3
Average monthly household expenditure on food items per expenditure decile (n=9912)



Source: own calculations, based on *IHS 1992/93*.

On the basis of the foregone analysis, we reject the idea of 'people buying a bit of everything' in the context of food consumption by the rural population in Uganda, and instead allow for utility maximization to result in a corner solution, which may change into an interior solution under alternative conditions, as living standards rise. This implies that would expect the number of different food items consumed (variety of the consumption bundle) to increase, when people advance their living standards. The next question is whether or not the food items that are already in the consumption bundle influence the type of food stuffs added to the menu. This question will be explored in the following section.

4 A HIERARCHY OF MENUS

Now that we have seen that people consume different quantities of food and that we may assume that all food items are normal goods for the smallholder population under consideration, we want to find out whether the selection of food items is purely a random choice, or if is there is an underlying sequence? We apply to probability theory to develop a simple ranking and testing procedure – as explained in appendix 3. The statistical test developed for this purpose uses chi-square as a measure of distance – as opposed to a measure of difference – in order to assess the dominancy of ranking over an initial weak ordering. We continue with the example of

Kapchorwa to rank the 25 food and beverage items according to the number of households consuming them. For each combination of two items we calculate the chi-square test statistic (table 7). For a given cut-off value of chi-squared measure of dominance a diagram can be drawn such as figure 4, which shows a hierarchy of menus based on $\chi^2_{(1)} > 3.84$.

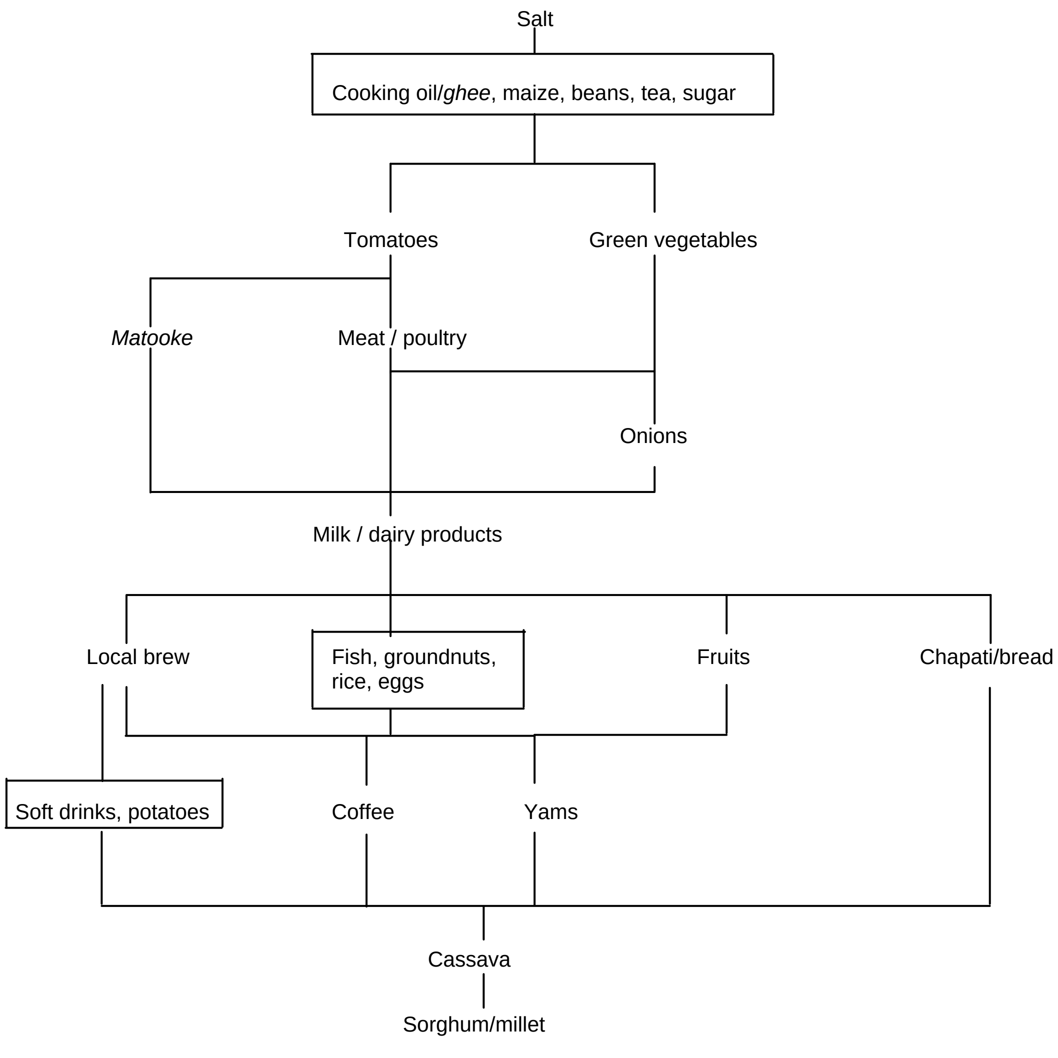
By varying the cut-off point of chi-square we can make the test more or less stringent and thus vary the number of levels within the hierarchy. This means that depending on the level of detail that we want, we can choose an alternative chi-squared cut-off point. In the present example, and further throughout the thesis, the cut-off point is set rather intuitively at 3.84. However, the dominant orderings are rather clear at high values of chi-square (see the figures on the diagonal in table 7). This means that the cut-off point would have to be set much higher than its present value in order for the number of levels in the hierarchy to come down substantially. Likewise, the cut-off point would have to be set at an extremely low value in order for the number of dominant ordering in the hierarchy to increase substantially.

The hierarchy of menus represents people's ranking of priorities *vis-a-vis* a certain set of food and beverage items. This ranking is strictly ordinal in nature. The priorities imply a ranking, about which no cardinal statements can be made. A dominant ranking in the hierarchy of menus is indicated by a straight line, and this dominance is transitive to those items ranked at a lower level; i.e. meat and poultry are dominantly preferred over onions, and both are dominantly preferred over milk. The ranking of the items in the hierarchy is transitive, meaning that when item *A* is dominantly preferred over item *B*, and *B* is dominantly preferred over C, than this automatically implies that *A* is dominantly preferred also over *C*. The statistical explanation of the transitivity of ranking is explained in appendix 3. The implication of this is the following. Since we use the chi-square measure in this test as a measure of distance, by varying the cut-off value of chi-square the test can be made more or less stringent. This will change the number of levels in the hierarchy but not the initial weak ordering of items, which remain consistent throughout.

Out of the 298 households in the Kapchorwa sample, 99.3% can be located at some point on the hierarchy of menus in figure 4. This implies that almost everybody follows one of the directions laid out in this scheme in consuming a particular set of food and beverage items. For example, 55% of the households consume milk or other dairy products at least once a week, as well as the other items ranked above it, according to one of the chosen routes. The hierarchy of menus has quite a few diversions into different directions, representing people's multiple differences in taste, culture and agricultural production schemes.

The survey assumed that water is essential for everyone, so the dominant food item is salt. Next, is a package of daily consumption items; beans, maize, tea and sugar. When fresh maize is available, it is roasted or boiled and mixed with cooked beans. Maize and beans are complementary foods, as maize provides calories and beans provide proteins. In combination, they provide complementary amino acids in

FIGURE 4
Kapchorwa: A Hierarchy of Menus Based on $\chi^2_{(1)} > 3.84$



Source: Kapchorwa field-survey data (2000).

TABLE 7
Kapchorwa Food Consumption: Computed Chi-Square Test Statistic for $\chi^2_{(1)}>3.84$

	Salt	Cooking oil or *ghee*	maize	Tea	Beans	sugar	Tomatoes	green vegetables	Meat or poultry	*Matooke*	Onions	milk, or other dairy	local brew	fish	ground nuts	rice	Eggs	fruits	chapati or bread	soft drink	potatoes	coffee	yams	cassava
Salt																								
Cooking oil or *ghee*	10.28																							
Maize	12.80	0.57																						
Tea	13.14	1.50	0.11																					
Beans	14.73	1.64	0.14	0.00																				
Sugar	19.00	2.88	0.23	0.07	0.04																			
Tomatoes	37.10	16.95	9.28	9.80	9.80	9.52																		
Green vegetables	50.28	29.40	21.24	20.25	20.25	17.75	3.46																	
Meat or poultry	57.07	38.75	28.45	26.68	29.49	28.57	5.71	0.34																
Matooke	69.05	46.41	36.45	40.71	39.56	38.63	13.47	3.04	1.64															
Onions	80.05	61.25	44.45	51.20	51.20	52.92	26.80	10.59	6.53	1.33														
Milk or other dairy	115.0	94.23	87.19	56.01	93.34	87.31	55.31	32.80	31.15	19.96	12.37													
Local brew	159.0	137.9	124.4	116.9	127.0	120.0	97.92	74.83	65.85	51.92	41.89	12.25												
Fish	173.0	153.6	147.8	146.9	147.6	148.4	119.3	98.26	87.38	79.53	64.07	26.70	1.31											
Groundnuts	174.0	156.4	147.1	148.6	152.2	147.6	121.1	96.65	98.48	88.20	63.11	26.57	1.49	0.01										
Rice	179.0	167.0	153.6	161.0	161.0	160.0	124.1	104.9	104.4	82.14	76.50	42.71	1.93	0.15	0.09									
Eggs	179.0	165.0	153.6	157.1	161.0	158.0	130.7	102.1	107.5	87.04	76.50	34.95	2.03	0.13	0.08	0.00								
Fruits	184.	170.0	164.1	162.1	162.1	163.0	132.2	108.3	109.3	89.29	78.82	38.37	3.50	0.73	0.60	0.29	0.29							
Chapati or bread	183.0	171.0	161.4	163.1	165.0	164.0	128.4	105.3	113.4	91.52	76.32	47.18	3.65	0.89	0.73	0.46	0.41	0.00						
Soft drink	187.0	175.0	163.4	167.0	167.0	168.0	133.6	109.9	112.2	92.16	79.32	47.12	3.84	1.47	1.17	0.86	0.76	0.11	0.05					
Potatoes	185.0	167.4	156.4	165.1	165.1	162.2	127.4	114.1	110.7	86.26	77.10	40.16	4.79	1.03	0.91	0.60	0.59	0.08	0.03	0.00				
Coffee	200.0	182.3	174.7	176.3	178.2	175.3	145.2	123.1	119.6	109.3	93.51	50.52	12.83	5.56	6.15	4.45	4.85	2.89	2.39	1.83	0.21			
Yams	203.0	187.2	183.2	181.2	181.2	180.2	149.8	128.8	119.8	118.1	90.59	55.31	13.63	8.33	7.86	5.54	6.04	3.90	3.39	3.12	2.66	0.09		
Cassava	243.0	231.0	225.0	221.1	223.0	222.0	194.5	169.3	171.0	160.8	140.1	103.1	43.66	47.18	43.58	39.38	34.71	33.80	35.04	29.04	23.40	16.32	17.20	
Sorghum / millet	273.0	257.1	257.0	253.0	251.1	252.0	224.4	207.6	204.5	190.7	178.0	143.2	92.24	81.39	79.07	74.88	74.88	75.44	69.14	66.04	63.76	49.91	50.26	14.52

Source: Kapchorwa field-survey data (2000).

addition. Dried maize is pounded into flour, and cooked with water to make porridge (*posho*) and also served with a sauce of beans (seasoned with salt). Both maize and beans are staple food crops in Kapchowa. Although, they are seasonal crops, they can be available all year through if production was large enough and storage properly done. Like tea and sugar, the ingredients are complementary, so they emerge as a package. If the household can afford it, the next step is to add flavour and nutrition to this basic meal, with some tomatoes or vegetables. Vegetables are consumed as a regular side dish, or sauce accompanying the staple foods and different varieties are grown throughout the year in the 'kitchen-garden'. The staple foods provide calories needed for body energy, but are low in other nutrients, while vegetables have a high nutritive value.[17] At this stage there are alternative menus. Some households will prefer to add tomatoes, plus meat and onions. Others, e.g. vegetarians, would prefer vegetables and onions or to stick with tomatoes and add *matooke*. *Matooke* is a perennial crop, but location specific in Kapchorwa District. The next priority is to add fresh milk to the diet.[18] The data suggests that milk plays a pivotal role in this hierarchy, leading us to the simple result that if one knows whether or not a household consumed milk, one knows that it must have consumed one or other of the above menus. About 55 percent of the population in Kapchorwa consume milk at least once a week. Milk is typically consumed fresh (and bought per cup) by the rural population; fermented milk is mostly used to season vegetables.

If the household can afford milk, there seem to be four main possibilities for supplementing the diet. One is to improve refreshments, in the form of local brew, soda drinks and coffee or to add potatoes to the menu. In Kapchorwa, it is mainly sweet potatoes that are grown. Together with yams and cassava, potatoes are perennial crops, which are harvested 'piece-meal'. They can be available whole year through because they can be 'stored' underground. As such, cassava, and to a lesser extent the other tubers are known as 'hunger foods', to secure food availability in times that other foods are scarce. Coffee is in principal a cash crop produced for the

[17] In particular, traditional vegetables have a very high nutritive value. They contain Vitamin A, B and C, proteins and minerals such as iron, calcium, phosphorus, iodine and fluorine. Traditional vegetables are produced on a small scale in the women's home gardens, and include various sorts of dark green leafy vegetables, such as *dodo, nakati, cassava leaves* and *sweet potato leaves*. See also, E.B. Rubai-hayo (1992 and 1994).

[18] Although, the variable included in the survey also covers "other dairy products", in most cases it concerns fresh milk only.

export market, but is also consumed in small quantities by the local population and mostly distributed through bars and small eating places. A second possibility is to consume a second complementary set of ingredients – fish, groundnuts, rice and eggs.[19] Fish is available, dried or fresh, all year round. Rice is not produced locally, but has to be imported. Groundnuts are grown in the 'kitchen-garden' on a small scale. Fruit and/or fruit juice is one alternative, chapati and bread is another. Which, given the season of the year and the availability of other foods, leaves yams, cassava, sorghum and millet as items that are less often consumed by the Kapchorwa villagers.[20]

The suggested hierarchy of menus implies that those people at a node, which represents a richer diet, are better off. When people increase welfare, it is likely that they add nutrition and flavour to their diet. If we consider the nutritional values of each food and beverage item on the list, the hierarchy appears to make good nutritional sense.[21] The most basic menu is composed of a variety of food items, including the primary food staples, which make a significant contribution to people's (minimum) nutritional needs. From the above priority pattern we learn that the probability of people consuming a particular food item(s) depends upon the basket of food and beverage items already consumed. This is confirmed by our findings for the rural sample populations in Kabarole and Mpigi district, as described in appendix 2.

5 SELECTION OF FOOD INDICATORS

The hierarchy of menus indicates different levels of welfare in terms of food consumption. Those people who consume a small variety of food are likely to be poorer than those who consume a wider variety of food. The hierarchy presented in figure 4 above differentiates between ten levels of food consumption, which means that there is scope for reducing the total number of 25 items to a smaller set of robust

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[19] Groundnuts have several uses in Uganda. The edible uses include the following. They are eaten together as a sauce with other foodstuffs such as *matooke*, potatoes, *posho*, or cassava. Roasted groundnuts are a complementary delicacy for tea, coffee, beer and soft drinks. Groundnuts can also be crashed to edible oil.

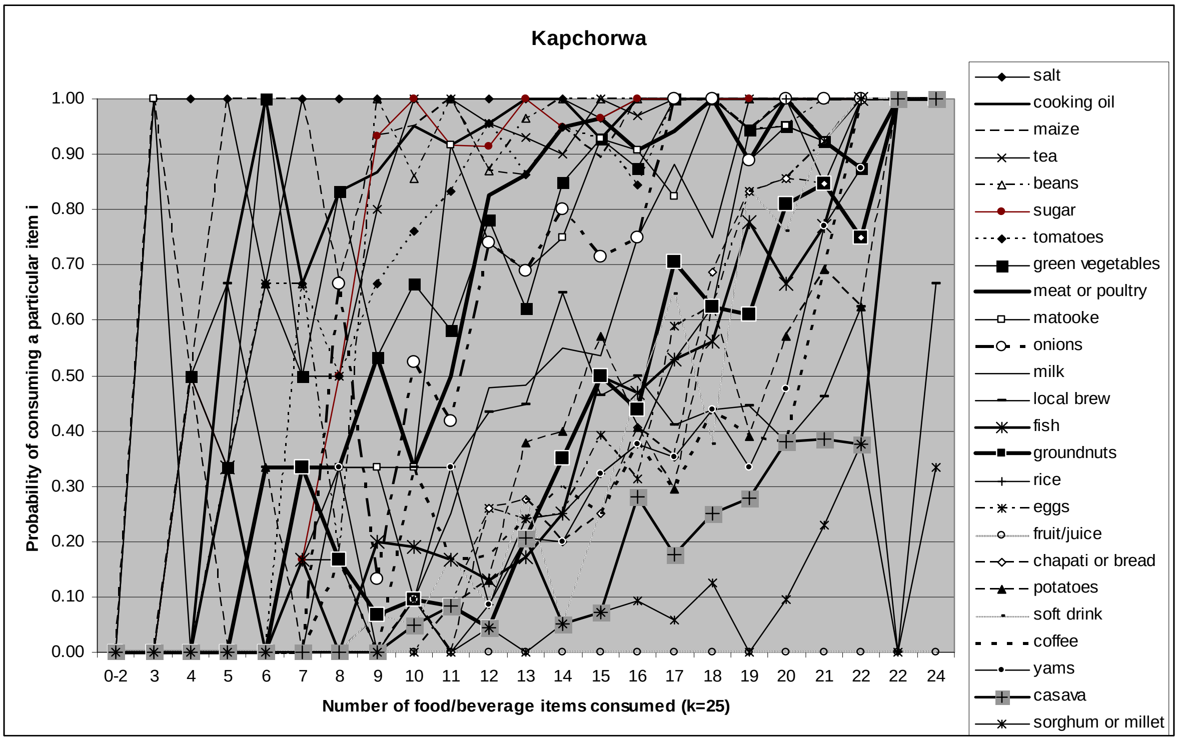
[20] Finger millet, the type mainly grown in Kapchorwa, rather than sorghum, is not consumed immediately, but used for producing local beer or mixed with cassava for making porridge or *ugali*. The main harvest of millet in Kapchorwa takes place in September/October.

[21] See table 3: The composition of foods in appendix 1.

indicators. A maximum number of 10 items would be enough to distinguish between the 10 different levels in the hierarchy.

By drawing a picture of the probability that a particular food or beverage item is consumed, given the number of items already consumed within the initial set of 25 food and beverage items *(k=25)*, we can visualise the distortions in the consumption pattern (see figure 5). The upward and downward peaks in this figure indicate those items, which distort the overall consumption pattern. This means that, for example, the probability that local brew is consumed is largely independent of the total number of food and beverage items consumed. As was noted before, there are quite a number of distortions, as indicated by the many peaks. But also there seem to be a lot of overlapping curves, indicating (close to) similar consumer preferences over particular set(s) of food and beverage items. For example, tea and sugar are complements and often consumed together. The figure further indicates that the minimum number of different items consumed out of this given set is three and the maximum is 24.

FIGURE 5
Probability of consuming particular items, given the number of items consumed (k=25)



Source: Kapchorwa field-survey data (2000).

The size and direction of the distortions can also be calculated. In short, we take the following pragmatic steps to select the most robust items:

1. Select items with a view to coming closer to a distribution that is more evenly spread (i.e. lowering the standard deviation around the mean);
2. Select items with a view to further improve the strength on the diagonal of the conditional probability pattern underlying figure 5.

The first step involves identifying those items that do not add new information about differences in consumption patterns of consumers across the board. Whereas, it was assumed *a priori* that water is consumed by everyone, it was found on the basis of the field-survey data that also salt, cooking oil, tea, sugar, maize and beans are consumed by nearly everyone on a daily and weekly basis. Whether or not someone consumes any of these items thus tells us little about his/her welfare situation. On the other end, cassava and sorghum/millet are consumed by too few people to make any significant statements about their consumption.

Step two involves removing the so-called distorting items because of differences in taste, production patterns and culture, e.g. gender. Local brew was already mentioned as a consumer good that is consumed independent of the total number of food items consumed. In other words, whether someone has a 'poor' or a 'rich' diet, local brew can be included in both cases. Some food items are location specific and/or seasonal. Although, *matooke* is grown throughout Uganda, it is less common in drier areas and is location specific in Kapchorwa district. Sorghum and millet are seasonal. Since they are grown on a much smaller scale than maize and beans, their availability decreases towards the end of the dry season and they may not be available for a long period of time, in particular when it has been a dry year.[22] Coffee is a permanent crop, but produced by smallholder farmers as a cash crop rather than a food crop.

Gender analysis of the food consumption data across the three districts shows that in Kapchorwa women consume significantly less often green vegetables, meat or

[22] In a year of plenty rainfall, there are up to two rainfall seasons in Kapchorwa. Their duration varies from area to area depending on the altitude and topography. The first, main harvesting of the staple food crops (maize and beans), grains (finger millet) and tubers (potatoes and yams) takes place in the period June through early August and the second, smaller harvesting in December and January.

poultry, chapati or bread, eggs and soft drinks compared to men in a week. We remove only those items, which indicate significant gender differences both in the daily and weekly consumption patterns.

Ultimately, what is left after taking the above steps is a small selection of three food and beverage items which represent three different welfare levels within our

TABLE 8
Individual consumption patterns of women and men in Kapchorwa (n=350)[23]

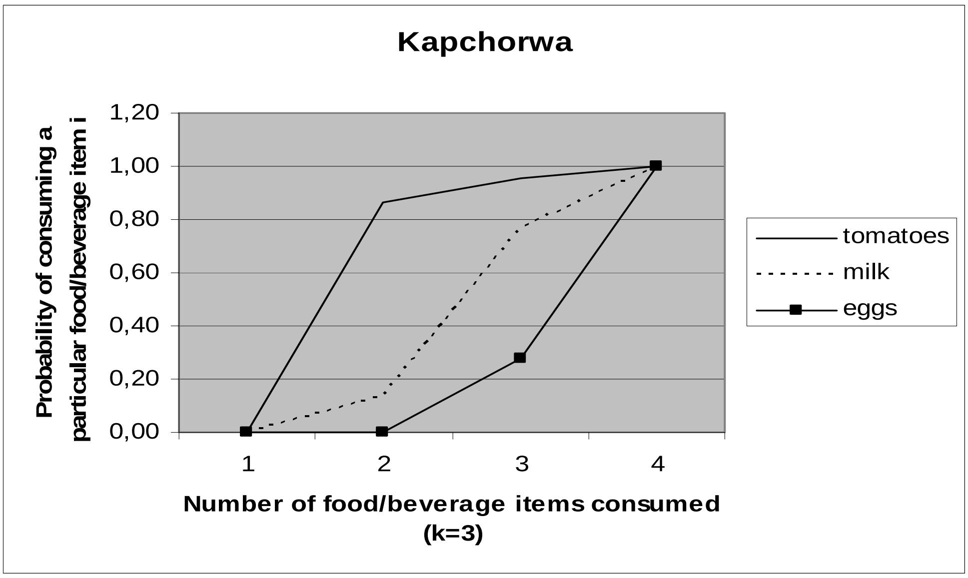
Consumption items	Percentage of individuals			
	Consumed yesterday		Consumed last week	
	Women	Men	Women	Men
Salt	98.9%	99.4%	98.9%	99.4%
Cooking oil/ghee	92.9%	94.6%	95.1%	94.6%
Sugar	90.1%	88.7%	92.3%	93.5%
Tea	89.6%	91.0%	91.8%	91.7%
Maize	86.3%	86.9%	93.4%	92.9%
Beans or peas	82.4%	88.7%	92.3%	92.9%
Tomatoes	74.7%	68.5%	87.9%	85.7%
Green vegetables	61.0%*	75.6%*	75.3%*	88.1%*
Matooke (bananas)	60.4%	65.5%	74.2%	77.8%
Onions	58.8%	64.3%	72.0%	73.2%
Meat or poultry	52.7%*	63.1%*	78.0%*	82.7%*
Milk or other dairy products	51.1%	46.4%	62.1%	58.9%
Local brew	38.5%	43.5%	42.3%	48.2%
Groundnuts	28.7%	29.2%	40.1%	40.5%
Eggs	27.5%	33.9%	35.2%*	46.4%*
Yams	26.9%	24.4%	37.4%	31.5%
Fruits	26.4%	34.5%	39.0%	41.7%
Fish	26.4%	29.8%	43.4%	43.5%
Coffee	26.4%	28.0%	34.1%	30.4%
Rice	25.3%	26.8%	41.2%	39.9%
Chapati or bread	22.5%*	33.3%*	32.4%*	44.6%*
Sweet potatoes	22.0%	26.2%	36.8%	38.1%
Soft drink	20.3%*	31.0%*	31.3%*	41.7%*
Cassava	13.2%	16.1%	18.1%	17.9%
Sorghum or millet	7.1%	4.8%	9.3%	7.1%
Total number of individuals	N = 182	n = 168	n = 182	n =168

*Indicating a statistical significant difference in consumption levels between women and men. The test performed is a *Chi-square test*, whereby $\chi^2=\Sigma((n_i-E(n_i))^2/E(n_i))$ and the rejection region: $\chi^2>\chi^2_{\alpha}$, where *df=k-1* and $\alpha = 0.05$.
Source: Kapchorwa field-survey data (2000).

[23] During the field-survey, it was tried to interview both a female and male member of the household visited, if they were present at the time of the visit. Therefore, the total number of people exceeds the number of households.

sample population for Kapchorwa: (i) tomatoes (ii) milk and (iii) eggs. The probability of consuming one particular item out of this set of three *(k=3)*, given the number already consumed is depicted in figure 6 below. As we can see in this figure, none of the probability curves intersect or overlap each other. Out of the 298 people covered in the Kapchorwa field-survey, 88.3 per cent follow the outlined consumption pattern.

FIGURE 6
Probability of consuming particular items, given the number of items consumed (k=3)



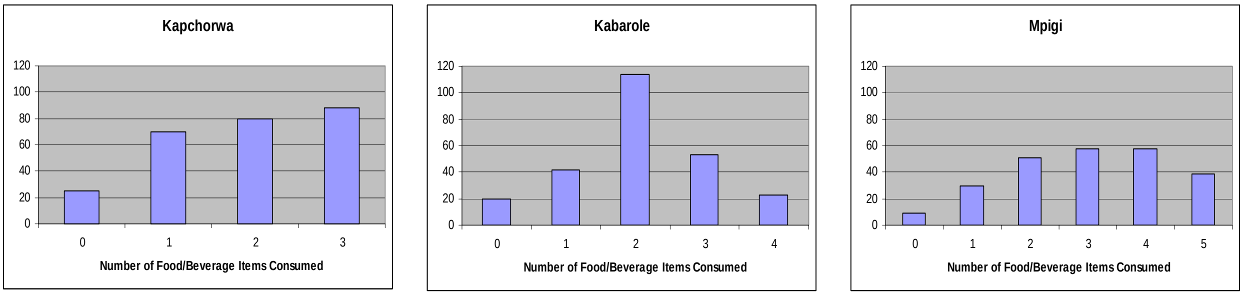
Source: Kapchorwa field-survey data (2000).

In the cases of the other two districts, more than three food indicators came out as the most robust – four in Kabarole, including: tomatoes, milk, eggs, and fish. Obviously, more people in Kabarole can afford to enrich their diet with fish at least on a weekly basis. In Mpigi district, five food indicators were selected including: potatoes, tomatoes, milk, rice and eggs. The fact that eggs can be added to the menu indicates a richer diet for one part of the population; the fact that potatoes are among the selected indicators means that there is another part of the population that cannot even afford to consume this staple food on a weekly basis, and are therefore most prone to food hunger in difficult times. On the basis of the selected indicators, the following frequency distributions for the smallholder farmer populations in each of the three districts can be drawn in figure 7 below.

The interpretation of figure 7 and the comparison across districts is as follows. People in Kabarole district consume a more varied and richer diet than the people in

Kapchorwa, as they include a fourth item at the tail of their hierarchy of menus, i.e. fish. Comparatively, some share of the population in Mpigi is worse off as they do not consume even the most basic food item that is on top of people's priority pattern, potatoes. At the other end, some share of the population in Mpigi is relatively better of than the populations in the other two districts as they can consume a richer menu and include both rice and fish in their weekly menu. A shift in numbers of people towards the right-end of the above presented welfare distributions would imply an improvement in nutrition, and thus, in welfare. As such, food priority patterns can provide direct input into a transparent poverty monitoring instrument.

FIGURE 7
Frequency distributions over food categories in Kapchorwa, Kabarole and Mpigi district



0 = none of the 25 food/beverage items
1 = up to tomatoes
2 = up to milk
3 = up to eggs

0 = none of the 25 food/beverage items
1 = up to tomatoes
2 = up to milk
3= up to eggs
4 = up to fish

0 = none of the 25 food/beverage items
1 = up to potatoes
2 = up to tomatoes
3 = up to milk
4= up to rice
5 = up to eggs

Source: field-survey data (2000).

6 RELATION TO THE MONEY-METRIC

How does a ranking of households based on food consumption patterns compare to a ranking based on the money-metric? Such a comparison, albeit crude, is feasible, because we have the formal household surveys for Uganda available, and these contain data on weekly food consumption patterns. On the basis of the surveyed food consumption patterns of the three food items commonly selected in all three districts, i.e. tomatoes, milk and eggs, we assign ranks to the households in the national survey according to the following scheme (see table 9). The outlined consumption pattern applies to 87% of the households in the formal household survey.[24] The comparison is therefore not perfect, since we are working with different surveys of different timing and sample populations, but we think it might still be useful.

TABLE 9
Household ranking on the basis of food items consumed (k=3)

Food items consumed			**Assigned**
Tomatoes	Milk	Eggs	
0	0	0	1
1	0	0	2
1	1	0	3
1	1	1	4

The above ranking gives us four welfare categories, whereby the lowest rank is assigned to those households that do not consume either one of the three selected food items. Next, we rank the households in the formal household survey on the basis of the per capita expenditure data, the measure that is normally used as the poverty headcount measure. The two alternative rankings are cross-tabulated with each other, see Table 10 below. The household rankings are matching best at the lower and higher end of the distribution; misplacement is highest in the two middle categories. The correlation between the two rankings is moderately positive and significant, as indicated by a Spearman rank correlation of 0.419, significant at the 0.01 level. This implies that the food indicators and the money-metric point into the same direction, but that the correlation is far from perfect.

However, we would not expect the relationship between food consumption patterns and the money-metric to be a perfect one. As Pyatt (1964) already discussed at length, income and wealth are important factors in the accumulation process, but this does not necessarily imply that they are important determinants of priority patterns (1964:19). This is shown by the fact that people in a wealthier district (Kabarole), rank more ‘luxury’ food items (e.g., milk) higher up in their hierarchy of menus relative to a poorer district (Kapchorwa), but only after ensuring consumption of the more basic food items first. In other words, their relative wealth stimulates

[24] The formal household survey is a national survey and includes rural and urban households. The food consumption data in the formal household survey were aggregated to the household level, whereas we collected food consumption data at the individual level.

TABLE 10
Cross-tabulation of alternative rankings, based on selected food indicators and PCE

Quartiles on the Basis of Selected Food Indicators * Quartiles on the Basis of Per Capita Expenditure Crosstabulation

% within Quartiles on the Basis of Selected Food Indicators

		Quartiles on the Basis of Per Capita Expenditure				
		1	2	3	4	Total
Quartiles on the Basis of Selected Food Indicators	1.00	42.0%	27.3%	18.4%	12.3%	100.0%
	2.00	23.2%	28.3%	27.5%	21.0%	100.0%
	3.00	7.9%	19.9%	31.5%	40.7%	100.0%
	4.00	4.1%	10.5%	23.5%	61.9%	100.0%
Total		25.0%	24.6%	24.9%	25.5%	100.0%

Source: own calculations, based on field-survey data (2000) and *IHS 1992/93*.

them to accumulate food items at higher speed, but without altering the initial ordering of items in the priority pattern. Pyatt has further pointed out that, what matters to the priority pattern itself, among other things, is the set of relative prices of the goods included in the set that is consumed as a 'first-order effect', as well as the relative prices of goods outside this set as a 'second-order effect' (1964:20). Further research would be required to look in more detail at the nature of the relationship between food consumption patterns such as these, and income and wealth. On this latter point, further reference is made to Pouw (2005) in which cross-comparisons are made with multiple other dimensions of poverty, including housing, household durables, clothing and personal possessions, agricultural tools, land and livestock ownership, as well as subjective poverty definitions.

7 CONCLUSION

Contrary to what consumption theory usually proclaims, the analysis in this paper shows that the number of food items consumed depends only on total household food expenditure. In the particular context of our sample population, we therefore reject the idea of "people buying a bit of everything", and instead allow for utility maximisation to result in a corner solution, which may change in an interior solution under alternative conditions (for example, in a non-subsistence context). This provides scope for looking into people's consumption patterns to see if they suggest useful way of household ranking. It is found that people tend to consume food items in a particular dominant order. The testing and ranking procedure developed has been successfully applied to the empirical data to distinguish between weak and dominant rankings. Given a certain cut-off value of the test statistic *Chi-square*, a hierarchy of menus can be drawn for each district. The hierarchy of menus represents people's ranking of priorities *vis-à-vis* a certain set of food and beverage items. In order to select a robust set of food indicators from the initial set of 25, we consider more closely the items that distort the dominant pattern, because of differences in taste, location specific production patterns, season and cultural preferences, including gender biases. We end up with a reduced set of three to five indicators per district. The selected food indicators represent different levels of welfare within the hierarchy, whereby people with a more varied diet are assumed to be better off than those consuming a less varied bundle of food. The consistency of this ranking is assessed by cross-comparing with the money-metric. The two rankings are positively and significantly correlated. However, there is no perfect match and we would not have expected so. It is not the money-metric that determines the consumer's priority pattern. Income and wealth do influence the rate at which households and individuals accumulate. From here we conclude that food consumption patterns can bring us a long way in identifying who the poor are and where they reside. Food consumption patterns are to a large extent similar at rural district level in Uganda. Across the different regions, and most likely also across rural and urban site locations, there exist specific differences in food consumption patterns that relate to differences in taste, culture, gender, and agricultural production patterns. Any attempt to characterize poverty nation wide would have to recognize this, and construct food poverty profiles for each district or region separately, whereas sub-districts would have to be recognized in urban areas.

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APPENDIX 1

FIGURE A.1

Frequency distributions of number of food items consumed by household size

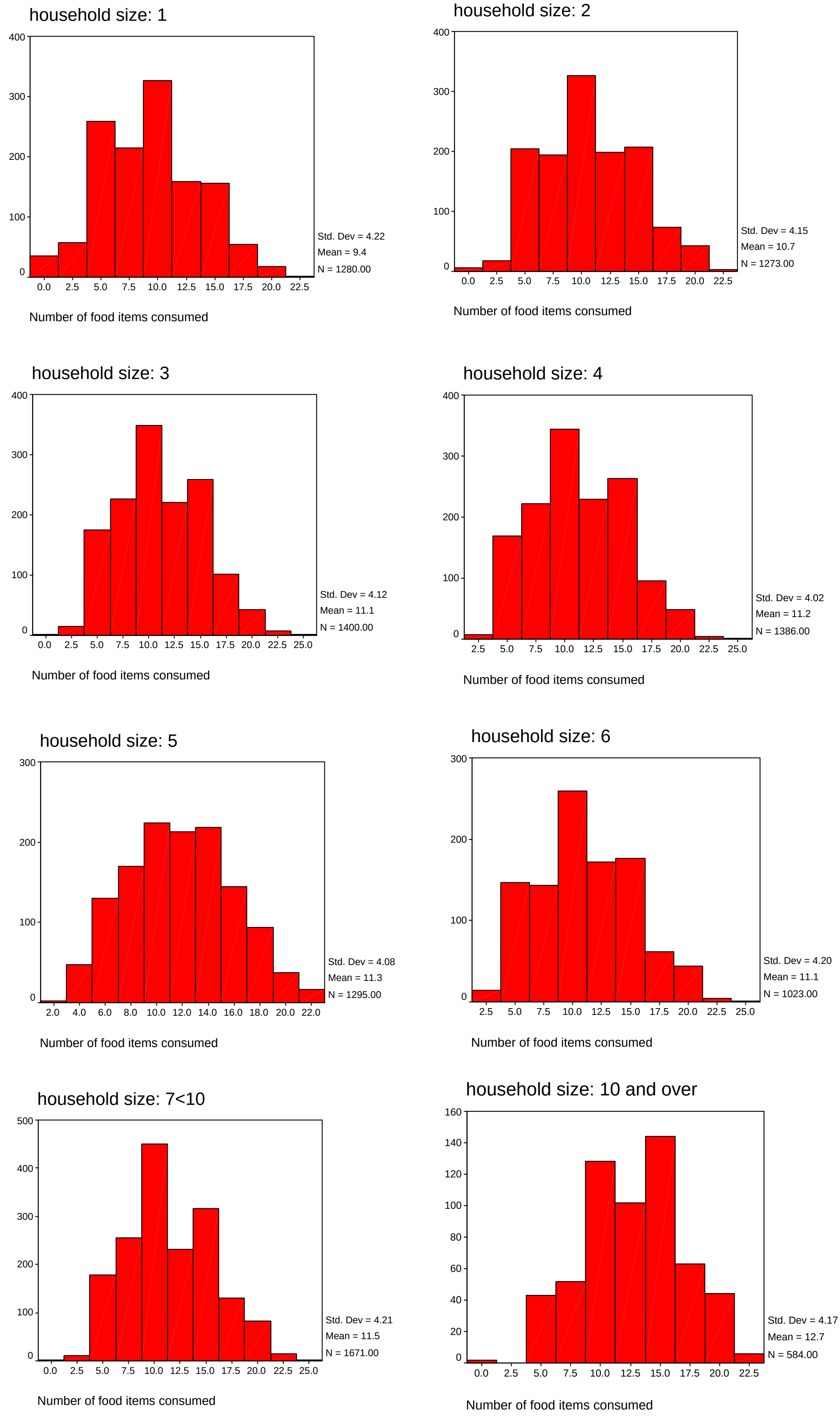


TABLE A.1

MS-1 Regression of number of food items on household total food expenditure and household size (n=5040)

$Pred.LN(Y) = \alpha + \beta_1 LN(X_1 PX_2) + (\beta_2 - \beta_1) LN(X_2) + \epsilon$	
Coefficients	
Constant term (α)	-2.123
(st. error)	(0.03)
Household total food expenditure (β_1)	0.515
(std. Error)	(0.004)
Household size (β_2-β_1)	-0.142
(std. Error)	(0.007)
Test statistics	
F-statistic	9681.57
t-statistic (α)	-70.69
t-statistic (β_1)	138.83
t-statistic (β_2-β_1)	-19.43
R-squared	0.799

Source: own calculations, based on *MS-1* (1993/94).

TABLE A.2

MS-2 Regression of number of food items on household total food expenditure and household size (n=4908)

$Pred.LN(Y) = \alpha + \beta_1 LN(X_1 PX_2) + (\beta_2 - \beta_1) LN(X_2) + \epsilon$	
Coefficients	
Constant term (α)	-0.909
(st. error)	(0.072)
Household total food expenditure (β_1)	0.351
(std. Error)	(0.008)
Household size (β_2-β_1)	0.031
(std. Error)	(0.009)
Test statistics	
F-statistic	1188.70
t-statistic (α)	-12.62
t-statistic (β_1)	41.49
t-statistic (β_2-β_1)	3.27
R-squared	0.326

Source: own calculations, based on *MS-2* (1995/96).

TABLE A.3
The composition of foods

Food/Beverage item	kJ	kcal	Protein
Cooking oil, sunflower	3765	900	0.0
Maize, white, whole kernel, dried	1445	345	9.4
Beans/peas, fresh, shelled	435	105	8.2
Beans, dried	1340	320	22.0
Sugar	1570	375	0.0
Tomatoes, raw	92	22	1.0
Green vegetables*	206	49	3.9
Beef, moderately fat	980	235	18.0
Goat, moderately fat	715	170	11.0
Pork, moderately fat	1705	170	18.0
Poultry, e.g. chicken	580	140	20.0
Matooke (bananas)	535	130	1.2
Onions, shallot, raw	160	38	1.2
Milk, cow, whole	330	79	3.8
Local beer	105	25	0.2
Fish, dried	1065	255	47.0
Groundnuts	2395	570	23.0
Rice, lightly milled, parboiled	1390	335	7.0
Eggs, hen	585	140	12.0
Fruit or fruitjuice*	380	91	1.4
Chapati or bread	1395	335	10.0
Soft drink, commercial	190	45	0.0
Potatoes	315	75	1.7
Yams, fresh	465	110	1.9
Cassava, meal	1320	320	1.6
Millet, finger, whole grain	1320	315	7.4
Sorghum, whole grain	1435	345	11.0

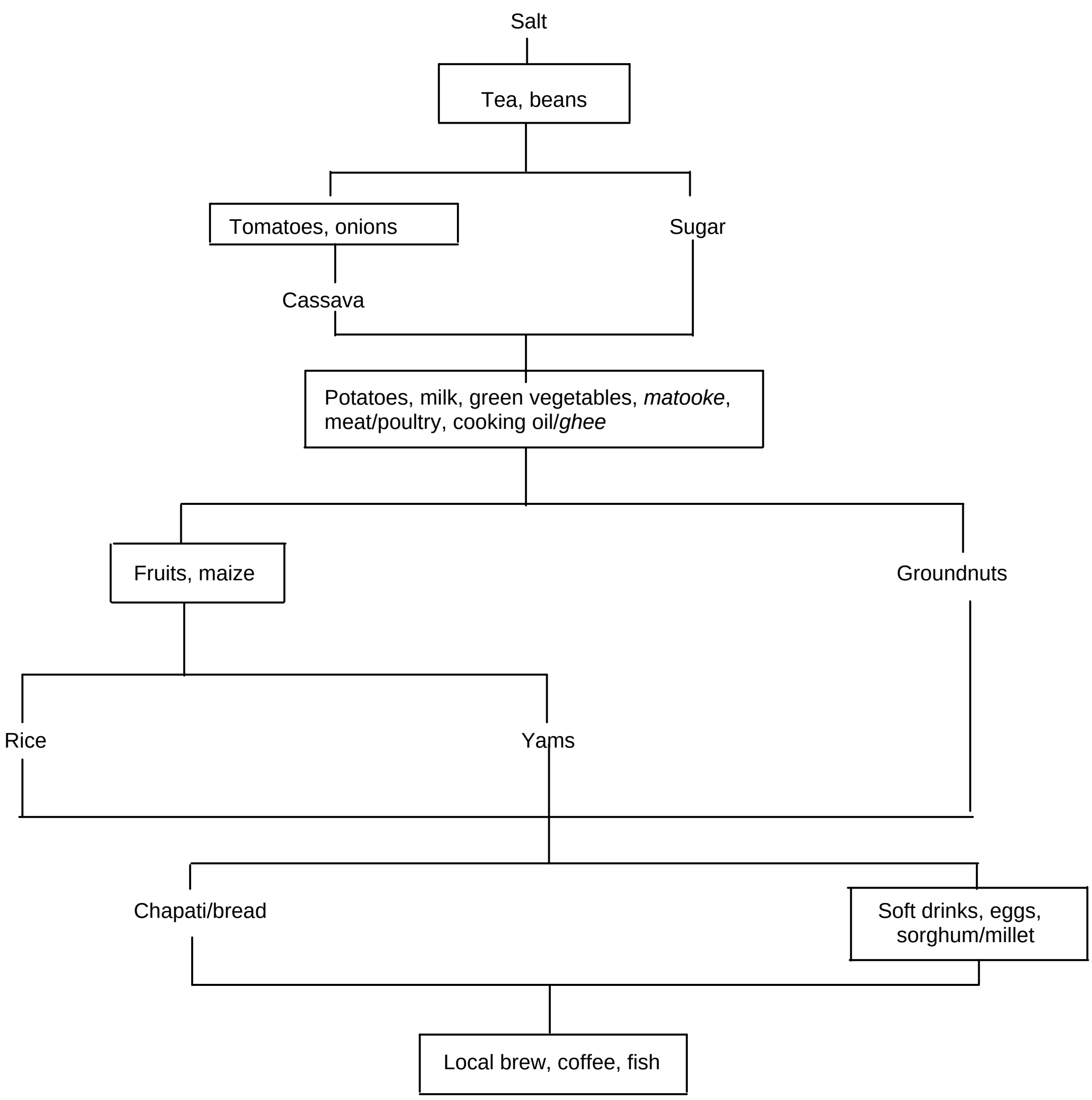
Note: nutrient values are expressed per 100 grams edible portion.
*The average of different sorts commonly eaten in this region was taken.

APPENDIX 2: KABAROLE

Food priority patterns

Kabarole district is located in the western, banana-coffee-cattle and Montane system. Although, there is some large-scale farming most of the farmers grow crops for subsistence. The main food crops grown include: *matooke* (cooking bananas), beans, cassava, maize, Irish potatoes, sweet potatoes, yams, groundnuts, tomatoes, onions, cabbages and pineapples. The main cash crops include: coffee and tea. The food priority pattern for smallholder farmers in Kabarole district can be pictured as follows, in figure A.2 below, which presents the hierarchy of menus based on $\chi^2_{(1)} > 3.84$ for the 25 food/beverage items included in the survey.

FIGURE A.2
Kabarole: a hierarchy of menus based on $\chi^2_{(1)} > 3.84$



Source: Kabarole field-survey data (2000).

In Kabarole, most of the basic food items appear high-up in the hierarchy of menus, these include: salt, tea and beans. However, cooking oil/*ghee* is also there, but only in the fifth level, which implies that all the other food items at this level and prior to it, can be considered ‘basic’ in this context. In addition, cassava, which is grown on a wider scale here, *matooke*, potatoes, meat or poultry and milk appear relatively high-up in the hierarchy, indicating a relatively richer diet for the majority of people in Kabarole, as compared to those in Kapchorwa and in Mpigi. There is a large population of milk-cows in Kabarole, which is reflected in the relatively high consumption of milk (72.3%). The basic diet is enriched with a selection of fruits, maize(flower) and groundnuts, thus leaving rice, yams, chapati/bread, eggs, sorghum/millet, fish and other drinks besides tea, as relative ‘luxuries’. The relative richness of this menu is confirmed by the average number of different food items consumed per person in a week, which is equal to 15 in Kabarole (out of the set of 25). Out of the 300 households in total, 98.0% can be located at some point on this hierarchy.

Analysis of the way people obtain their consumed foods and beverages confirms that most of the food crops are home-grown, i.e. *matooke*, beans, cassava, green vegetables, potatoes, yams, fruits and maize (50/50). Other food crops are bought in the marketplace or local shops, including tomatoes, onions, groundnuts and rice. Eggs and milk are sometimes self-provided and sometimes bought. Local brew, coffee, chapati or bread and all manufactured items are usually bought. Some items that are received as gifts on some occasions include: local brew, coffee, soft drinks and sorghum/millet.

Gender analysis shows that women consume significantly more often *matooke* and green vegetables compared to men, but less often potatoes, meat/poultry and local brew (table A.4).

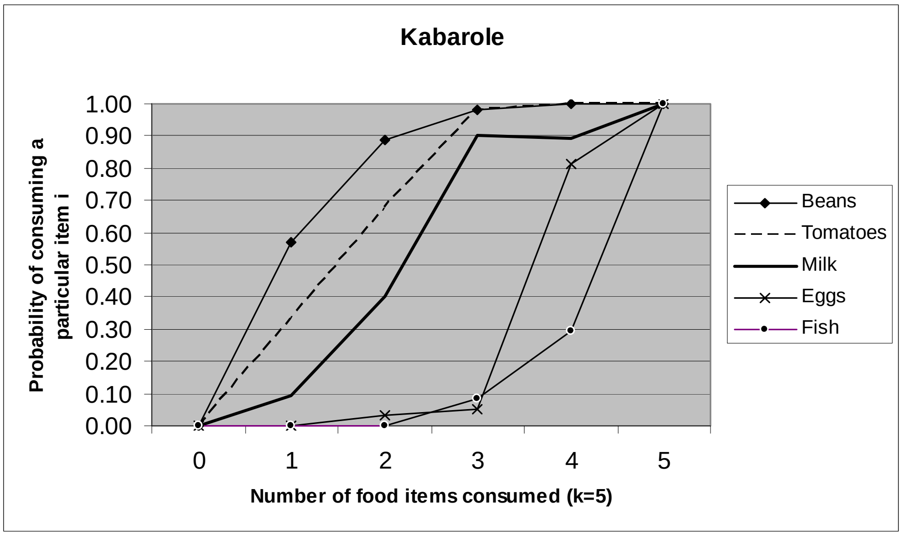
The selection of a robust set of food indicators in Kabarole comes down to a set of five, including: beans, tomatoes, milk (or other dairy products), eggs and fish. The probability curves for consuming each of these items, given the total number of items consumed out of this set of five *(k=5)* are depicted in figure A.3 below. The curves for beans and tomatoes consumption are quite close, hinting to the fact that both are considered ‘basic’ food items and likely to be consumed, if either one is consumed. The curves for eggs and fish consumption are partly overlapping in the early stage, but quite distinct from each other later on. We could decide, depending on the level of detail that we ultimately want, to reduce the set of indicators further down to four by taking out either eggs or fish. Out of the 300 people in the Kabarole sample, 282 that is 94% are captured by the outlined priority pattern over foods.

TABLE A.4
Consumption patterns of women and men in Kabarole (N=356)

Consumption items	***Percentage of individuals***			
	Consumed yesterday		**Consumed last week**	
	Women	Men	Women	Men
Salt	98.0%	97.4%	98.0%	98.1%
Tea	92.6%	90.3%	96.0%	92.2%
Beans or peas	82.2%	87.0%	92.1%	89.0%
Sugar	73.3%	66.2%	83.2%	82.5%
Tomatoes	71.8%	71.4%	86.6%	85.1%
Onions	66.8%	68.2%	82.2%	80.5%
Matooke (bananas)	64.9%*	53.2%*	75.2%	68.2%
Milk or other dairy products	61.4%	56.5%	72.3%	70.8%
Green vegetables	59.9%*	46.8%*	80.7%*	62.3%*
Cassava	56.9%	64.3%	77.2%	76.6%
Potatoes	53.5%	53.2%	65.8%*	77.9%*
Cooking oil/*ghee*	50.5%	46.1%	73.3%	66.9%
Fruits	40.1%	39.0%	62.9%	57.1%
Yams	36.6%	36.4%	54.0%	50.6%
Chapati or bread	24.8%	23.4%	41.1%	39.6%
Maize	24.3%	22.7%	55.0%	57.8%
Meat or poultry	22.8%	24.0%	66.2%*	76.2%*
Groundnuts	22.3%	26.0%	53.0%	53.9%
Rice	18.3%	16.9%	54.0%	45.5%
Sorghum or millet	16.8%	18.2%	24.8%	24.7%
Eggs	13.9%	12.3%	27.7%	29.2%
Local brew	8.4%*	26.0%*	14.4%*	35.7%*
Soft drink	7.9%	7.1%	31.7%	32.5%
Fish	4.5%	4.5%	16.3%	17.5%
Coffee	3.5%	7.8%	14.9%	20.8%
Total number of individuals	n = 202	n = 154	n = 202	n = 154

*Indicating a statistical significant difference in consumption levels between women and men (*df=k-1* and $\alpha = 0.05$).
Source: Kabarole field-survey data (2000).

FIGURE A.3
Probability of consuming particular items, given the number of items consumed (k=5)



Source: Kabarole field-survey data (2000).

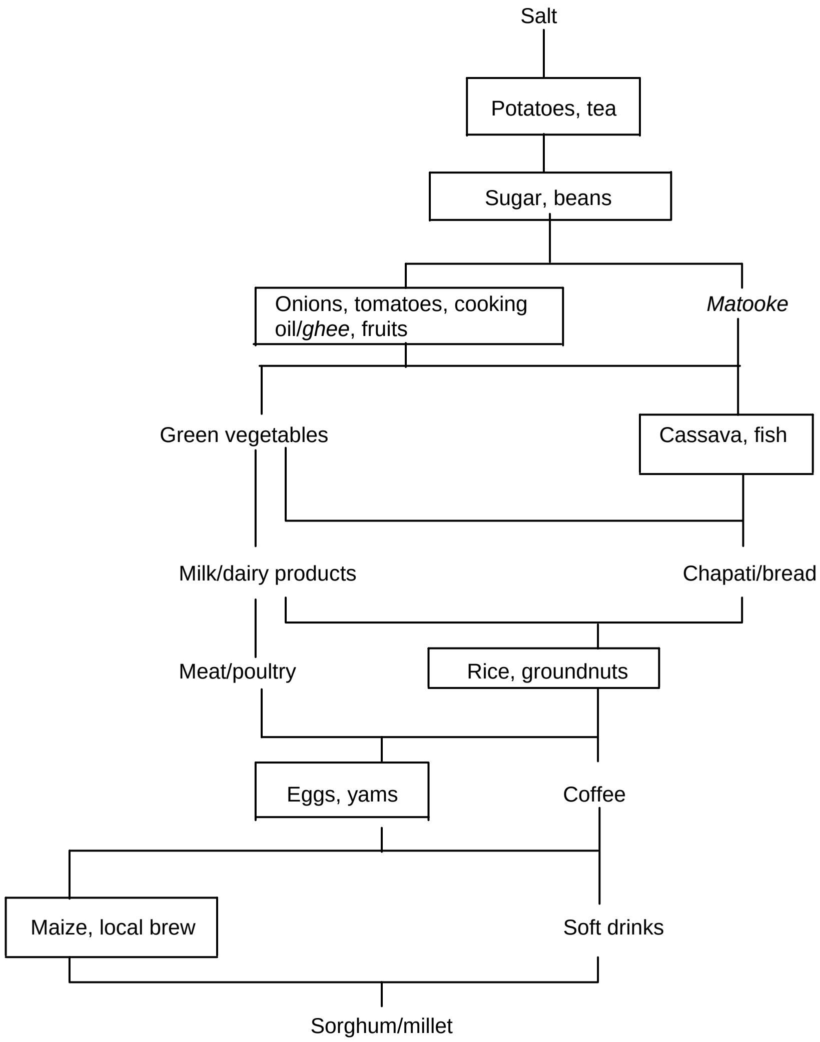
APPENDIX 2: MPIGI

Food priority patterns

Mpigi district is located in the central, medium altitude intensive banana coffee system. The district receives heavy and reliable rainfalls and has relatively high temperatures. The main food crops grown are *matooke* (bananas), maize, beans, cassava, Irish potatoes, sweet potatoes, yams, groundnuts, and green vegetables. The cash crops are coffee and cotton. The food priority pattern for smallholder farmers in Mpigi district can be pictured as follows, in figure A.4 below, which presents the hierarchy of menus based on $\chi^2_{(1)} > 3.84$ for the 25 food and beverage items included in the survey.

In Mpigi, there appear to be more layers in the top of the hierarchy of menus, compared to those of Kapchorwa and Kabarole district. This points to more distinct consumption patterns, even of the daily basic food items such as salt, tea, sugar, beans and potatoes. Out of the 340 households in total from Mpigi, 100% can be located at some point on this hierarchy. Being close to the lake and in the Nile delta explains the consumption almost being part of the basic diet, especially compared to meat and poultry, which are added at a much later stage. The consumption of milk (62.3%) is closer to that in Kapchorwa (60%) than in Kabarole (72.3%), where we noted the

FIGURE A.4
Mpigi: A hierarchy of menus based on $\chi^2_{(1)} > 3.84$



Source: Mpigi field-survey data (2000).

population of milk-cows is relatively high. The basic diet is further enriched with chapati/bread, meat/poultry, rice, groundnuts, eggs, yams and coffee, thus leaving local brew and soft drinks as relative luxuries and maize and sorghum/millet as relative rarities. The average number of different food items consumed per person in a week is 13.9, the lowest variety compared to 14.6 in Kapchorwa and 15 in Kabarole (out of the set of 25). Out of the 340 households in total, 100% can be located at some point on this hierarchy.

Analysis of the way people obtain their consumed foods and beverages confirms that most of the food crops are home-grown, i.e. *matooke*, beans, cassava, green vegetables, potatoes, yams, fruits and maize (60/40). Other food crops are bought in the marketplace or local shops, including tomatoes, onions, groundnuts, rice and sorghum/millet. Eggs, milk and maize are sometimes self-provided and sometimes bought. Local brew, coffee, chapati or bread and all manufactured items are usually bought. Some items that are received as gifts on some occasions include: local brew, coffee, soft drinks, milk and meat/poultry. In Mpigi, consumption patterns seem to be more equitable from a gender perspective. Significant gender differences, which are systematically reported in daily and weekly consumption patterns include, coffee and local brew of which men consume more than women.

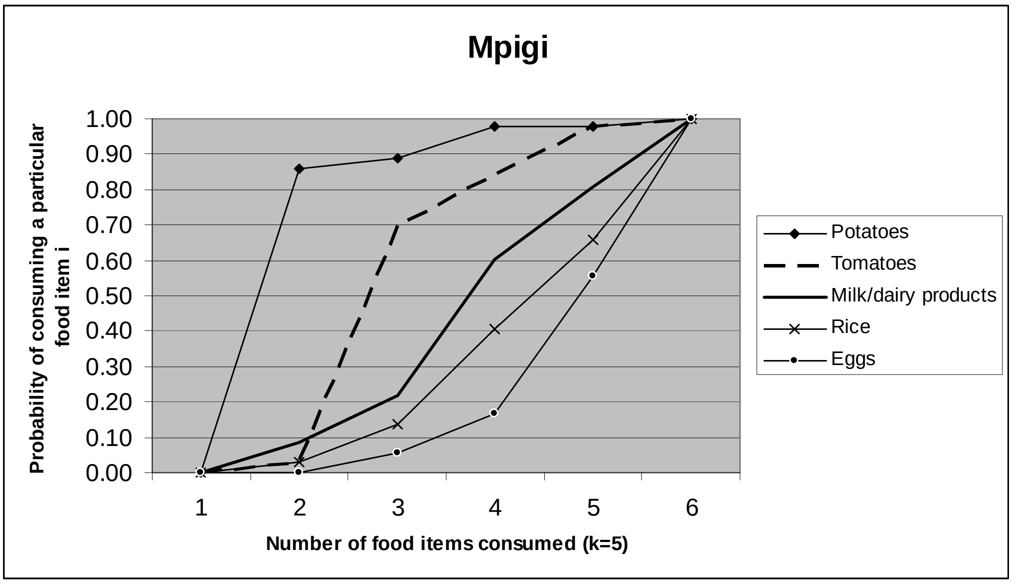
TABLE A.5
Consumption patterns of women and men in Mpigi (n=384)

Consumption items	***Percentage of individual***			
	Consumed yesterday		**Consumed last week**	
	Women	Men	Women	Men
Salt	100.0%	98.6%	100.0%	100.0%
Tea	91.6%	86.3%	92.4%	89.7%
Beans or peas	83.2%	77.4%	87.4%	84.2%
Sugar	77.3%	70.5%	93.3%	90.4%
Tomatoes	73.9%	73.3%	83.2%	85.6%
Onions	68.9%	65.8%	80.3%	74.0%
Matooke (bananas)	63.9%	58.2%	80.7%*	71.9%*
Milk or other dairy products	63.4%	55.5%	76.5%	75.3%
Green vegetables	58.0%	56.2%	75.2%	74.0%
Cassava	55.5%	48.6%	75.2%	70.5%
Potatoes	47.9%	49.3%	67.2%	67.8%
Cooking oil/*ghee*	47.1%	45.2%	56.7%	54.8%
Fruits	45.0%	45.9%	63.4%	61.0%
Yams	36.1%*	24.7%*	51.7%	47.3%
Chapati or bread	27.3%	24.0%	59.7%	56.8%
Maize	25.2%*	16.4%*	40.8%	43.2%
Meat or poultry	19.3%	15.8%	50.0%	46.6%
Groundnuts	17.2%*	27.4%*	20.2%*	29.5%*
Rice	16.8%	17.8%	44.5%	40.4%
Sorghum or millet	16.8%	16.4%	29.4%	34.9%
Eggs	15.1%	12.3%	18.5%	17.8%
Local brew	13.9%	18.5%	23.9%	30.8%
Soft drink	5.5%*	21.1%*	9.2%*	28.1%*
Fish	5.0%	8.2%	15.1%	16.4%
Coffee	0.8%	0.0%	1.3%	0.0%
Total number of individuals	n = 238	n = 146	n = 238	n = 146

*Indicating a statistical significant difference in consumption levels between women and men (*df=k-1* and α = *0.05*).
Source: Mpigi field-survey data (2000).

The selection of a robust set of food indicators in Mpigi comes down to a set of five, including: potatoes, tomatoes, milk, rice and eggs. The probability curves for consuming each of these items, given the total number of items consumed out of this set are depicted in figure A.5 below. The curve for potatoes is overlapping with tomatoes towards the end, indicating that at higher consumption levels, the two go together. The curve for tomatoes is crossed over by milk in the beginning, indicating that there is a slight preference for milk at low consumption levels. The curves for rice and egg consumption are quite close. This could be a reason for further reducing the set of food indicators to four, by taking out either rice or eggs. Out of the 340 households in the Mpigi sample, still 323 that is 95% are captured by the outlined priority pattern over foods.

FIGURE A.5
Probability of consuming particular items, given the number of items consumed (k=5)



Source: Mpigi field-survey data (2000).

APPENDIX 3

This appendix describes the ranking problem and develops a statistical test for assessing the dominancy of ranking over an initial set of weak orderings of attributes. Furthermore, it explains the transitivity of ranking rule.

The ranking and testing procedure

The basic idea of probability is that any of the possible outcomes in the sample space might occur as the actual outcome of the activity, and concern often focuses on the occurrence of some subset of the possible outcomes. Let us translate this idea to our ranking problem. In the occurrence of owning one attribute, *Pr(A)* is the probability of one attribute being owned, given the set of attributes that might possibly be owned out of the set *s*. Whereby, *s* is an element of the total of possible attributes *S*. The condition that any of the attributes in *s* may be owned helps to estimate the probability that one attribute will be owned. We therefore denote *Pr(A)* by the fuller statement *Pr(A|s)*. This is read as the probability of *A*, given *s*, which concisely conveys our basic idea.

Let us explore the simple case of the ownership of two attributes, *A* and *B*. If we turn to table A.6 below, we find that there are four possible outcomes to the event of owning one (n_a or n_b), two (n_{ab}) or neither one (n_0) of these attributes as indicated by the number of households.

TABLE A.6
Ownership distribution over two attributes

Attribute A

		No	Yes	
Attribute B	No	n_0	n_a	$N - N_b$
	Yes	n_b	n_{ab}	N_b
		$N - N_a$	N_a	N

The probability of *A* occurring, *Pr(A)* is computed by N_a/N, and the probability of *B* occurring, *Pr(B)* is computed by N_b/N, whereby,

$$N_a = n_a + n_{ab} \qquad (E.1)$$

$$N_b = n_b + n_{ab} \qquad (E.2)$$

From which follows that,

$$N_a - N_b = n_a - n_b \qquad (E.3)$$

What we are looking for is a possible hierarchy between attribute A and B, which would be evidence of a ranking. For example, given that $N_a > N_b$, we look for a situation which in its most extreme form $n_a = N_a - N_b$ and, more generally $n_a >> n_b$. The null hypothesis is that the distribution of predicted frequencies (i.e. no ranking) correctly characterizes the process underlying the generation of the observed data. Considering our example of two attributes, the null hypothesis and alternative hypothesis would then read as follows,

$$H_0 : n_a = n_b \qquad (E.4)$$

$$H_a : n_a > n_b, \text{ or } n_a > ½ (n_a + n_b) \qquad (E.5)$$

The general form of the test statistic, which is the *Chi-squared* test of distance of the null hypothesis, is denoted by,

$$\chi^2 = \Sigma((On_k - En_k)^2/En_k) \qquad (E.6)$$

If no significant ranking occurs, the probability of owning attribute A is equal to the probability of owning attribute B, in which case we would expect to observe the same frequencies of each of the attributes owned, i.e.,

$$E(n_a) = ½ (n_a + n_b), \text{ and} \qquad (E.7)$$

$$E(n_b) = ½ (n_a + n_b) \qquad (E.8)$$

Table A.7 shows the calculations needed to determine the value of the test statistic $\chi^2_{(1)}$ in this example:

TABLE A.7
Observed and expected frequencies for two attributes

Attribute A	B	*Observed frequencies (On_k)*	*Expected frequencies (En_k)*
0	0	n_0	$E(n_0)$
1	0	n_a	½ ($n_a + n_b$)
0	1	n_b	½ ($n_a + n_b$)
1	1	n_{ab}	$E(n_{ab})$
Total Sum		N	E(N)

The calculated test statistic χ^2 is then equal to,

$$\chi^2 = (2n_a^2/(n_a + n_b)) + ((2n_b^2/(n_a + n_b)) - (n_a + n_b) \quad (E.9)$$

$$= ((n_a^2 + n_b^2) - 2(n_a n_b))/(n_a + n_b) \quad (E.10)$$

$$= ((n_a - n_b)^2/(n_a + n_b)) \quad (E.11)$$

which is equal to,

$$\chi^2 = (N_a - N_b)^2 / ((N_a + N_b) - 2n_{ab}) \sim \chi^2_{(1)} \quad (E.12)$$

which follows a chi-square distribution with 1 degree of freedom. If the number of categories defined in the distribution is *r*, the χ^2 has *(k – 1)* degrees of freedom. Given the total number of observations, the number in the *k*th category is set by the numbers in the other *(r – 1)* categories. In our example of two attributes, this implies the degrees of freedom to be *(k – 1= 2 – 1=1)*. The critical value is therefore $Pr(\chi^2 \geq \chi^2_c) = \alpha$.

Going back to table A.7 we further learn that,

$$0 \leq n_{ab} \leq \min (N_a, N_b) \quad (E.13)$$

from which we derive that,

$$| N_a - N_b | \geq \chi^2_{(1)} \geq (N_a - N_b)^2 / (N_a + N_b) \quad (E.14)$$

Hence, there is a lower and a higher bound to the value of χ^2, which is easily computed. This provides us with two reference points (or a scale) for comparing the calculated χ^2 with the critical value χ^2_c. If the observed frequencies are equal to the predicted frequencies, i.e. if $n_a = ½(n_a + n_b)$, then χ^2 equals zero. If the observed frequencies are very different from the predicted frequencies, then χ^2 is large. Hence, large values of the test statistic are used to reject the null hypothesis that there is no ranking between attribute A and B.

*The transitivity problem*So far, we have tested for dominance of ranking only between two attributes which are sequential in the ranking list; i.e. $N_a > N_b$ and $N_b > N_c$. What we want to find out next is whether dominance of ranking is transitive, i.e. whether, given that the ranking $N_a > N_b$ is dominant and $N_b > N_c$, it is automatically the case that $N_a > N_c$ is also dominant? The answer to the question whether the ranking is transitive is positive if we can prove that:

$$(N_a - N_b)^2 > \theta (N_a + N_b - 2n_{ab}) \qquad (E.15)$$

$$(N_b - N_c)^2 > \theta (N_b + N_c - 2n_{bc}) \qquad (E.16)$$

and,

$$(N_a - N_c)^2 = (N_a - N_b)^2 + (N_b - N_c)^2 + 2(N_a - N_b) \cdot (N_b - N_c)$$

$$> \theta (N_a + 2N_b + N_c - 2n_{ab} - 2n_{bc}) + 2(N_a - N_b) \cdot (N_b - N_c) \qquad (E.17)$$

$$= ((N_a + N_c - 2n_{ac}) + 2(N_b - n_{ab} - n_{bc} + n_{ac})) \cdot \theta + 2(N_a - N_b) \cdot (N_b - N_c) \qquad (E.18)$$

Since we know that the last part of equation *(A.18)* is positive, since $N_a > N_b > N_c$ it follows that $2(N_a - N_b) \cdot (N_b - N_c) > 0$, we only need to prove that the first part is positive as well. Given that,

$$n_{ab} = n_{ab\bullet} + n_{abc} \qquad (E.19)$$

$$n_{bc} = n_{bc\bullet} + n_{abc} \qquad (E.20)$$

$$n_{ac} = n_{ac\bullet} + n_{abc} \qquad (E.21)$$

it follows that,

$$2(N_b - n_{ab} - n_{bc} + n_{ac}) = 2(N_b - n_{ab\bullet} - n_{bc\bullet} + n_{ac\bullet} - n_{abc}) \qquad (E.22)$$

The dots in the equations above and below indicate any other attribute that comes next, or prior to the ones specified. Since we are interested in their value, not in their names, they are indicated by a small dot.

Since,

$$N_b = n_{\bullet b \bullet} + n_{ab\bullet} + n_{\bullet bc} + n_{abc} \qquad (E.23)$$

it follows that,

$$2(N_b - n_{ab\bullet} - n_{bc\bullet} + n_{ac\bullet} - n_{abc}) = 2(n_{\bullet b \bullet} + n_{ac\bullet}) \qquad (E.24)$$

which is greater than zero.

Furthermore, given that it always holds that,

$$(N_a + N_c - 2n_{ac}) \cdot \theta < 2(N_a - N_b) \cdot (N_b - N_c) \qquad (E.25)$$

it follows that the first part of equation *(E.18)* is positive as well. This leads us to conclude that the dominance of ranking is transitive.

The implications of the transitivity rule can be explained as follows. In order to construct the hierarchy of menus for Kapchorwa district as presented in figure 4 of the main text, we set the chi-square cut-off point at $\chi^2_{(1)} > 3.84$. What will happen if we now set the cut-off point at a lower level, let us say at 1.0? This will make the test more stringent and result in more layers in the hierarchy. In the given example, a cut-off point of $\chi^2_{(1)} > 1.0$ would for example imply that Meat/Poultry will appear on a separate layer in the hierarchy, and thus increase the number of layers. The same applies to Local Brew. However, this does not alter the initial weak ordering of items, which is in accordance with the transitivity of ranking rule. Likewise, a higher chi-square cut-off point will tend to decrease the number of layers in the hierarchy. Again, however, this will not change the initial weak ordering of items because of the application of the transitivity of ranking rule.