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Household consumption allocation and the collective household model: Children share of household resources in The Gambia

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Abstract. This paper applies the collective household model to allocate household resources among household members. With a Collective Quadratic Almost Ideal Demand System (CQUAIDS) estimated by a Feasible Generalized Nonlinear Least Squares (FGNLS) method, it studies the household demand for six categories of household goods using household income and expenditure survey data from The Gambia, directed to studying the allocation of resources among young and adult members of households in The Gambia. It establishes the sharing rule for children and adult members of the household and shows the effect of demographic, distributive factor, price and income elasticities on the shares of household resources. The results establish that a higher share of resources goes for children while the sharing rule varies for different household types. Also, the findings show significant effects of demographic, distributive factor, price and income on the allocation of the household resources of consumption goods by the household.

Keywords: Household resources, collective model, CQUAIDS, sharing rule, children share, price and income elasticities

1. Introduction

Household consumption is one of the most important indicators of economic development, as it also gives a detailed view of the standard of living of a population. In recent history, and even in the distant past, household consumption expenditure accounts for about 70 per cent of the Gross Domestic Product (GDP) of most developed and developing economies [1]. This being a key motivation for studying household economy, consumption patterns and the allocation of resources within the household [2].

Although considerable attention was given to the study of "the household economy" and the available microeconomic theory, the concept of individualism in the household was never taken seriously until Becker 1981. Households were treated as if they were an individual, with little consideration of the special consumption preferences of individuals within the household. This traditional view was standard and it was used to model almost if not all investigations relating to household behaviour. Such configuration of the household economy is called a unitary model [3,4]. The unitary model considers the household behaviour as behaviour that maximizes a unique, price-independent social utility function, subject to a family budget constraint [5]. It is therefore referred to as a common preference model. Despite its use in economic analysis, the unitary model is subject to several limitations because it fails to incorporate the process by which resources are distributed within the household [5]; it is not adequate to describe the observed behaviour of households consisting of multiple individuals [6].

In this work, the collective household framework is employed to define and estimate the sharing rule with the household demand system. The collective model is built on the fundaments of methodological individualism [7,8]. It addresses the question of how individual preferences lead to a collective choice and how household members reconcile different preferences [5,9] in-

troduces children to this framework (collective household) as agents and not as a public good in order to be able to identify children's share of household resources. It is a simple measure of children's share of household resources seeing children as household members who make decisions about what to consume and when and, therefore, have a preference. This was built on the already existing work of [10] without having to make any strong restrictions that the share on household consumption is the same for married and non-married men and women. Similarly, using an Italian dataset, [11] showed that the resource share can be obtained even though household consumption is not assignable to an individual member. The research showed that children's resource share does not have a strong dependency on household expenditure. Other applications of the model, including to extended families, can be found in [10,12–16].

In the current study, it is recognized that there can be privately consumed goods, public goods or both public and privately consumed goods within the household. Household demand is estimated with Almost Ideal Demand Systems (CQUAIDS). Important in this application is to point out the difference between The Gambia and other developed countries where this model is studied. These differences are potentially explained by cultural settings, but also the economic composition of the household. The study is meant to begin a process of revising the generally adopted measures of welfare by including individual preference and appropriately allocate household resources and consumption without assuming equality. It is the intent, that this work be able to guide policies on taxes and price as well as the evaluation of targeted projects.

2. Methodology

The specification of the collective Almost Ideal Demand Systems follows [17,18]. With a linear-log of household expenditure demand system, the sharing rule is developed. The demand for a specific group of consumption by a household member is defined such that it is dependent on, the log of prices, demographic characteristics, distribution factor, the individual share of household resources and log size of groups.

Following [18], the Almost Ideal Demand Sytems can be obtained from an indirect utility function of the following form:

$$V_n(P_n, \emptyset_n) = \frac{\log(\emptyset_n) - \log(A_n(p_n))}{B_n(P_n)}$$

Where $A_n(p_n)$ and $B_n(p_n)$ are respectively individual portions of household subsistence and bliss cost and $\emptyset_n$ (to be defined) is the share of household consumption for a household member, k. With separability of household utilities, unit values can substitute for prices of commodities [19–21]. With this, one can explicitly model each of the household goods without the other goods interfering (Attanasio et al., 2013). It is a given that food consumption accounts for a very large portion of household expenses and that it is not affected by other classes.

The nth individual's resource share is given by;

$$w_{ni}^D = \frac{\partial \log(A_n(p_n))}{\partial \log(p_{ni})} + \frac{\partial B_n(p_n)}{\partial \log(p_{ni})} [\log(\emptyset_n) - \log(A_n(p_n))]$$

Where, $\log(A_n(p_n))$ and $B_n(p_n)$ are at least differentiable and a concave price aggregator with the functional form described below. w_{ni}^D is the demand for consumption of good i by individual n.

$$\log(A_n(p_n)) = \alpha_{ki} + \sum_{ki}^{\alpha} \log P_{ki} + \frac{1}{2} \sum_i \sum_j \gamma_{nij} \log(p_{ni}) \log(p_{nj})$$

$$B_n(p_n) = \prod_i P_{ni}^{B_{ni}}$$

Recall that the prices aggregators $A_n(p_n)$ and $B_n(p_n)$ are individual portions of household subsistence and bliss cost. As assignability assumption is not sufficient to identify the share of resources of each household member [22], both adult members and child members of the household have equal access to cost as if there exists a perfectly competitive market price which is the same for household members for all goods. The individual shares are aggregated in the following way: $W_i = w_{1i}^D + w_{2j}^D$, where W_i is the demand for a good (i) by the household.

$$\alpha_i + \sum \gamma_{ij} \log(p_j) + \sum_{n=1}^{2} B_{ni}(\log(\emptyset_n) - \log(A_n(p_n))).$$

$\emptyset_n = \frac{p_k q_k + \left(\frac{1}{fs} p_h q_h\right) N_k}{x}$, the share of household consumption for a household member, k. Call it the weight for adult and children. x Is the household total expenditure and $p_k q_k$ is the total assignable expenditure to household member $k|k = a, c$.

$p_h q_h$, is the household consumption after all assignable are assigned and deducted from the total expenditure. N_k is the number of household members in that group, and fs is the family size (household size). The model recognizes the presence of heterogeneous effects which is introduced using a translation of the household technology [23]. The demand system modified with the demographic characteristics of the household which captures the form of detected heterogeneity is given by the following equation:

$$\alpha_i + t_i(d) + \sum \gamma_{ij} \log(p_j) + \sum_{n=1}^{2} B_{ni} \log(\emptyset_n^*) - \log(A_n(p_n)) + \varepsilon_i$$

ε_i is a disturbance terms/an error term, and $\log \emptyset_n^*$ is the log of total household income which is modified by translating household technology in the following way:

$$\log(\emptyset_n^*) = (\log(\emptyset_n) - \sum_i t_i(d) \log P_i$$

Note that the demand functions are written in a linear way to ease econometrics estimations. Because the model is consistent with utility maximization theory, it also exhibits all the properties/restrictions. Adding up: $\sum_{i=1}^{n} a_i = 1$, $\sum_{i=1}^{n} \beta = 0$, $\sum_{i=1}^{n} \gamma_{ij} = 0$ for every j, conditions such as $\sum_{i=1}^{n} a_i = 1$ is necessitated by the fact the sum of all shares is equaled to one.

Homogeneity, $\sum_{i=1}^{n} \gamma_{ij} = 0$ for every i. The constraint of homogeneity requires that the price aggregator is homogenous of degree 1 in price and expenditure while b(p) is homogenous of degree zero.

Symmetry; $\gamma_{ij} = \gamma_{ji}$.

To estimate the model, all theoretical restrictions are imposed except for negativity. The model is estimated by the Feasible Generalized Nonlinear Least Squares (FGNLS) method with systems of nonlinear equations seemingly unrelated which is available in STATA.[1] The pseudo unit values used as a substitute for prices for each consumption category is obtained by a technique developed by [24]. This technique allowed us to obtain unit values from expenditure shares without having to use the information on the quantity consumed. We provided a solution for the possibility of endogeneity with a control function and heterogeneity by a transformation technology using mainly household characteristics.

[1] Stata is a general-purpose software package created by StataCorp LLC.

3. Data, findings and discussion of results

In this work, The Gambia Integrated Household Survey dataset (IHS) is employed (IHS 2015/2016). The IHS is an income and expenditure survey conducted at five-year intervals by The Gambia Bureau of Statistics (GBoS) with technical and financial support from the World Bank and development partners for the assessment of the welfare and poverty status of households and individuals living in The Gambia. The dataset contains detailed information about household consumption expenditure items as well as income sources also with information on demographic and social-economic variables of the population collected from a sample of more than 13,000 households from the urban and rural areas over a period of 12 months. Prices are replaced with unit values computed from the data on consumption expenditure using a method developed by [24].

3.1. Consumption expenditure and the compilation of the consumption data

This work employs household consumption instead of income as a measure of welfare. Household consumption expenditure is contained in part two of the IHS questionnaire. It provides detailed consumption data on all relevant consumption items with total expenditure, quantity and prices (for food consumption items). Other consumption expenditures (non-food) are not accompanied by price or quantity data. These items are grouped into six main categories similar to [18], also [25] although for only food consumption expenditure; this is also the same grouping employed by the Gambia Bureau of Statistics for consumer price compilation, namely food, housing, transportation and communication, recreation, clothing and other. The household consumption values on food and non-food are aggregated based on guidelines provided in [26]. All adjustments made to the data are based on the guideline for the compilation of household consumption expenditure from household survey data. Some of these will be discussed.

Aiming at a composite measure of consumption expenditure, broad consumption categories are quite exhaustive. Categorisation first consider consumption into two broad groups, food and non-food consumption as in the Integrated Household Survey (IHS2015/16). Food consumption comprises both consumptions at home and outside to capture payment in restaurants and canteen, including beverages either taking at home or away being it alcoholic or non-alcoholic. Then non-food consump-

Table 1
Summary statistics

Variable	Mean	Std. dev.	Min	Max
Budget shares/consumption shares				
Food	0.672	0.127	0.129	0.950
Clothing	0.070	0.049	0.001	0.470
Housing	0.102	0.065	0.006	0.621
Transport and communication	0.069	0.061	0.001	0.779
Recreation	0.037	0.040	0.000	0.506
Others	0.050	0.054	0.000	0.681
Weights and sizes				
Weight for adult	0.449	0.137	0.151	0.997
Weight for child	0.551	0.137	0.003	0.849
Number of adults	4.343	2.729	1.000	33.000
Number of children	5.407	3.475	0.000	38.000
Distribution factors				
Age ratio	0.432	0.044	0.235	0.750
Monogamy	0.600	0.490	0.000	1.000
Clothes price ratio	0.454	0.051	0.231	0.708
Education ratio	0.471	0.165	0.111	0.889
Demographics				
Gender of the head (male)	0.989	0.103	0.000	1.000
Age of the head	49.763	12.908	20.000	96.000
Household size	9.456	4.350	3.000	21.000
Resident (rural)	0.299	0.458	0.000	1.000
Number employed	4.551	3.505	0.000	38.000
School attendance	0.321	0.467	0.000	1.000
Ownership of dwelling	0.805	0.396	0.000	1.000
Asset index	0.115	1.158	−0.296	3.373
Log expenditure	11.933	0.511	10.046	14.469

tion expenditure is divided into five groups, namely: housing, clothing, transportation and communication, recreation and other non-food consumptions.

Food consumption as a group entails the consumption expenditure on all food items, for example, meat, fish, vegetable, fruits, beans, cereals, fats, etc. as well as of alcoholic and non-alcoholic beverages. **Housing** expenditure is computed to include goods for housing maintenance, electricity cost, non-durable household goods, furniture, household textiles, small electrical and nonelectrical household goods, equipment for the house and all recorded materials for maintenance and repair of the dwelling occupied by the household members. **Clothing** expenditures are clothing for men, women and children including footwears. It should be noted also that expenditure on clothing and footwear is assignable to either the young or the adult. **Transportation and communication** include the cost incurred for the purchase and payments for fuels and lubricants, maintenance and repair of personal transport, passenger transport, transport assets, long distance/international transport and communications. **Recreation** includes recreations and culture, newspapers and periodicals, stationery and drawing materials (not for school), gardens and pets, guest houses and accommodation service, the share for recreation also include educational expenses. All other expenses are grouped in the **other expenditure.** This group contains health expenditure, insurance, ceremonies, mix goods, domestic workers, hairdressing, games of chance(s) and other expenses not mentioned elsewhere.

It is also worth noting that items included in the computation of the household housing expenditure might have different recall periods in the survey, for example, goods for housing maintenance have a recall period of seven days while expenditure on furniture has a recall of 12 months (a year). In this regard, the guideline provided for the aggregation of household consumption expenditure becomes extremely crucial. For assets that could last for more than a year such as a motor vehicle, we computed the use-value, similarly, other expenses of different recall periods were converted to annual expenditure. It is important to keep in mind that in the end, we calculated the share of each group which should be interpreted as the proportion of household expenditure for a group (for example food share of household consumption). All expenditure categories are computed as annual totals before shares are obtained.

Table 1 is a review of the descriptive statistics of variables used in the model. It shows the mean, standard deviation, and minimum and maximum values. As expected of any developing country, food consump-

Table 2
Pseudo unit value obtained by Menon, Perali and Tommasi, 2017 procedure

Pseudo unit value	Mean	Std. dev.	Min	Max
Food	11.310	0.263	10.167	12.066
Housing	7.273	0.642	5.892	12.437
Clothing	6.514	0.425	4.783	7.889
Transport and communication	6.491	0.612	4.811	7.797
Recreation	2.871	0.480	1.641	3.847
Others	6.101	0.561	4.175	9.014

Table 3
Sharing rule total sample

Variable	Mean	Std. dev.	Min	Max
Adults	0.464	0.029	0.268	0.934
Children	0.536	0.029	0.066	0.732

Table 4
Sharing for extended families only

Variable	Mean	Std. dev.	Min	Max
Adult share	0.447	0.028	0.258	0.746
Children share	0.553	0.028	0.254	0.742

tion expenditure accounts for the higher proportion of household consumption, about 67.2 per cent of total household consumption expenditure, on average, with a minimum of 12.9 per cent and a maximum of up to 95.0 per cent of total expenditure. Clothing, housing, recreation, transportation and communication and other services account for 7.0 per cent, 10.2 per cent, 3.7 per cent, 6.9 per cent and 5.0 per cent respectively of the total household consumption expenditure. Importance to note in share of consumption expenditure going to recreation which mainly include educational expenditure is the fact that public education is generally free for all students up to upper secondary (high school. This is a possible indication of the low share of recreation on household budget and the insignificant effect of income on recreational expenditure as can be seen in Table 5.

3.2. Sharing rule

The individual resources share, w_j^i as constructed, are affected by price, income, demographic and distribution factors. As noted earlier in the methodology section, adult and children expenses are obtained summing up assignable and excludable goods for each group plus shares from other household consumption items which are assumed to be shared equally among all household members. In Table 5, β_1 and β_2 represent the effect of adults' and children's income respectively. As opposed to adults, children expenditure/income have a stronger and adverse effect on demand for goods such as food and recreation including education (Table 5). These consumption goods are more of necessities than other consumption goods. The error coefficients are all non-significant in their respective equations. The residuals are evaluated at the 95% confidence level, implying that the CQUADS specification does not miss out anything after including the quadratic terms. Higher age ratios between husband and wife, monogamy and a larger difference in educational attainment between the couples reduce the share of household resources going to adults. The direct opposite is true for children. Table 3 also shows the effects of price changes.

Contrary to the largely cited claim by child right activist, and some existing empirical evidence emanating from this work suggest, children, control a large share of household resources, 53.6 against 46.4 per cent for children and adult respectively (Table 3). This is conflicting with what you can find in [15]. This can be explained to a great extent by the existing cultural norms and social settings. Given substantial expenses on education and children clothing, with less time and money spent on recreation and other adult activities. Also, the dominance of rural households in the sample of the data employed could similarly explain why children might be prioritized. Children share of resources may also be affected by resources, not under the control of their parents but other extended family members [15]. It is also important to note, although the children spend a greater share of household resources, they are often presented with much more delicate needs as compared to the adults. The result presented especially on allocation to consumer goods is a clear manifestation of the need to invest more in upgrading the welfare status of the household to ensure sustainable development for The Gambia. This will not just help in the attainment of the Sustainable Development Goals number 1 (end poverty in all its forms everywhere) but in the realization of every other United Nations goal such as attainment of universal education, access to health etc.

3.3. Demographic effects

Table 4 captures the possible heterogeneity among households. It describes the demographic effect on resources shares. Demographic variables such as family sizes are important variables in defining the allocation of household resources [27]. Household size is inversely related to food share of the household budget as opposed to other consumption shares. This is consis-

Table 5
Price, income and distribution factor parameters; estimates of the collective AIDS

	Food	Clothing	Housing	Recreation	Transport and com.	Others
Constant	0.931	0.018	0.035	−0.030	0.049	−0.003
	0.018	*0.017*	*0.015*	*0.011*	*0.017*	*0.016*
Income effect						
B1	0.099	−0.008	−0.012	−0.077	−0.020	0.018
	0.018	*0.006*	*0.007*	*0.005*	*0.008*	*0.006*
B2	−0.102	0.013	0.044	−0.010	0.024	0.032
	0.014	*0.007*	*0.008*	*0.005*	*0.008*	*0.007*
Price effect						
Food	0.005					
	0.005					
Clothing	0.004	−0.010				
	0.003	*0.003*				
Housing	0.000	0.000	0.001			
	0.002	*0.001*	*0.002*			
Recreation	0.002	0.003	0.001	−0.006		
	0.002	*0.001*	*0.001*	*0.001*		
Transport and com	−0.008	0.001	0.000	0.000	0.004	
	0.003	*0.001*	*0.001*	*0.001*	*0.002*	
Others	−0.002	0.001	−0.001	0.000	0.003	−0.001
	0.003	*0.002*	*0.001*	*0.001*	*0.001*	*0.002*
Distribution factors						
Age ratio		−1.093				*0.098*
Monogamy		−0.060				*0.010*
Price cloth ratio		0.756				*0.081*
Education ratio		−0.197				*0.033*
Error correction terms						
Food		−0.013				*0.007*
Clothing		−0.001				*0.003*
Housing		0.002				*0.004*
Recreation	−0.005				*0.002*	
Transport and com	0.017				*0.004*	
Others		0.001				*0.003*

Standard errors are in italics.

Table 6
Demographic effects estimated by collective AIDS

Variables	Food	Clothing	Housing	Recreation	Transport and com	Others
Household size	−0.001	0.001	0.000	0.001	0.000	0.000
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
Male	−0.133	0.033	0.019	0.047	0.034	0.000
	0.016	*0.009*	*0.010*	*0.008*	*0.010*	*0.008*
Age of the head	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
Urban	−0.034	0.008	0.021	0.004	0.011	−0.011
	0.004	*0.003*	*0.003*	*0.001*	*0.003*	*0.002*
Number of employed members	0.003	0.000	−0.001	−0.001	−0.001	0.001
	0.001	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
School attendance	−0.028	0.008	0.004	0.012	0.004	−0.001
	0.004	*0.002*	*0.003*	*0.001*	*0.003*	*0.002*
Extended	−0.013	0.000	0.005	0.004	0.001	0.002
	0.003	*0.002*	*0.002*	*0.001*	*0.002*	*0.002*
Own a dwelling	0.009	−0.002	−0.006	0.000	−0.006	0.005
	0.004	*0.002*	*0.002*	*0.001*	*0.002*	*0.002*
Asset index	−0.011	0.001	0.011	0.002	0.000	−0.003
	0.001	*0.001*	*0.001*	*0.000*	*0.001*	*0.001*

Standard errors are in italics.

Table 7
Children and adult expenditure on consumption share

	Linear parameters				Quadratic parameters			
Variable coef.	Est. val.	Std. err.	z	$P > z$	Est. val.	Std. err.	z	$P > z$
Food								
Adults	0.8487	*0.1038*	8.1800	0.0000	−0.0366	*0.0056*	−6.5000	0.0000
Children	0.1628	*0.0298*	5.4700	0.0000	−0.0171	*0.0022*	−7.6900	0.0000
Clothing								
Adults	−0.0580	*0.0445*	−1.3000	0.1930	0.0049	*0.0024*	2.0500	0.0410
Children	0.0555	*0.0128*	4.3500	0.0000	−0.0049	*0.0010*	−5.1200	0.0000
Housing								
Adults	−0.1503	*0.0555*	−2.7100	0.0070	0.0072	*0.0030*	2.3900	0.0170
Children	−0.0215	*0.0159*	−1.3500	0.1750	0.0023	*0.0012*	1.9300	0.0530
Transport and com.								
Adults	−0.4985	*0.0528*	−9.4500	0.0000	0.0277	*0.0029*	9.7100	0.0000
Children	0.0190	*0.0151*	1.2600	0.2080	−0.0018	*0.0011*	−1.5900	0.1120
Recreation								
Adult	−0.0230	*0.0256*	−0.9000	0.3700	−0.0107	*0.0014*	−7.6600	0.0000
Children	−0.2220	*0.0077*	−28.9500	0.0000	0.0220	*0.0006*	37.8900	0.0000

Standard errors are in italics.

Table 8
Income and price elasticities

	Food	Clothing	Housing	Recreation	Transport and com.	Others
Income elasticities						
Adult	1.003	1.054	1.102	−4.530	1.137	1.494
	0.063	*0.049*	*0.067*	*63.422*	*0.204*	*0.325*
Children	0.913	0.875	1.128	5.105	1.084	1.394
	0.019	*0.068*	*0.095*	*64.421*	*0.109*	*0.435*
Compensated price elasticities						
Food	**−0.294**	0.074	0.095	0.031	0.051	0.042
	0.047	*0.007*	*0.018*	*0.027*	*0.018*	*0.008*
Clothing	0.699	**−1.069**	0.113	0.087	0.096	0.074
	0.058	*0.021*	*0.021*	*0.022*	*0.016*	*0.009*
Housing	0.648	0.069	**−0.870**	0.030	0.072	0.052
	0.052	*0.006*	*0.016*	*0.024*	*0.017*	*0.011*
Recreation	1.191	0.463	−0.042	**−1.396**	−0.027	−0.212
	12.241	*4.405*	*3.119*	*5.764*	*2.393*	*4.483*
Transport and com.	0.512	0.093	0.115	0.033	**−0.857**	0.107
	0.118	*0.015*	*0.023*	*0.023*	*0.049*	*0.036*
Others	0.632	0.084	0.101	−0.017	0.131	**−0.932**
	0.068	*0.018*	*0.025*	*0.037*	*0.043*	*0.011*
Uncompensated price elasticities						
Food	**−0.945**	0.009	0.000	0.003	−0.011	−0.005
	0.048	*0.003*	*0.003*	*0.009*	*0.003*	*0.003*
Clothing	0.034	**−1.136**	0.016	0.060	0.032	0.026
	0.036	*0.015*	*0.011*	*0.008*	*0.008*	*0.005*
Housing	−0.130	−0.009	**−0.983**	−0.002	−0.003	−0.003
	0.051	*0.007*	*0.007*	*0.004*	*0.005*	*0.004*
Recreation	1.446	0.487	−0.007	**−1.428**	0.007	−0.195
	25.041	*5.870*	*0.792*	*5.762*	*0.578*	*3.450*
Transport and com.	−0.263	0.015	0.001	0.002	**−0.932**	0.051
	0.189	*0.012*	*0.011*	*0.007*	*0.051*	*0.030*
Others	−0.368	−0.015	−0.044	−0.059	0.036	**−1.001**
	0.353	*0.010*	*0.041*	*0.016*	*0.033*	*0.008*

Standard errors are in italics.

tent with the claim by [23]; large household sizes benefit from economies of scale and as household size increase, per capita expenditure on food decreases. Male headed households spent a relatively lesser share on food consumption, potentially due to higher income by male-headed households. Apparently, the same applies for extended families as opposed to single parent and nuclear families as almost if not all extended families

Table 9
Demographic effects on consumption shares estimated by engel curves

Variable	Food	Clothing	Housing	Transport	Recreation
Constant					
Est. val.	−3.967	0.080	0.859	2.268	1.292
Std. err.	0.482	0.207	0.258	0.245	0.119
$P > z$	0.000	0.698	0.001	0.000	0.000
Demographics					
Sex (male)	−0.028	0.006	−0.002	0.002	0.015
	0.145	*0.465*	*0.860*	*0.830*	*0.003*
Age of head	0.000	0.000	0.000	0.000	0.000
	0.887	*0.856*	*0.735*	*0.920*	*0.027*
Household size	−0.006	0.000	0.002	0.001	0.001
	0.000	*0.119*	*0.000*	*0.000*	*0.000*
Residence (urban)	−0.036	0.008	0.022	0.007	0.006
	0.000	*0.001*	*0.000*	*0.009*	*0.000*
Number of employed member	0.004	0.000	−0.002	−0.002	−0.001
	0.000	*0.250*	*0.000*	*0.000*	*0.000*
Educational attainment	−0.038	0.007	0.009	0.002	0.012
	0.000	*0.000*	*0.000*	*0.430*	*0.000*
Own a house	0.010	−0.004	−0.004	−0.005	−0.003
	0.070	*0.093*	*0.178*	*0.118*	*0.021*
Asset index	−0.011	0.001	0.009	0.000	0.002
	0.000	*0.066*	*0.000*	*0.745*	*0.001*

Standard errors are in italics.

Table 10
Goodness of fit

	Mean	Min	Max	Est-true	R-square
Food	0.672	0.129	0.950	−0.001	0.9716*
Clothing	0.070	0.001	0.470	0.000	0.6648*
Housing	0.102	0.006	0.621	0.000	0.7438*
Recreation	0.069	0.001	0.779	0.000	0.7636*
Transport and com.	0.037	0.000	0.506	0.000	0.5766*
Others	0.050	0.000	0.681	0.000	

are large. These effects are statistically different from zero at the 95 per cent confidence level.

As will be seen in Fig. 1, Gambian households are often large (average – 9.5 persons per household). With a mean of 4.3 and 5.4 for adults and children respectively and a large range, the maximums can be as high as 33 and 38 for adults and children respectively (Table 1). On one hand, there are households without children, on the other hand, every household has at least an adult member. Obviously, children are taken care of by adults who may either be their parents or someone else.

Of all the included classes of household consumption (food, clothing, housing transportation and communication and recreation), the gender of the head of the household and his/her ages, are only important in explaining the share of consumption devoted to recreation. Although gender (male) shows a negative effect on food consumption, this effect is not statistically different from zero. Although it has been shown that gender of the head, location/geography and other household features have important powers in given information about the household welfare, the result of this tends to give much weight to the effect of gender [23]. Possibly because almost all included households are headed by a male, headship by a female is less than 2 per cent of the sample for which our result is obtained (Table 9).

This result conforms with the findings that demographic characteristics of the household have an important effect in explaining the allocation of household resources. As opposed to [28], who suggest that household characteristics do not affect the allocation of resources within the household, resource share does depend on household characteristics. Provided with the large variability in the characteristics, it makes sense leading to the observed findings, given the large sample considered, the robustness of the result is trustworthy. Except for their effect on clothing, which is not affected by household expenditure, household size, residence (rural), school attendance of the head, number of employed household members, ownership of dwelling occupied by the household and asset index all show noticeable effects on the allocation of resources. Larger household sizes harm the share of food consumption. This is an often mentioned finding in the literature of household economics. Larger household sizes push the Engel curves outwards [23]. The asset index constructed by the principal component analysis method as an indicator of the wealth status of the household has a negative impact on the food share of household resources likewise other expenses which include health care expenditure. Urban households and households headed

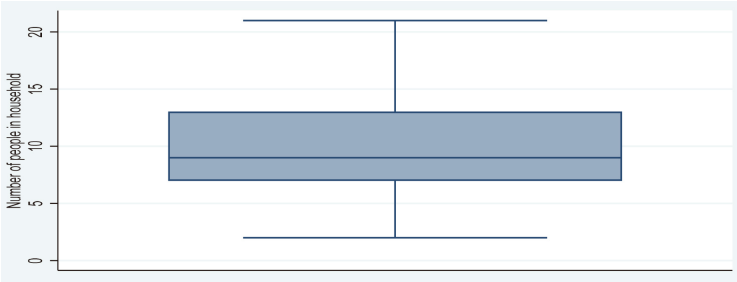

Fig. 1. Mean size of the household.

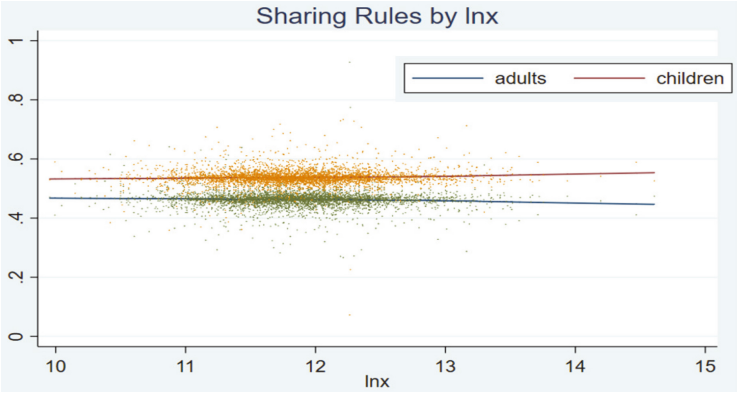

Fig. 2. Sharing rule by log of household consumption shares.

by a person who has attained some form of formal education are also more likely to spend a lower share of their household budget on food while 'the age of the head' shows no statistical significant effect on budget shares. These characteristics (urban, school attendance, higher wealth index and lower household sizes) are all associated with households of better welfare status [27].

3.4. Income/expenditure effect

The collective model shows the relationship between consumption shares and household consumption expenditure just like the Engel curve. The Engel curve estimates resource share without having to acquire data on price variations [29]. It is predicted that food share of household consumption will decrease with increasing log expenditure. Table 7 shows the effect of expenditure on adults and children on the share of household consumption which goes to a consumption item (class/group). Given the nature of the relation between expenditure and resource shares, both the linear and quadratic terms are featured and are clearly shown in Table 7. The collective quadratic demand system is estimated first estimating the model without the quadratic term and then with the quadratic term. This helps to detect the possible presence of endogeneity (omitted variable biased) in the model without the squared terms. These terms (quadratic) are all different from zero and do in fact make a significant change to the results. The cubic terms are excluded in the results as they are not significantly different from zero. Although the linear terms are not significant for most of the shares, in each case, either of children or adult expenditure will significantly affect the resource share.

All quadratic terms are statistically significant except for children expenditure on transport and communication signifying a strong effect of household income on consumption shares. Food share decreases by 3 per cent for a 1.0 per cent increase in adult expenditure and 1.7 per cent for children expenditure. The magnitude of the effect of children expenditure shares is larger on recreation (Tables 3 and 5). In the sample of households considered, recreation seems to compose of more expenditure by children compared to adults.

3.5. Price and income elasticities

Own Price elasticities, income and cross elasticities are evaluated at their means. The result presented in Table 6 show these elasticities with their respective

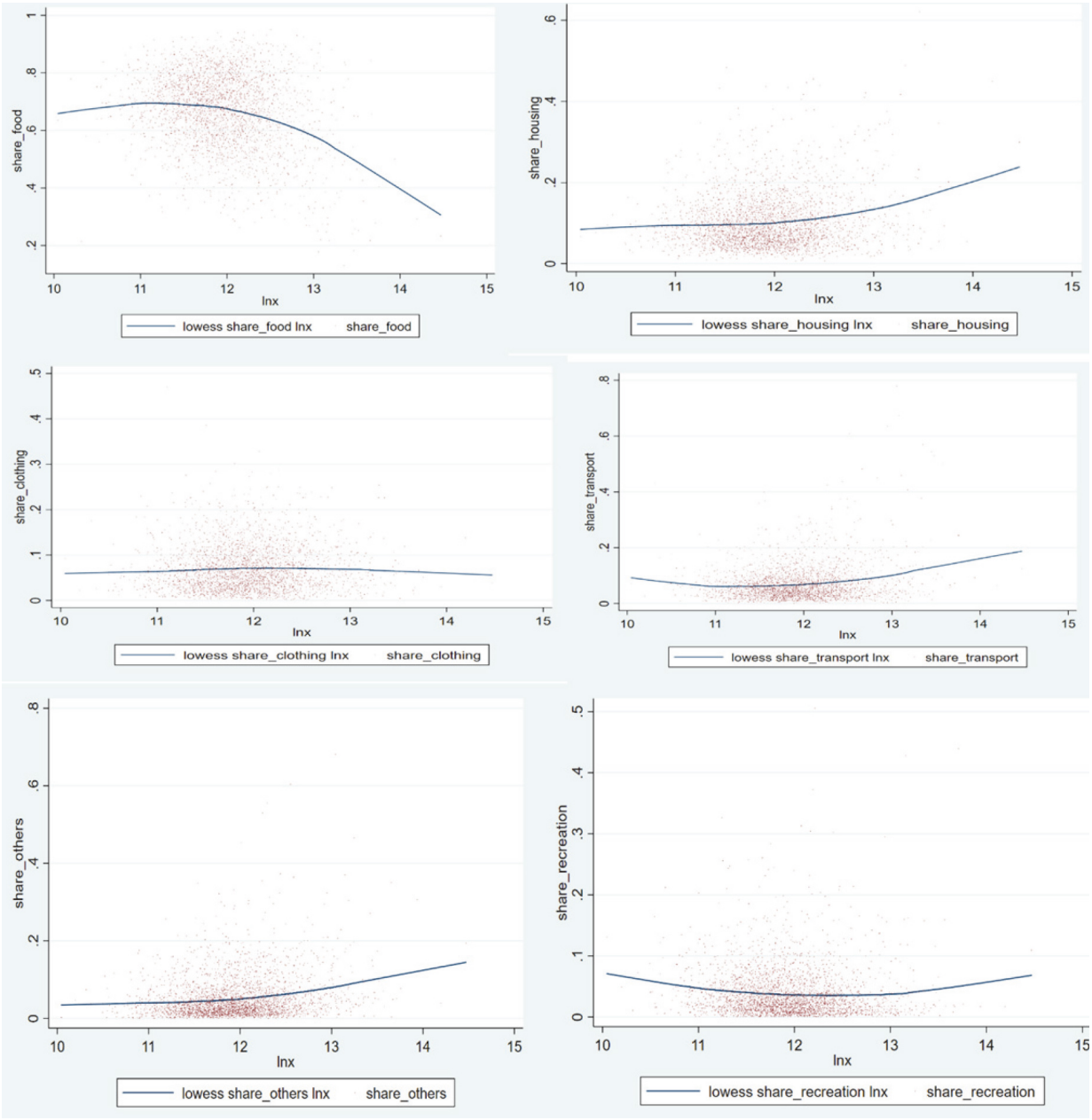

Fig. 3. Share of expenditure and log expenditure.

standard errors. Table 8 also show the compensated (Hicksian) elasticities which measure the reaction of demand to price changes holding real income/utility constant [24]. It tells how much of a need good is needed to maintain a certain utility. On the other hand, the uncompensated (Marshallian) price elasticities measure the reactiveness of demand to price changes holding income constant. As members of the household face the same price for the same goods, this work could not establish a difference in price elasticity for different household members.

All price elasticities compensated and uncompensated, are negative (microeconomics theory requires) and are significantly different from zero except for recreation. The compensated price elasticity for food is largely below unitary unlike other consumption shares especially for clothing and recreation which are both elastic (price elasticity larger than one). Food is a neces-

sity. We can similarly observe some significant cross-price elasticities. This result can help to explain the effect of price changes on wellbeing. The existing evidence of the significant impact of price changes on demand for a consumption good such as food reveals that price (rise or fall) is associated with welfare lost or gained, holding economic and social factor constant. To be specific, a rise in prices which is usually the case in developing countries will increase the amount of income needed to maintain a given welfare status.

Microeconomic theories suggest that income elasticities are positive. As seen in Table 8, the demand for household goods is more responsive to change in adult income compared to children. Although, demand is also elastic toward children allocated-income for most of the consumption goods. Besides recreation, which is also associated with abnormally large standard errors, all elasticities are significantly different from zero, income elasticities are positive for both children and adults. All goods have at least elastic income elasticities except food and clothing [26] empirically showed that the level of elasticity for a consumption good depends on the income status of the country, highlighting that income elasticity gets smaller the richer the country. Potentially, this is an explanation for the unimaginably higher elasticity for recreation which also have the lowest share of household resources, spent on mainly younger members of the household.

It is important to note the effect of income changes on wellbeing. Although not fully established, enhancement of household income can largely help in improving the welfare of household members. In fact, [26] outlined that income changes do affect the calories intake of household members in many countries. Nevertheless, [30], highlighted that income have a minimal effect on food consumption, however this is contrary to the findings of this work. This work tends to favour the claim that household income has a strong impact on resource allocation and household wellbeing.

4. Conclusion and recommendation

The collective model is a model of household behaviours which feature the relationship between preferences of individual household members and how it results in a collective household decision. The CQAID method recovers the distinct needs and characteristics of the individual's consumption in the household. Notwithstanding, it goes without saying that the estimation of these models is not so trivial or else will require strong restrictions. This work estimated the resource share among children and adult household members in Gambian households, using a household income and expenditure survey dataset. The work also introduces household level heterogeneity with a transformational technology composed of household characteristics. This technique is able to establish the effects of demographic and distribution factors on the allocation of household resources and the sharing rule. The study reveals that food consumption expenditure accounts for more than 2/3 (67.2 per cent) of total household consumption expenditure, a strong sign of low living standards.

The evidence suggests that household resources are not shared equally among members. Resource shares are dependent on household characteristics, distributive factors and on price and income. Expenditure allocation to either young or adult member of the household affects the expenditure allocation to different consumption goods; as allocation to children have a more pronounced effect on education and recreation, adult allocation affects more conspicuous consumption goods such as food, housing and clothing. Given indications that changes in household income do not effectively change expenditure on goods such as education and other recreational expenses, rural support projects should prioritize education. Free education can greatly help to shift the responsibility of schooling children from parents and therefore reduce education inequality. This is essential to enhance current wellbeing as well as the future. Pro-poor growth policy interventions intended to ensure inclusive development and/or to reduce poverty and food insecurity should emphasize rural residence, large households headed by an unemployed and/or illiterate male or female as households are in all ways less privileged and are highly vulnerable. The study also indicated that rural households are associated with children not currently enrolled in schools. This being a likely cause of an inter-generational transfer of poverty, and other welfare deficiencies.

Controlling family sizes can largely influence the human capital accumulation of The Gambia, given a larger share of resources going to children mainly to care for their wellbeing, feeding, health care, clothing and other related expenses. Households are better able to invest more in education and other activities which could increase future benefits. For extended families, there is a special need for support in the form of free education, special rural enhancement projects and review of their health status given the large evidence that exists in support of the old claim that children born in a large household are less privilege and face more chal-

lenges. Finally, data collection for the purpose of welfare evaluation of individual members of the household should capture some degree of individual consumption. Wherever possible, reconsidering the definition of the household is similarly important in the precise measurement of the welfare status of the members of the household as Gambian households are large and could be composed of many sub-families.

It is worth mentioning that this work is a beginning of a process of employing household demand and individual preferences to produce more precise measures of welfare for better welfare and policy analysis. An update will feature time use and cost of bearing children.

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This work is dedicated to my entire extended family, and to every rural child who is unable to acquire higher education due to access, quality and/or poverty.

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