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Children's Resources and Poverty: A Collective Consumption Evidence from Ethiopia

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Abstract

We estimate a collective complete demand system model to recover children's resource shares and analyze their poverty. Identification of the sharing rule between children and adults relies on private assignable goods and distribution factors. Based on Ethiopian LSMS-ISA data for two sub-samples of families with children (married male-headed and single female-headed), we observe inequalities in intrahousehold resource allocation and well-being. We find that children command fewer household resources and are poorer than adults, worsening with the number of children. Resource allocation is affected by parental differences in education and age, child education, proportions of female children and women, and the number of non-biological children. Single mothers not only are more altruistic to their children but also avoid higher child poverty than married male heads. However, this seems to disappear when the number of children increases. Unlike the general belief that poor children live only with poor adults and households, our estimates show non-poor families and adults also host poor children. Regional and rural-urban disparities exist. Further, traditional poverty measures, which ignore intrahousehold resource allocation, understate child (and adult) poverty. Findings have implications for fertility, gender, targeting, and spatial redistribution issues.

Keywords: *Collective AIDS model, resource shares, intrahousehold resource allocation, child poverty, inequality, Ethiopia*

JEL codes: *D13, I32, J12, J16, O12*

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1. Introduction

Considering the household as a black box, the unitary model assumes that choices of all household members, including children, are proxied by a single preference of the household head. This, besides violating the microeconomics teachings of individual consumer theory, hides a member's welfare loss or gain due to any inequality in intrahousehold resource allocation. However, there is substantial evidence that rejects the unitary model and underlines the role of intrahousehold resource allocation since the early '90s (Bourguignon, Browning, Chiappori, & Lechene, 1993; Browning, Bourguignon, Chiappori, & Lechene, 1994; Schultz, 1990; Thomas, 1990). Very importantly, ignoring this intrahousehold resource allocation leads to a considerable understatement of the level of poverty in developing countries (Bargain, Donni, & Kwenda, 2014; Dunbar et al., 2013; Haddad & Kanbur, 1990).

Unlike the neoclassical model, the collective household model argues that household choices are grounded on individual member preferences. In seminal contributions, Chiappori (1988, 1992) contends that the key to unlocking the black box is the sharing rule with which the family allocates available resources across its members. When such a rule exists, the efficiency of the collective decision process is implied, and the exogenous bargaining process within the household is captured. One can thus consider intrahousehold inequality in resource allocation and make individual welfare analyses.

Consequently, there has been increased interest, both on academic and global policy fronts, to measure resource shares and the welfare of household members, including children. Academia continues documenting inequality in intrahousehold resource allocation (Bargain et al., 2014; Belete, 2021; Bourguignon et al., 1993; Browning et al., 1994; Dunbar et al., 2013; Lise & Seitz, 2011; Lucia Mangiavacchi, Perali, & Piccoli, 2018). Recently, the Commission on Global Poverty has recommended the World Bank to compute poverty rates at women, children, and young adult levels. However, until the seminal article of Bourguignon (1999), children had no bargaining power and were considered public or private goods for their parents. As they do not enter households by choice and generally bring little to household resources, children could be the most vulnerable to intrahousehold inequality (Dunbar et al., 2013). On the other hand, they may benefit from parental altruism (Bhalotra, 2004).

Only a few empirical pieces of evidence are available from developing countries on resource shares and children's welfare, allowing bargaining with adults in a collective framework. And the scant existing evidence is mixed. Dunbar et al. (2013) and Bargain et al. (2014) apply almost similar collective consumption models, though with different identification strategies, on Malawi and Cote d'Ivoire, respectively. The methodologies in these studies are applied to data from two more sub-African countries: Bose-duker (2018) in Ghana and Bargain, Lacroix, & Tiberti (2018) in South Africa. All, except Bose-duker (2018), find that child resource shares are lower than adults, and vary by family size and type and that conventional poverty measures understate the incidence of child poverty. In contrast, Mangiavacchi et al. (2018), estimating a complete collective demand system model, document children enjoying higher resource shares than adult females but traditional poverty indices slightly overstating child poverty in Albania. This is also in agreement with the findings of Bose-duker (2018) for Ghana¹. Our study contributes to this debate by

¹The issue of overstatement or understatement of child poverty across authors and methods has to be examined cautiously because it depends on the assumption made on children's needs, i.e., child poverty line is lower with lower needs.

estimating children's sharing rule from a collective complete demand system and analyzing their poverty status using data from Ethiopia.

One source of debate in the collective consumption model literature is identifying the sharing rule. As almost all surveys collect consumption data at the household level, the issue is how one can recover information about individual members from household-level consumption data. While some of the recommended structural models are highly restrictive (consumption of purely private and private goods) and easy to estimate resource shares such as Chiappori (1992), others are difficult to estimate and are not suitable for recovering children's sharing such as Browning, Chiappori, & Lewbel (2006). Yet, others propose models at the middle that are only a little restrictive and easy to estimate from Engel curves (Dunbar et al., 2013; Lewbel & Pendakur, 2008). A crucial identifying restriction, for example, is that resource shares are independent of total household expenditure, which Menon, Pendakur, & Perali (2012) and (Bargain et al., 2018) empirically validate. In this study, we use a similar restriction but follow the estimation procedures of a collective Almost Ideal Demand System model as in Menon, Perali, & Piccoli (2018), Chavas, Menon, Pagani, & Perali (2018) and Mangiavacchi et al. (2018) to recover the resource sharing rules of children and adults. The sharing rule is allowed to depend on observed assignable expenditures and distribution factors.

Our empirical exercise uses data from the 2013/14 wave of the Ethiopia Socioeconomic Survey (ESS), conducted as part of the LSMS-ISA project by the World Bank and Ethiopia's Central Statistical Agency (CSA). Ethiopia is an interesting case study for our issue. It is one of the poorest countries in the world with a sizable child population, reaching over 52%, according to the latest census. Official adult-equivalent-based child poverty incidence (32.4%) is higher than that at the household level (29.6%) (CSA, UNICEF, & OPM, 2015; MoFED, 2012). Multidimensional poverty incidence is also among the highest globally (87%), and the human development index remains one of the least (0.396). These occurred when the government pursued various anti-poverty and 'transformation' strategies, and the economy was growing fast, for instance, at 8% in per-capita terms over the period 2004–2014 (World Bank, 2016).

Once children's resource shares are estimated and analyzed, we use them to compute poverty measures of incidence, depth, and severity. These intrahousehold inequality-robust rates are then compared with those based on equal resource sharing (household level). The study uses a needs-based national poverty line. It also tests the hypotheses by Haddad & Kanbur (1990) that poverty depth and severity measures that ignore intrahousehold resource allocation understate the level of poverty. In addition, we provide evidence on the gender and family type aspects of intrahousehold resource allocation as we estimate child resource shares and poverty indices for married male-headed and single female-headed families. As a further benefit of the new method of child poverty estimation using resource shares, we look at the overlap between the poverty of children, adults, and the household. What proportion of poor children lives with non-poor adults? What portion of poor children live in non-poor households? Do these differ when the head is a female? We also provide evidence on the overlap between child undernutrition and monetary poverty at the child, adult, and household levels.

Our results confirm inequalities in intrahousehold resource allocation and poverty, which vary with the number of children, family type, and location. The resource allocation is affected by parental differences in education and age, child education, proportions of female children and

women, and number of non-biological children. Older mothers assign more resources to children. Children's expenditure shares are also higher if they are all in school and when there are more girls relative to boys. We find that children have lower expenditure shares (16% or 30%) than adults (23% or 32%), depending on the family type (male-headed or single-mother). These correspond to monthly non-durable per-child outlays of ETB 339 or 433, and per-adult outlays of ETB 491 or 457 in male-headed or single-mother families, respectively. Consistent with Bargain et al. (2014), results show that single mothers are more altruistic to children than male-heads.

Using resource shares to estimate poverty incidence, depth, and severity measures, we find that children are poorer than adults, which varies with family type and location. In a sample of families with children, the prevalence of child poverty increases from 65% when there is only one child to 93% when families host more than four children. Besides being more altruistic to their children, single-mother families host fewer poor children than male-headed families. In line with previous literature (Haddad & Kanbur 1990), traditional poverty measures, which ignore intrahousehold resource allocation, understate child (and adult) poverty compared to those based on resource shares.

Our estimates also show that up to a fifth of non-poor households and adults host poor children, unlike the general belief that poor children live only with poor adults and families. Changing the poverty measure to undernourished children also provides a similar conclusion, consistent with Brown, Ravallion, & Van de Walle (2017), that up to a tenth of monetarily non-poor adults or households host stunted children. Moreover, a lower proportion of poor children lives with non-poor adults in female-headed families than in male-headed ones. This aligns with our previous evidence that single mothers are more equal to their children than adults in male-headed families. These overlaps question the use of household information to target children's welfare. Finally, we observe regional and rural-urban disparities in resource shares and poverty.

The remainder of the paper is organized as follows. The following section discusses the theoretical framework and empirical issues. After describing the data in the third section, we present and discuss the results in the fourth section. The last section provides concluding remarks.

2. Theoretical Framework and Estimation Issues

2.1. The Collective Household Consumption Model

Consider a household consisting of adults and children, indexed by $k = 1, 2$, respectively². Private goods could either be assigned to each member, e.g., clothing, or non-assigned, e.g., food. Represent adults' assignable consumption by c^1 and children's by c^2 and aggregate non-assignable consumption by q so that total household consumption becomes³ $C = c^1 + c^2 + q$. In a centralized setting, the budget constraint of the collective household is $p_{c^1}c^1 + p_{c^2}c^2 + p_qq = e$, where $p_h, h = c^1, c^2, q$ are associated prices of assignable and non-assignable goods and e is total

² *The very scant literature that estimates a collective consumption model with public goods makes a strong assumption that people in different marital statuses have similar preferences, as done for singles and married ones by Browning, Chiappori, & Lewbel (2013). However, such an assumption fails to identify the model when children are considered as decision-makers, as we do in this paper, and it is difficult to observe children living alone. Moreover, in our empirical application, the large majority of goods are private, for e.g., food and alcohol, clothing, and other goods categories constitute a total share of over 92%.*

³ *Note that if index $k = 1, 2$ is a superscript, it indicates an endogenous variable and if it is a subscript, it is associated with an exogenous variable. Also note that i and j index goods.*

household expenditure. Unlike assignable goods, one cannot observe individual quantities and prices of non-assignable goods.

Preferences of each household member are assumed to be of caring type in which the utility of one member depends on the sub-utility of the other, i.e., for each $k = 1, 2$ we consider $U^k(c^1, c^2, q^1, q^2; \mathbf{d}) = U^k[u^1(c^1; q^1; \mathbf{d}); u^2(c^2; q^2; \mathbf{d})]$ where \mathbf{d} represents a vector of demographic variables⁴ that affect preferences of the members directly so that observed heterogeneity is captured. Note that $\mathbf{d} = (d_1, d_2, d_{12})$ where d_1 and d_2 are characteristics specific to adults and children respectively while d_{12} are household-level characteristics. We assume that utilities u^k are continuously differentiable as a consequence of which demand functions of each member will ultimately be smooth.

We assume that household decisions are Pareto-efficient (Chiappori, 1988, 1992). This alternatively means that family decisions are made in a decentralized fashion in two stages: (i) Members decide on how to share the total household expenditure e so that each member receives a sharing rule ϕ_k with $\phi_k > 0$ such that $e = \phi_1 + \phi_2$; (ii) Given the sharing rule ϕ_k , each member maximizes her own utility function $u^k(c^k, q^k; \mathbf{d})$ subject to her budget constraint $p'_{c^k} c^k + p'_q q^k = \phi_k$ thereby choosing her optimal (Marshallian) consumptions of assignable goods $\hat{c}^k = c^k(p_{c^k}, p_q, \phi_k, \mathbf{d})$ and non-assignable goods $\hat{q}^k = q^k(p_{c^k}, p_q, \phi_k, \mathbf{d})$.

Household-level (aggregate) Marshallian demand systems of assignable and non-assignable goods are obtained as

$$\hat{c}(p_{c^1}, p_{c^2}, p_q, e, \mathbf{d}) = c^1(p_{c^1}, p_q, \phi_1, \mathbf{d}) + c^2(p_{c^2}, p_q, \phi_2, \mathbf{d})$$

and

$$\hat{q}(p_{c^1}, p_{c^2}, p_q, e, \mathbf{d}) = q^1(p_{c^1}, p_q, \phi_1, \mathbf{d}) + q^2(p_{c^2}, p_q, \phi_2, \mathbf{d}).$$

Note that individual-level optimal Marshallian demands are observed as functions of prices, the sharing rule and demographic attributes. Optimal consumption levels of the non-assignable goods are only observed at the household level.

2.1.1. The Collective Complete Demand System

The demand system model we specify follows from Menon et al. (2018), Chavas et al. (2018) and Mangiavacchi et al. (2018) who extend the QAIDS of Banks, Blundell, & Lewbel (1997) to the collective framework and hence named the Collective Quadratic Almost Ideal Demand System (CQAIDS). The model begins with a specification of an individual expenditure function in terms of price aggregators and a demographically-translating household technology to ultimately get individual Hicksian and Marshallian budget share demands. The sharing rule is specified as a function of observed individual expenditure and a vector of distribution factors. Individual expenditures are also scaled guarantee the independence of the sharing rule and total expenditure (Chavas, Menon, & Perali, 2017). Appendix A1 contains the detailed derivation of the model.

⁴ They are also termed “preference factors” (Bourguignon, Browning, & Chiappori, 2009).

Given continuous and concave price aggregators p taking up the functional forms, $\ln A_k(\mathbf{p}) = \frac{1}{2}(\alpha_0 + \sum_i \alpha_i \ln p_i + \frac{1}{2} \sum_i \sum_j \gamma_{ij} \ln p_i \ln p_j)$; $B_k(p) = \beta_0 \Pi_i P_i^{\beta_i^k}$, and $\lambda_k(\mathbf{p}) = \sum_i \lambda_i^k p_i$, additionally assumed to be a differentiable, homogeneous function of degree zero of prices. The demographically-modified demand for good i in terms of budget share w_i is aggregated from member demands w_i^k as

$$w_i = \alpha_i + t_i(\mathbf{d}) + \sum_j \gamma_{ij} \ln p_j + \beta_i^1 [\ln e_1^* - \ln A_1(\mathbf{p})] + \lambda_i^1 \frac{[\ln e_1^* - \ln A_1(\mathbf{p})]^2}{B_1(\mathbf{p})} + \beta_i^2 [\ln e_2^* - \ln A_2(\mathbf{p})] + \lambda_i^2 \frac{[\ln e_2^* - \ln A_2(\mathbf{p})]^2}{B_2(\mathbf{p})} \quad (1)$$

where $\ln e_1^*$ and $\ln e_2^*$ are modified logarithmic individual total expenditures from observed ones ($\ln e_k$) given by a translating household technology:

$$\ln e_k^* = \ln e_k - \sum_i t_i(\mathbf{d}) \ln p_i. \quad (2)$$

Demographic augmenting of the demand system helps capture observed heterogeneity among households and is done by introducing a translating technology $t_i(\mathbf{d})$ so that demographic attributes \mathbf{d} enter additively with expenditures (Lewbel, 1985; Perali, 2003). The translating technology is specified as $t_i(\mathbf{d}) = \sum_r \tau_{ir} d_r$ for $r = 1, \dots, R$. Note that we can estimate, for each good i , income parameters (β_i^1 , β_i^2 , λ_i^1 and λ_i^2) at the individual level while the rest at the household level (i.e., intercepts α_i , price parameters γ_{ij} and demographic scaling effects $t_i(\mathbf{d})$).

2.1.2. The Sharing Rule

Until now, we have made an implicit assumption that individual total expenditures e_k are observed. However, such information is barely collected, as is the case in many household surveys and in the survey that we used for this study. As a solution to this issue, one can exploit expenditures on exclusive or assignable goods $\mathbf{p}'_c \mathbf{c}^k$ to learn about how much each member receives from total household resources and then correct for the resulting measurement error (Caiumi & Perali, 2015; Mangiavacchi & Piccoli, 2017; Menon et al., 2018). The lower the proportion of non-assignable expenditures $\frac{\mathbf{p}'_q \mathbf{q}}{e_k}$, the lower will be the measurement error. We will get back to this correction issue in a moment.

We have exploited all available expenditure-related information in the survey if some goods are consumed exclusively by adults or children. Expenditures on clothing, which are collected at male, female, girl and boy levels, as well as on education, which are collected at each individual level, are clearly assignable. Moreover, we assume consumption of the following items exclusively by adults: alcoholic drinks, stimulants (specifically, chat and cigarettes) and certain personal care items. Once assignable individual expenditures are considered, non-assignable expenditures are assumed to be shared equally by adults and children⁵. Hence, one can consider $e_k = \frac{\mathbf{p}'_c \mathbf{c}^k}{h_k} + \frac{\mathbf{p}'_q \mathbf{q}}{h}$ where h_k is the number of persons in adult and children groups and h is total household size

⁵ Chavas et al. (2017) test the innocence of such an assumption; they show that assuming a fair distribution of non-assignable goods among family members does not affect parameter estimates of the sharing rule.

(Chavas et al., 2017). Hence, observed resource shares become $\sigma_k = \frac{e_k}{\sum_k e_k}$ where $\sigma_1 + \sigma_2 = 1$ so that $\ln e_k = \sigma_k \ln e$.

Returning to the awaiting correction issue of e_k , a modifying function $m(\mathbf{z}) \in \left(0, \frac{e}{e_k}\right)$ is used to correct any measurement error related to e_k which leads to the specification of the sharing rule. The arguments of this function are distribution factors \mathbf{z} which affect the intrahousehold bargaining between adults and children but not their preferences⁶. The m -function can optionally be thought to capture the magnitude and direction of transfer of resources from adults to children or vice versa (Menon et al., 2018): if $m < 1$, the expenditure transfer goes from member 1 (adult) to member 2 (child) and the direction is reversed if $m > 1$.

This enables us to define the sharing rule, which explains a shadow intrahousehold resource allocation, as a function of individual expenditures and distribution factors, i.e., for member 1 (adult), we have $\phi_1(e_1, \mathbf{z}) = e_1 \cdot m(\mathbf{z})$ which in log becomes linear as⁷

$$\ln \phi_1(e_1, \mathbf{z}) = \ln e_1 + \ln m(\mathbf{z}) = \sigma_1 \ln e + \ln m(\mathbf{z}). \quad (3)$$

Since by definition $\ln e = \ln \phi_1 + \ln \phi_2 = \ln e_1 + \ln e_2$, we have the sharing rule for member 2 (child) equal to

$$\ln \phi_2(e_2, \mathbf{z}) = \ln e - \ln \phi_1 = \sigma_2 \ln e - \ln m(\mathbf{z}). \quad (4)$$

The functional form of the scaling function $m(\mathbf{z})$ is assumed to be of Cobb-Douglas type for empirical purposes so that in log form, it becomes linear as:

$$\ln m(\mathbf{z}) = \sum_{l=1}^L \phi_{z_l} \ln z_l \quad (5)$$

where L is the dimension of distribution factors vector \mathbf{z} .

The introduction of the expenditure-scaling function $m(\mathbf{z})$, and consequently the sharing rule, has the effect of modifying the system specified in equation 1 into

$$w_i = \alpha_i + t_i(\mathbf{d}) + \sum_j \gamma_{ij} \ln p_j + \beta_i^1 [\ln \phi_1^* - \ln A_1(\mathbf{p})] + \lambda_i^1 \frac{[\ln \phi_1^* - \ln A_1(\mathbf{p})]^2}{B_1(\mathbf{p})} \\ + \beta_i^2 [\ln \phi_2^* - \ln A_2(\mathbf{p})] + \lambda_i^2 \frac{[\ln \phi_2^* - \ln A_2(\mathbf{p})]^2}{B_2(\mathbf{p})}$$

⁶ Note that the scaling function does not depend on expenditures, a separability property in line with the theoretical properties of independence of income of the sharing rule by Dunbar et al. (2013) and Chavas et al. (2017) and the empirical validation by Menon, Pendakur, & Perali (2012).

⁷ Since ϕ_k should not exhaust all household total expenditures e , i.e., $\phi_k < e$, the m -function is restricted to stay between 0 and $\frac{e}{e_k}$.

where, from equation 2, 3 and 4, $\ln\phi_1^*$ and $\ln\phi_2^*$ are given by $\ln\phi_1^* = \sigma_1 \ln e + \ln m(\mathbf{z}) - \sum_i t_i(\mathbf{d}) \ln p_i$ and $\ln\phi_2^* = \sigma_2 \ln e - \ln m(\mathbf{z}) - \sum_i t_i(\mathbf{d}) \ln p_i$. In our empirical application, we fit to our data the linear version of the above model where the quadratic terms λ_i^1 and λ_i^2 are not estimated.

2.2. Empirical Estimation and Post-estimation Issues

Endogeneity of Total Expenditure

We address the endogeneity of total expenditure primarily due to measurement errors by instrumenting total expenditure using wealth indicators as an instrument⁸. However, wealth may still be mismeasured as a result, for example, of omission or incorrect valuation of its components. As far as these mismeasurements are independent of consumption recall errors and if wealth is correlated with true total expenditures, our proposed instrument remains valid (Dunbar et al., 2013). A control function procedure is used, which uses as regressors the residuals of an auxiliary regression of total expenditure on a set of socio-demographic variables and our instrument into the demand system model (Dauphin, El Lahga, Fortin, & Lacroix, 2011; Lucia Mangiavacchi et al., 2018; Mukasa, 2015). The procedure is executed in two steps: the log of total expenditure $\ln e$ is first estimated using OLS on a vector η of socio-demographic variables and the instrument as $\ln e = \eta \cdot \delta + v$ and then the residual $\hat{v} = \ln e - \eta \cdot \delta$ enters in the estimation of the demand system.

This gives the CAIDS model in budget shares as

$$w_i = \alpha_i + t_i(\mathbf{d}) + \sum_j \gamma_{ij} \ln p_j + \beta_i^1 [\ln\phi_1^* - \ln A_1(\mathbf{p})] \\ + \beta_i^2 [\ln\phi_2^* - \ln A_2(\mathbf{p})] + \rho_i \hat{v} + \xi_i$$

where ρ_i captures any endogeneity of total expenditure, and ξ_i is the error term.

The system is finally estimated using feasible generalized nonlinear least squares method and imposing the QAIDS standard regulatory conditions: adding-up ($\sum_i \alpha_i = 1$), homogeneity ($\sum_i \gamma_{ij} = \sum_j \gamma_{ij} = 0$, $\sum_i \tau_{ir} = 0$ and $\sum_i \beta_i^k = 0$ for each $k=1,2$) and symmetry ($\gamma_{ij} = \gamma_{ji}$, $\forall i \neq j$). Our empirical exercise estimates the model for two sub-samples of families with children: married male-headed and single female-headed families. The basic motivation behind our choice of the two sub-samples is the assumption that children may be treated differently in the two family structures, and hence their bargaining power and welfare may vary⁹.

⁸ We also note that prices too may potentially be endogenous due, for example, to common unobserved shifts in preferences affecting both prices and quantities. However, the lack of plausible instruments for a host of prices leads us to assume that they are exogenous. In fact, we are not alone in this respect (see, for instance, Dauphin, Lahga, Fortin, & Lacroix (2011) and Lucia Mangiavacchi & Piccoli (2011) which consider endogeneity of total expenditure but assume exogeneity of prices).

⁹ Estimating a single model merging married male-headed and married female-headed together suffers from very low sample sizes for the latter. For drawing better gender-based comparisons, we exclude married female-headed and single male-headed households, both of which are very negligible. Hence, we separately estimate for married male-headed and for single-mother families with children. This is also due to the fact that some of our distribution factors account for parental (wife-husband) differences in age and education which cannot be defined for single-mothers. Bargain et al. (2014) do similarly in their alternative estimations.

Post-estimation Issues

Once the estimated resources of adults ϕ_1^* and children ϕ_2^* are recovered, aggregate resource shares S_k are given by

$$S_k = \frac{\phi_k^*}{e}, \quad k = 1, 2$$

where e is total household expenditure. Per-child and per-adult resources r_k and resource shares s_k are given by

$$r_k = \frac{\phi_k^*}{h_k} \quad \text{and} \quad s_k = \frac{S_k}{h_k}$$

where h_k is the number of adults or children.

The identification of resource shares allows us the measurement of poverty and inequality at individual level. Unlike the traditional method, which relies on counting of families with children living below the poverty line to identify children as poor, this new method provides the “true” poverty of children. It also provides better estimation of the depth and severity of poverty. In the empirical estimation, we consider the national poverty line that is based on the Cost of Basic Needs approach and takes into account both food and non-food needs. Two types of poverty estimates are computed for each index: one group based on estimated resources r_k for children and adults, which take into account the intrahousehold resource allocation, and another based on equal-sharing expenditures y at the household level (adult-equivalents in our case). Haddad & Kanbur (1990) proved that poverty measures which ignore intrahousehold allocation understate the level of poverty.

Consider two expenditure gap functions, $g(r_k, z)$ convex in estimated individual resources r_k and $g(y, z)$ convex in household level expenditures y , defined as

$$g(r_k, z) = \begin{cases} \left(\frac{z - r_k}{z}\right)^\alpha, & r_k \leq z \\ 0, & r_k > z \end{cases} \quad \text{and} \quad g(y, z) = \begin{cases} \left(\frac{z - y}{z}\right)^\alpha, & y \leq z \\ 0, & y > z \end{cases}$$

where z is poverty line. α is a measure of poverty aversion. When $\alpha = 0$, the function g measures headcount. $\alpha = 1$ implies depth, and $\alpha = 2$ indicates severity of poverty. Note also that it is only when $\alpha \geq 1$ that $g(r_k, z)$ and $g(y, z)$ become convex in r_k and y respectively. Hence, the FGT (Foster, Greer, & Thorbecke, 1984) poverty indices based on individual resources r_k and adult-equivalent household level expenditure y are given by

$$P_{\alpha k}(r_k, z) = \frac{1}{N} \sum_{n=1}^N g(r_k, z) \quad \text{and} \quad P_\alpha(y, z) = \frac{1}{N} \sum_{n=1}^N g(y, z)$$

where $n = 1, 2, \dots, N$ is the number of households with children. For convex $g(r_k, z)$ and $g(y, z)$ (i.e., $\alpha = 1, 2$), Haddad & Kanbur (1990) show that $P_{1k}(r_k, z) > P_1(y, z)$ and $P_{2k}(r_k, z) >$

$P_2(y, z)$. These say that both poverty depth and severity measures that ignore intrahousehold resource allocation understate the level of poverty. Nonetheless, where convexity fails (i.e., $\alpha = 0$), Haddad & Kanbur (1990) argue that $P_{0k}(r_k, z) \geq P_0(y, z)$, implying a headcount ratio with no account of intrahousehold resource allocation can overstate or understate poverty and is an empirical matter. Later, we will verify these hypotheses using data from Ethiopia.

3. Ethiopian Expenditure Data

Data for the study come from the 2013/14 wave of Ethiopia Socioeconomic Survey (ESS) collected jointly by the World Bank and the Central Statistical Agency of Ethiopia (CSA) as part of the Living Standard Measurement Study-Integrated Surveys of Agriculture (LSMS-ISA). ESS is a panel survey with three waves to date (2011/12, 2013/14 and 2015/16). While the sample design of the first wave provides representative estimates for rural-area and small-town households, subsequent waves include medium and large towns and cities so that they have become nationally representative. It uses a stratified, two-stage design where regions of Ethiopia serve as the strata. The first stage involves the selection of primary sampling units (or enumeration areas) using simple random sampling. The second stage of sampling entails the selection of households. ESS contains household-level data on a range of modules including expenditure, assets, shocks, non-farm enterprises, credit and farm production. Individual data on demographics, education, health, some expenditure items and time use are also collected. Moreover, community-level data as well as data on prices from local markets are available. However, in addition to being a rural-only survey, the 2011/12 wave lacks expenditure data on education, health, housing, and food away from home. Lack of price data on assignable clothing and other goods such as education and personal care also forced us to exclude the 2015/16 wave.

The 2013/14 wave collected data from 5,262 households. ESS does not collect expenditures on durable goods except on furniture. Only information on the number of ownerships of more than 35 assets is gathered. A wealth index from these assets is used to instrument total household expenditure. Individual-level labor incomes and household-level income from various non-labor sources, transfers and non-farm enterprises are aggregated with farm income that is extracted from the production, sales, home consumption and associated costs of various crops, livestock and their by-products. The wealth index aggregate of the ESS dataset by FAO's Rural Income Generating Activities (RIGA) project is used in this study.

We aggregate the non-durable expenditure items into four expenditure groups: food at home and alcohol, clothing, household utilities and energy, and other goods. The details are available in Table A1 of the Appendix. The food and alcohol expenditure group is aggregated from 26 food items and a sub-group of alcoholic drinks. The second group, clothing, is composed of non-assignable linen as well as assignable clothes, shoes and fabric for men, women, boys and girls. The third expenditure group consists of household utilities and energy¹⁰. All other non-durable expenditures are aggregated in the fourth group, other goods, composed of spending on education, food away from home, cigarettes, transport, and laundry and personal care.

¹⁰ We exclude housing rents because only 13% of households with children reported rents and no housing prices are available. Given that over 70% of our sample are of rural households and over 92% have their own home so that they do not pay rents, this assumption of equal treatment of rents will not pose a serious problem. The associated welfare differences could be captured by differences in spending on household utilities including energy.

Prices data come in various forms. For food at home items, we calculate unit values from expenditure and quantity information. For most non-food items, local market prices collected in ESS price questionnaire are employed. For alcoholic drinks, food away from home and for non-food items whose prices are missing in ESS (namely, water, electricity, communication, education, personal care items, matches, and assignable and non-assignable clothing), we resort to the 2013/14 CSA's average retail prices. We first aggregate them up to the *zonal* (provincial) level and then match them to the ESS data.

From a total of 5,262 households, we select 3,196 families with children, composed of two sub-samples: two-parent male-headed (2,467 households) and single-parent female-headed (729 households). Exclusive/assignable consumption is based on a host of non-durable expenditure items. Clothing and footwear expenditures, collected at men, women, girl and boy levels as well as education expenditures, collected at individual level, are clearly assignable. Further, we assign expenditures on alcoholic drinks, stimulants (*chat/khat* and cigarettes) and some personal care items to adults.

Table 1 presents the demographic variables and socioeconomic characteristics by family type and for the whole sample. We consider demographic variables referring to the household in general and its members (head and children) in particular. If the head sick and Christian (Muslim and other religions being the reference category) capture the head's characteristics. The number of children who fell sick and, to account for the age factor, the number of older children (aged between 15 and 17) are incorporated to control for children's attributes. Two household level characteristics are used to control for economic status: female employment ratio (working females over household total labor of 14-60 years) and if the household has safe water source. Presence of other adults than parents is also controlled. Whether seasonal differences matter is captured by a dummy if the household was interviewed in February. Exposures to price shock and natural shocks are also accounted for. Finally, spatial differences in demand are controlled by incorporating dummies for rural areas as well as five regions (Amhara, Oromia, SNNP, Tigray and Other regions), with living in the capital, Addis Ababa, being the reference category.

71% of the overall sample households live in rural areas, reaching 75% for the male-headed and 55% for single-mother families. A fifth of them are drawn from each of Amhara region, Oromia region and other smaller regions, a quarter from the SNNP region, a tenth from Tigray and the rest from Addis Ababa. Both family types statistically differ in almost all of the demographic variables considered. Notably, average household size in married male-headed families is 5.8, of whom 3.3 (57%) are children, while these figures are 4.0 and 2.1 (53%) in single-mother families. For the total sample, children account for 56% of the 5.4 family size. The latest available census shows that children constitute over 52% of the population in Ethiopia.

Table 1: Demographic and socioeconomic characteristics of the sample

Variable	Male-headed family (N = 2467)		Single-mother family (N = 729)		Whole sample (N = 3196)	
	Mean	S.d.	Mean	S.d.	Mean	S.d.
Head is Christian	0.65***	0.48	0.74	0.44	0.67	0.47
Head sick	0.20***	0.40	0.38	0.49	0.24	0.43
Number of sick children	0.50***	0.91	0.28	0.61	0.45	0.85
A stunted child in household	0.31***	0.46	0.12	0.32	0.26	0.44
Number of children aged 15-17y	0.39**	0.59	0.47	0.59	0.41	0.59
Female employment ratio	0.51***	0.16	0.65	0.34	0.54	0.22
Another adult in household	0.32**	0.47	0.37	0.48	0.33	0.47
Household has safe water source	0.67***	0.47	0.79	0.41	0.70	0.46
Household interviewed in February	0.90*	0.30	0.87	0.33	0.89	0.31
Household faced price shock	0.18***	0.39	0.23	0.42	0.19	0.39
Household faced natural disaster shock	0.15	0.36	0.13	0.33	0.14	0.35
Household size	5.78***	1.97	3.96	1.76	5.36	2.07
Number of children	3.28***	1.71	2.05	1.27	3.00	1.70
Wealth index	1.17*	3.27	0.93	3.73	1.12	3.38
Household lives in rural area	0.75***	0.43	0.55	0.50	0.71	0.46
Household lives in Addis Ababa	0.03***	0.17	0.07	0.26	0.04	0.20
Household lives in Amhara region	0.19*	0.39	0.22	0.42	0.20	0.40
Household lives in Oromia region	0.21**	0.41	0.16	0.37	0.20	0.40
Household lives in SNNP region	0.26***	0.44	0.19	0.39	0.24	0.43
Household lives in Tigray region	0.10***	0.30	0.19	0.39	0.12	0.33
Household lives in other regions	0.21***	0.41	0.16	0.37	0.20	0.40

*Notes: *, ** & *** show significance in the mean difference of variables in both family types at 10%, 5% & 1% levels, respectively. For regional dummies, the excluded category in regressions is living in the capital, Addis Ababa. SNNP=Southern Nations, Nationalities and Peoples.*

As shown in Table 2, most household resources (about 70 percent in male-headed and 65 percent in single-mother households) are spent on food at home and alcohol. However, compared to the male-headed, single-mother families spend a little higher share on non-necessities (household utilities and energy and other goods). Moreover, t-test results for mean differences in observed resource and shares of each child and adult exhibit statistical differences in both family types.

We use six distribution factors to capture the rule governing bargaining between children and their parents: education and age differences between wife and husband (only for the male-headed subsample), if all children are in school, proportion of female children, proportion of women, and number of non-biological children. Distribution factors do not affect preferences but do influence bargaining power. Education and age differences or ratios of couples are quite popular determinants of intrahousehold resource allocation (Chavas et al., 2017; Dercon & Krishnan, 2000; Menon et al., 2018). To capture the role played by gender in intrahousehold resource allocation, we use two ratios - proportions of female children and female adults, the first of which is also employed by Mangiavacchi & Piccoli (2017). We also consider as exogenous the number of

extended or non-biological children which may also affect bargaining power in the household without affecting consumption choices.

Table 2: Expenditures, prices and distribution factors

Variable	Male-headed family (N = 2467)			Single-mother family (N = 729)			Whole sample (N = 3196)	
	Zero%	Mean	S.d.	Zero%	Mean	S.d.	Mean	S.d.
<i>Expenditures, shares and prices</i>								
Food	0.08	0.69***	0.15	0.28	0.66	0.17	0.68	0.16
Clothing	3.66	0.11***	0.04	9.66 ^c	0.09	0.04	0.10	0.04
Utilities	0.91	0.07***	0.07	1.99	0.10	0.09	0.08	0.08
Other goods	0.54	0.13***	0.12	1.00	0.16	0.14	0.14	0.13
Log of food prices		2.56***	0.67		2.41	0.71	2.52	0.68
Log of clothing prices		5.25***	0.13		5.21	0.14	5.24	0.13
Log of utilities prices		2.35**	1.73		2.13	1.79	2.30	1.74
Log of other goods prices		3.28***	0.56		3.44	0.58	3.31	0.57
<i>Expenditure and member shares</i>								
Log of total expenditure		7.51***	0.70		7.22	0.73	7.44	0.72
Share of assignables		0.16***	0.09		0.13	0.07	0.16	0.09
Observed share: children		0.50	0.14		0.50	0.16	0.50	0.15
Each child's share		0.18***	0.07		0.29	0.12	0.21	0.10
Observed share: adults		0.50	0.14		0.50	0.16	0.50	0.15
Each adult's share		0.21***	0.07		0.31	0.13	0.24	0.10
<i>Distribution factors</i>								
Education diff. of parents (w - h) ^a		-1.29	3.19		-	-	-	-
Age diff. of parents (w - h) ^a		-8.48	6.48		-	-	-	-
All children in school***		0.61***	0.49		0.70	0.46	0.63	0.48
Proportion of female children		0.51	0.33		0.52	0.41	0.52	0.35
Proportion of adult women***		0.49***	0.10		0.84	0.23	0.57	0.21
Number of non-biological children***		0.19***	0.48		0.82	1.11	0.33	0.73

Notes: ^aNot used in model estimation in single-mother sub-sample. *, ** & *** show significance in the mean difference of variables in both family types at 10%, 5% & 1% levels, respectively.

For married male-headed households, the husband on the average has 1.3 more years of education than his wife, which could reach up to 15 years. There is also a substantial age gap between couples, the wife being 8.5 years younger on average, and ranging between 40 years younger and 25 years older¹¹. In over 70 percent of single-mother households, school-age children attend school which is significantly higher than in male-headed households (60 percent). While the proportion of girls and boys is almost balanced in both family types, single-mother families have more adult women. Moreover, not all children live with their biological parents: as many as four and eight children in male-headed and single-mother households are non-biological, respectively. These

¹¹ This is not surprising as women in Sub-Saharan Africa typically marry older men, with a median age difference of 7 years (UN Population Division, 2001, *World Marriage Patterns*, New York). Bargain et al. (2014) also find for Cote d'Ivoire that the mean difference ranges between 8.2 to 8.7 depending on the number of children.

distribution factors are proposed to play a role in the resource allocation between children and their parents.

4. Results and Discussion

This section presents the results of our estimations. After briefly presenting results from the demand system estimations, we present and discuss estimates on child resource shares and poverty. Analyses are also made disaggregating the estimates by the number of children and location.

4.1. Demand System Estimation Results

We estimate two collective AIDS models: a quadratic version for married male-headed households and a linear version for single female-headed households. These specifications are dictated by the graphical analyses of the Engel curves (Figure A1) and estimation results are summarized in Table A3 in the Appendix. In addition to having the expected sign, the majority of price- and expenditure-related parameters are significantly different from zero at conventional levels. Control parameters capturing endogeneity of total expenditure are significant in three-fourths of both sub-sample regressions indicating the importance of instrumenting total expenditures. Results of the regression of log of total expenditure on the wealth index instrument and other variables, whose residuals enter in the demand systems regressions for our controlling exercise, are summarized in Table A2 in the Appendix.

Some significant non-spatial demographic effects on non-durable consumption are observed. For example, religion plays a role where families headed by a Christian male, relative to Muslims and other believers, have lower spending on food and alcohol but higher on household utilities and energy. While the sickness of the head increases food budget and reduces clothing, a greater number of sick children does the opposite. Both family types with more older children (15 to 17 years) as well as other adults have higher clothing demands. Households hit by price shocks reduce consumption of food and alcohol and increase that of other goods. Regarding spatial effects, there exist significant differences in demand across regions. As expected, compared to living in the capital city, living in less urbanized regions of Amhara, Oromia, SNNP and other smaller regions is associated with higher food expenditure shares and lower shares for utilities and energy and other goods categories.

The associated income and prices elasticities are also estimated (Table A4 of the Appendix). The signs are in line with economic theory. Both children and adults reveal almost similar income elasticity patterns: inelastic for food and clothing, almost unitary for utilities and elastic for other goods. Adults have more elasticity than children towards clothing and utilities. In line with consumption theory, all own-price elasticities (uncompensated and compensated) are also negative. In particular, own-price effects indicate that, with the exception of the other goods category, which is elastic, all categories are inelastic. The compensated cross-price elasticities generally suggest substitutability: the food and alcohol category is a significant substitute for the clothing category and the other goods category, and the latter are substitutes for the remaining categories in traditional families.

The estimated coefficients of the sharing function are presented in Table 3. Five out of six distribution factors in married male-headed and two out of four in single female-headed families significantly affect the bargaining power between children and adults. The gap in the education

difference between parents (wife minus husband) positively and significantly affects adults' sharing rule, against the expectation that educated mothers, relative to fathers, are more altruistic towards their children. In contrast, Dunbar et al. (2013) find that higher mother's education is associated with higher bargaining power (resource shares) for both children and women in Malawi. The negative coefficient of the difference in age between the wife and the husband also implies that older mothers tend to allocate more resources to children.

Table 3: Coefficients of the sharing rule's expenditure scaling m -function

Variable	Male-headed family	Single-mother family
Education difference (wife-husband)	0.187 (0.037)***	-
Age difference (wife-husband)	-0.069 (0.015)***	-
All children in school	-0.324 (0.166)*	1.200 (0.504)**
Percentage of female children	-0.409 (0.228)*	-0.181 (0.327)
Percentage of adult women	1.188 (0.862)	3.178 (2.940)***
Number of non-biological children	0.291 (0.145)**	0.120 (0.122)

*Notes: *, ** & *** show significance at 10%, 5% & 1% levels respectively. Standard errors, corrected for clustering and sampling weights, are in parentheses.*

When all children are in school, the relative resource share of children are higher in male-headed families though this effect is reversed in single-mother families. On the other hand, parents with more female children keep less resources to themselves, as shown by the negative coefficient attached to the proportion of female children, also suggesting discrimination against boys as documented in other works (Deaton, 1989; Dunbar et al., 2013; Gibson & Rozelle, 2004). This distribution factor is not significant in single-parent families. A higher proportion of adult women reduces children's sharing rule. Lastly, the number of non-biological children living in the family reduces the resource share of children in both family types though it is not statistically significant in single-mother households. This is in line with discrimination by adults against children who are not their own biological daughters or sons. These findings have important policy implications such as in income transfer programmes targeted at child poverty because their effectiveness is largely conditional on parental altruism (Bhalotra, 2004).

4.2. Children's Resources and Poverty

4.2.1. Children's Resources

The estimated resource shares generally reveal significant inequalities in intrahousehold resource allocation (Table 4). In aggregate terms, children command slightly less resources (48% of total expenditure in the whole sample, 47% in male-headed and 49% in single-mother families). These are not of course surprising, given that children constitute 55%, 56%, 53% in the total sample, male-headed and single-mother households respectively. Recall that the observed aggregate shares indicate equal allocations between children and adults in all family structures.

Table 4: Means of estimated resources and shares by family type

	Male-headed	Single-mother	Whole sample
Total expenditure (ETB) (e)	2221 (53.04)	1664 (87.82)	2115 (46.33)
Resource in ETB:			
Children's resources (ϕ_2)	1033 (28.02)***	804 (56.76)***	989 (25.18)
Each child	339 (8.87)***	433 (20.00)***	357 (8.37)
Adults' resources (ϕ_1)	1188 (35.38)***	860 (44.23)***	1126 (30.01)
Each adult	491 (14.82)	457 (19.70)	485 (12.57)
Resource shares:			
Children's resource share ($S_2 = \phi_2/e$)	0.47 (0.005)*	0.49 (0.008)*	0.48 (0.005)
Each child ($r_2 = S_2/h_2$)	0.16 (0.002)***	0.30 (0.007)***	0.19 (0.002)
Adults' resource share ($S_1 = \phi_1/e$)	0.53 (0.005)*	0.51 (0.008)*	0.52 (0.005)
Each adult ($r_1 = S_1/h_1$)	0.23 (0.003)***	0.32 (0.007)***	0.24 (0.003)

Notes: *** & * show significance of mean difference in male-headed and single-mother sub-samples at 1% & 10% levels respectively. ETB=Ethiopian Birr; 1 ETB=0.0524 US\$ (2013/14 Avg.) (NBE). All observations are weighted to make estimates nationally representative. Standard errors, corrected for clustering and sampling weights, are in parentheses.

The distributions of children's and adults' resource shares are shown in Figure A2 in the Appendix. For the entire of the expenditure distribution, the trends in the shares are generally similar. The finding of almost horizontal curves goes in line with our identification restriction that the sharing rule is not affected by total household expenditure.

Aggregate child and adult resource shares are affected by the number of children and adults and hence are less informative. As a result, we need to consider the average per-child resource shares in households of different sizes. Intrahousehold inequalities between children and adults widen when one considers average per-member shares. In the whole sample, while each child claims less than a fifth of household resources, each adult gets about a quarter. Not only a child in single-mother families (30%) commands more resources than that in male-headed families (16%) but also the gap between children and adults is lower in the former than in the latter. This finding is in line with that elsewhere in Africa. Bargain et al. (2014) find for Cote d'Ivoire that in single-mother families, children get higher share of household resources (31%) than in two-parent families (23%), which are likely to be male-headed. As expected, families headed by unmarried females have lower total household expenditure (1,664 ETB) than those headed by married males (2221 ETB). However, single-mothers spend more for each child (433 ETB per month) than male-headed couples (339 ETB per month) suggesting that female heads are more altruistic to their children than male heads.

4.2.2. Child Poverty

While resource shares provide information on who gets what from the household's cake, they do not tell whether the allocated cake to each member is enough to satisfy their needs. A step computing member's welfare and any intrahousehold disparity therein is needed. For instance, in

addition to analyzing poverty among children, one can assess any existing inequality between child and adult poverty.

We use the estimated per-member resources to compute FGT rates of poverty incidence, gap and severity among children and adults for both family types and the whole sample of households with children. For comparison, rates are also computed based on adult-equivalent (equivalent scale) expenditures where resources are assumed to be shared equally among members. The poverty threshold considered is the (official) national poverty line computed using the Cost of Basic Needs approach¹². Results are presented in Table 5. Note that the new approach of employing estimated resources in poverty measurement provides us with more disaggregations in the indices compared to the traditional approach (shown here by extra rows of estimates for children and adults)¹³.

Table 5: Poverty measures based on new method and traditional approaches (%)

	Male-headed families		Single-mother families		Whole sample	
	New Method (1)	Household level (2)	New Method (3)	Household level (4)	New Method (5)	Household level (6)
Child poverty headcount	83.8***		72.9***		81.7	
Adult poverty headcount	70.2	66.5 ^u	69.7	61.2 ^u	70.1	65.5 ^u
Child poverty gap rate	45.9***		33.0***		43.4	
Adult poverty gap rate	32.3***	27.8 ^u	28.2***	22.7 ^u	31.5	26.8 ^u
Child poverty severity	29.6***		18.8***		27.6	
Adult poverty severity	18.4***	14.6 ^u	14.4***	11.2 ^u	17.6	14.0 ^u

*Notes: *, ** & *** show significance of mean difference of poverty rates (based on estimated resources) between male-headed and single-mother sub-samples at 10%, 5% & 1% levels respectively. ^u shows household level or equal sharing-based poverty rates are less (or understate poverty) than estimated resources-based rates at 1%. MoFED (2012)'s 2010/11 CBN-based national poverty line, adjusted for inflation, is considered. All observations are weighted to make estimates nationally representative.*

Firstly, one can notice from columns 1, 3 and 5 that indicators of poverty incidence, gap and severity are higher for children than for adults. In the whole sample, about 84% of children live below the national poverty line, lower at 70% among adults¹⁴. Such gaps between child and adult poverty incidence also exist in both family types though the one in single mothers is lower. This

¹² We use the national poverty line (MoFED, 2012) which is used to target the poor in the country and it is based on the needs. In 2010/11, the poverty line was 315 ETB/person/month (3781 ETB/person/year) and after adjusting for inflation, it becomes 501 ETB/person/month for 2013/14.

¹³ We do not need to make a fixed adjustment to the poverty line to consider the lower needs of children such as the OECD scale. Our estimation of the intrahousehold resource allocation is such that a fair distribution of goods not assigned to members is corrected by our expenditure-scaling function (Chavas et al., 2017) whose estimates were presented in the previous section. Note also that Bargain et al. (2014) question the relevance of the OECD scale to adjusting child poverty lines.

¹⁴ Care must be exercised in taking these figures. The 2013/14 round of the ESS considers a select of consumer goods, missing certain food aggregates. The poverty estimates here primarily aim to show the application of resource shares as an alternative method to the traditional methods, and hence they cannot easily be compared with other estimates such as those in MoFED (2012).

finding strengthens the previous evidence of intrahousehold inequality in resource allocation. Secondly, the incidence, depth and severity of poverty among children in male-headed families are significantly higher than those in female-headed families. Thirdly, in all cases, our estimated resources count more poor children (and adults) than what household level or equal-sharing methods do; and the same is true for higher child poverty measures (compare estimates in columns 1, 3 and 5 correspondingly with those in columns 2, 4 and 6). All the differences are statistically significant at the 1% level. This shows that the traditional approach of measuring poverty based on equal resource sharing, which ignores intrahousehold distribution among members, understates poverty situation. We thus find in our data the hypotheses of Haddad & Kanbur (1990). Recent collective consumption model studies also document similar conclusions from other sub-Saharan Africa countries although their analyses are restricted only to the poverty headcount ratio. Dunbar et al. (2013) on Malawi and Bargain et al. (2014) on Cote d'Ivoire find that standard poverty indices understate the incidence of child poverty.

Table 6: Child poverty headcount rates (%) by number of children

	One child	Two children	Three children	Four children	Over four children	Overall
Male-headed households:						
Poverty rate: child	65.5	78.8	87.2	87.5	92.9	83.8***
Poverty rate: adult	47.4***	61.5**	71.0	78.8	84.1	70.2
Poverty rate: household level	41.1**	57.5**	68.3	72.2	83.4	66.5***
Single-mother households:						
Poverty rate: child	64.1	76.7	78.1	86.5	92.7	72.9***
Poverty rate: adult	62.5***	71.7**	76.5	81.1	86.5	69.7
Poverty rate: household level	53.2**	67.3**	63.6	66.4	79.1	61.2***
Whole sample:						
Poverty rate: child	64.9	78.3	86.2	87.4	92.9	81.7
Poverty rate: adult	53.9	64.1	71.6	79.0	84.2	70.1
Poverty rate: household level	46.3	60.0	67.7	71.6	83.2	65.5

*Notes: *, ** & *** show significance of poverty difference between male-headed and single-mother sub-samples at 10%, 5% & 1% levels respectively. All observations are weighted to make estimates nationally representative.*

One may also be interested to see what sacrifices parents and/or children must pay when more children join the family. Table 6 summarizes poverty headcount estimates by the number of children.¹⁵ As expected, child poverty increases with the number of children in the household. In

¹⁵ We are aware that modeling multi-children and multi-adult households is challenged by economies of scale. For instance, children may share clothing, books, etc. thereby underestimating child resource shares and overestimating poverty among larger families. Our current estimations cannot consider this and it remains a limitation of the paper. In fact, the issue of joint consumption by children is a limitation of collective consumption models to date (Bargain et al., 2014; Lucia Mangiavacchi et al., 2018) and forms a future research agenda. Some prefer to use a very restrictive sample such as households with just one child (Chavas et al., 2017) or separate estimations by size

the whole sample of families with children, the incidence of child poverty increases from 65% when there is only one child to 93% when families host more than four children within the family. Dunbar et al. (2013) also find similar positive relationship between child poverty and number of children. Similar trends are observed in both family structures. However, the previous finding that children in single-mother families are less likely to be poor than those in male-headed couples no more stays when disaggregated by the number of children. No difference in child poverty incidence rates is statistically significant except the overall rate. On the other hand, like in the overall case, poverty among children consistently remains worse than that among adults though the gap falls with an increase in the number of children.

4.2.3. Overlap between Child Poverty, Household Poverty and Undernutrition

A further benefit of the new method to child poverty estimation using resource shares is that it helps to look at the existing overlap between the poverty of children, adults and other members. What proportion of poor children live with non-poor adults? What portion of poor children live in non-poor households? Do these differ when the head is a female? We also provide evidence on the overlap between child undernutrition and monetary poverty at child, adult, and household levels.

Table 7: Overlaps between child, adult and household poverty by family type

		Male-headed families				Single-mother families				Whole sample			
		Adult is poor		HH is poor		Adult is poor		HH is poor		Adult is poor		HH is poor	
		Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Child is poor	Yes	0.67 (0.013)	0.17 (0.011)	0.66 (0.013)	0.18 (0.011)	0.65 (0.024)	0.08 (0.014)	0.60 (0.025)	0.13 (0.017)	0.67 (0.011)	0.15 (0.009)	0.67 (0.011)	0.17 (0.009)
	No	0.03 (0.005)	0.13 (0.008)	0.00 (0.002)	0.16 (0.009)	0.05 (0.009)	0.22 (0.020)	0.01 (0.004)	0.26 (0.021)	0.04 (0.004)	0.15 (0.008)	0.01 (0.002)	0.18 (0.009)
Status match*		0.80		0.82		0.87		0.86		0.82		0.83	
Poor in all		0.63 (0.013)				0.59 (0.025)				0.62 (0.012)			

*Notes: *Status match implies the proportion of children with similar status in two measures. All estimates are weighted to make them representative of the corresponding population. Standard errors in parentheses.*

Table 7 summarizes the estimates of the overlap between child-, adult- and household-level poverty by family structure. Two-thirds of poor children live with poor adults or households in general, irrespective of family structure. However, the proportion of poor children living with non-poor adults is non-negligible: 15 percent in the whole sample. Far less portion of poor children live with non-poor adults in female-headed families (8 percent) than in male-headed ones (17 percent), supporting our previous evidence that single mothers in general are more equal to their children than male-heads. Note that these estimates only slightly change when child poverty is allowed to overlap with household poverty. Our estimates also show that the match in poverty status of children and either of adults or households in general ranges between 80 to 87 percent

(Bargain et al., 2014). While we provide results for families with one child as well as with two, three, four, and over four children, the estimates should be taken with caution.

depending on the family type and comparison group considered. Moreover, only about 60 percent of poor children reside with a poor adult and in a poor household which is slightly higher in male-headed households.

Table 8 provides further evidence on other overlaps for the whole sample, this time the overlap of child stunting with child poverty, adult poverty and household poverty where stunting here refers to prevalence of any under-7 child who is stunted. Two interesting results stand out. First, undernourished children still exist in monetarily non-poor households which is also consistent with recent findings across Africa (Brown et al., 2017). Second, the prevalence of undernourished children decreases from 9%, 6%, and to 3% as one changes the child stunting overlap with the poverty of the household, adults, and children, respectively.

These evidences lend support to the burgeoning literature on the role of inequality in intrahousehold resource allocation on household member's welfare (Bargain et al., 2014; Dunbar et al., 2013; Haddad & Kanbur, 1990). In particular, it adds to the rejection of the widely held view that poor children live with/ in poor adults/ households (Brown, Calvi, & Penglase, 2018; Brown et al., 2017). From a policy perspective, it questions the effectiveness of targeting poor households for a social protection aiming at improving child welfare.

Table 8: Overlaps between child undernutrition and poverty of children, adults, and the household

		Child poverty		Adult poverty		Household poverty	
		Poor	Non-poor	Poor	Non-poor	Poor	Non-poor
		(1)	(2)	(3)	(4)	(5)	(6)
Any child stunted	Stunted	0.24 (0.010)	0.03 (0.004)	0.21 (0.010)	0.06 (0.005)	0.19 (0.009)	0.09 (0.006)
	Not stunted	0.58 (0.012)	0.15 (0.008)	0.50 (0.012)	0.24 (0.010)	0.47 (0.012)	0.26 (0.010)
Status match*		0.39		0.45		0.45	

*Notes: *Status match implies the proportion of children with similar status in two measures. All estimates are weighted to make them representative of the corresponding population. Standard errors in parentheses.*

4.2.4. Spatial Distribution of Child Resource Shares and Poverty

Answering the question of where on the map children make the most/least decisions on home resources and locating poor children aid policymakers interested on the issue. Hence, average resource share and poverty estimates are disaggregated by region and place of residence (rural, small towns, and medium and large towns)¹⁶. Looking at the average resource share estimates, three findings stand out (Table 9). Firstly, in line with our previous finding, a child has less resource share than an adult across regions and rural/urban residence. Secondly, a child's resource share shows no systematic relationship with urbanization (Figure A3 in the Appendix). Average per-adult expenditure shares vary across regions between 20% and 26% in the whole sample.

¹⁶ Based on the 2007 Population Census, the ESS defines a small-sized town as one with population of less than 10,000; medium-sized between 10,000 and 100,000 and big-sized greater than 100,000.

Thirdly, across all regions and residence types, single-mother families significantly allocate more resources to children compared with male-headed families.

Table 9: Spatial distribution of resource shares and poverty headcount rate (%)

	Regions						Rural/urban		
	Addis Ababa	Amhara	Oromia	SNNP	Tigray	Other regions	Rural	Small towns	Medium & large
Male-headed families:									
Per-child resource share	0.21***	0.16***	0.16***	0.15***	0.15***	0.16***	0.16***	0.17***	0.17***
Per-adult resource share	0.26	0.24***	0.22***	0.22***	0.23***	0.24***	0.22***	0.24***	0.28***
Poverty headcount: child	50.9*	85.2**	84.0	87.2	78.5***	80.7***	87.5**	74.2	58.7
Poverty headcount: adult	26.9**	73.2	69.5	77.7*	61.1	59.0	76.1	56.2*	29.6***
Poverty headcount: HH	16.5	72.1	64.6	72.8	59.2**	57.0	73.2	47.1	21.7***
Single-mother families:									
Per-child resource share	0.26***	0.33***	0.27***	0.30***	0.30***	0.29***	0.29***	0.32***	0.32***
Per-adult resource share	0.24	0.35***	0.30***	0.33***	0.31***	0.32***	0.32***	0.32***	0.32***
Poverty headcount: child	35.6*	76.1**	76.4	86.3	66.9***	63.7***	80.6**	63.7	54.9
Poverty headcount: adult	46.0**	73.8	69.4	85.2*	58.6	54.0	76.2	68.7*	52.2***
Poverty headcount: HH	27.2	65.0	65.1	73.4	46.7**	52.1	69.7	52.3	40.9***
Whole sample:									
Per-child resource share	0.23	0.20	0.17	0.17	0.20	0.18	0.18	0.21	0.22
Per-adult resource share	0.25	0.26	0.23	0.23	0.20	0.25	0.23	0.26	0.29
Poverty headcount: child	44.7	83.1	82.9	87.1	73.0	77.8	86.4	71.3	57.4
Poverty headcount: adult	34.5	73.3	69.5	78.8	60.3	58.1	76.1	59.3	37.4
Poverty headcount: HH	20.9	70.5	64.7	72.9	55.1	56.2	72.7	48.5	28.5

Notes: *, ** & *** show significance of mean difference in male-headed and single-mother sub-samples at 10%, 5% & 1% levels respectively. All observations are weighted to make estimates representative.

Regarding poverty incidence, disaggregated estimates in Table 9 similarly disclose presence of large spatial disparities. For instance, the chance of children falling in poverty in male-headed (resp. single-mother) families ranges between 88% (81%) in rural areas to 59% (55%) in medium and large towns, and falling as low as 51% (46%) in the nation's largest city and capital, Addis Ababa. There is significant difference in child poverty incidence between male-headed and single-mother households in the majority of the regions and rural areas. On the other hand, if intrahousehold resource allocation was ignored, poverty would once again be understated, and we would notice no significant poverty prevalence difference between the two family types in all regions (except Tigray) and rural/urban areas (except medium and large towns). The right panel of Figure A3 in the Appendix maps the disparities in child poverty across regions for the whole sample of families with children.

5. Concluding Remarks

Children have long been sidelined in the literature as decision makers in household resources. While they could be a victim of the widely-evidenced intrahousehold inequality, parental altruism may benefit them. The scant collective model evidence on children's shares of household resources and poverty in developing countries that are sizably populated by children is inconclusive. We estimate a complete collective demand model to recover children's resource shares and analyze poverty in married male-headed and single female-headed families in Ethiopia. Identification strategy of the sharing rule relies on use of private exclusive goods and distribution factors.

Results generally confirm disparities in intrahousehold resource allocation and poverty. The allocation is significantly affected by parental differences in education and age, child education, proportions of female children and women as well as number of non-biological children. Children command less household resources than adults and children in single-mother families have higher resource shares than those in male-headed families.

After using resource shares for computing incidence, depth and severity of poverty, we also find that children are poorer than adults. Single mothers are more altruistic to their children and avoid higher child poverty than married male heads although this seems to disappear when the number of children increases. We find that traditional poverty measures, which by construction ignore intrahousehold allocation, understate child (and adult) poverty compared to those based on our resource shares. Our estimates also show that non-poor families also host poor children, unlike the general belief that poor children live only with poor adults and households. We also find that monetarily non-poor adults and households host stunted children. Finally, regional and rural-urban disparities exist in both child resource shares and poverty.

Our results are important for few intervention issues. Firstly, by disclosing intrahousehold inequalities in resource allocation and poverty that children do better only at low family size, the results lend support to fertility interventions. Ignoring this inequality means a misleading picture of the incidence, depth and severity of poverty. Secondly, gender of the household head matters to children as mothers are found to be more pro-child. Thirdly, the overlaps between child poverty, adult poverty, household poverty and child stunting question the effectiveness of targeting just poor households for a social protection aiming at improving child welfare. Lastly, pro-rural spatial redistributive efforts are implied to reduce disparity between children in rural and urban areas.

A Appendix

A.1 Derivation of the Collective Demand System Model

The derivation is based on Menon et al. (2018), Chavas et al. (2018) and Mangiavacchi et al. (2018). Consider an extended PIGLOG individual expenditure function

$$\ln e_k(u_k, \mathbf{p}) = \ln A_k(\mathbf{p}) + \frac{\varphi(u_k) B_k(\mathbf{p})}{1 - \varphi(u_k) \lambda_k(\mathbf{p})} = \ln A_k(\mathbf{p}) + \frac{B_k(\mathbf{p})}{\Psi(u_k) - \lambda_k(\mathbf{p})}$$

where $\Psi(u_k) = \varphi(u_k)^{-1}$ is decreasing in utility $\varphi(u_k)$; $\mathbf{p} = \{p_{c^1}, p_{c^2}, p_q\}$; and the continuous and concave price aggregators take up the usual functional forms: $\ln A_k(\mathbf{p}) = \frac{1}{2}(\alpha_0 + \sum_i \alpha_i \ln p_i + \frac{1}{2} \sum_i \sum_j \gamma_{ij} \ln p_i \ln p_j)$, $B_k(\mathbf{p}) = \beta_0 \prod_i P_i^{\beta_i^k}$ and $\lambda_k(\mathbf{p}) = \sum_i \lambda_i^k p_i$, assumed to be a differentiable, homogeneous function of degree zero of prices. $\alpha_i, \gamma_{ij}, \beta_i^k$ and λ_i^k are parameters to be estimated. One can interpret the price aggregator $A(\mathbf{p})$ as that level of subsistence expenditure [or poverty expenditure (Deaton & Muellbauer, 1980)] of member k when her utility $u_k = 0$. The remaining two price aggregators, $B_k(\mathbf{p})$ and $\lambda_k(\mathbf{p})$, are associated with expenditure levels of each household member whose variations allow identification of the corresponding parameters β_i^k and λ_i^k .

Shephard's lemma gives individual Hicksian demand of good i as budget share:

$$w_i^k = \frac{\partial \ln e_k(u_k, \mathbf{p})}{\partial \ln p_i} = \frac{\partial \ln A_k(\mathbf{p})}{\partial \ln p_i} + \frac{\frac{\partial B_k(\mathbf{p})}{\partial \ln p_i} [\Psi(u_k) - \lambda_k(\mathbf{p})] + B_k(\mathbf{p}) \frac{\partial \lambda_k(\mathbf{p})}{\partial \ln p_i}}{[\Psi(u_k) - \lambda_k(\mathbf{p})]^2}.$$

Inverting this individual expenditure function gives indirect utility function:

$$\Psi(u_k) - \lambda_k(\mathbf{p}) = \frac{B_k(\mathbf{p})}{\ln e_k(u_k, \mathbf{p}) - \ln A_k(\mathbf{p})}.$$

Substituting this gives the individual budget share of good i

$$w_i^k = \frac{\partial \ln A_k(\mathbf{p})}{\partial \ln p_i} + \frac{\frac{\partial B_k(\mathbf{p})}{\partial \ln p_i} \left[\frac{B_k(\mathbf{p})}{\ln e_k(u_k, \mathbf{p}) - \ln A_k(\mathbf{p})} \right] + B_k(\mathbf{p}) \frac{\partial \lambda_k(\mathbf{p})}{\partial \ln p_i}}{\left[\frac{B_k(\mathbf{p})}{\ln e_k(u_k, \mathbf{p}) - \ln A_k(\mathbf{p})} \right]^2}$$

which could be expressed as:

$$w_i^k = \frac{\partial \ln A_k(\mathbf{p})}{\partial \ln p_i} + \beta_i^k [\ln e_k - \ln A_k(\mathbf{p})] + \lambda_i^k \frac{[\ln e_k - \ln A_k(\mathbf{p})]^2}{B_k(\mathbf{p})}.$$

Given the aforementioned informational constraint that quantities and prices of non-assignable goods are not observed, the above decentralized budget shares are aggregated at the household level for good i as follows:

$$w_i = \alpha_i + \sum_j \gamma_{ij} \ln p_j + \beta_i^1 [\ln e_1 - \ln A_1(\mathbf{p})] + \lambda_i^1 \frac{[\ln e_1 - \ln A_1(\mathbf{p})]^2}{B_1(\mathbf{p})} \\ + \beta_i^2 [\ln e_2 - \ln A_2(\mathbf{p})] + \lambda_i^2 \frac{[\ln e_2 - \ln A_2(\mathbf{p})]^2}{B_2(\mathbf{p})}.$$

Following Lewbel, (1985) and Perali (2003), the demand system is augmented to capture observed heterogeneity among households by introducing a translating technology $t_i(\mathbf{d})$ so that demographic attributes \mathbf{d} enter additively with expenditures. This provides the demographically-modified demand system as follows:

$$w_i = \alpha_i + t_i(\mathbf{d}) + \sum_j \gamma_{ij} \ln p_j + \beta_i^1 [\ln e_1^* - \ln A_1(\mathbf{p})] + \lambda_i^1 \frac{[\ln e_1^* - \ln A_1(\mathbf{p})]^2}{B_1(\mathbf{p})} \\ + \beta_i^2 [\ln e_2^* - \ln A_2(\mathbf{p})] + \lambda_i^2 \frac{[\ln e_2^* - \ln A_2(\mathbf{p})]^2}{B_2(\mathbf{p})}$$

where $\ln e_1^*$ and $\ln e_2^*$ are modified logarithmic individual total expenditures given by the translating household technology $\ln e_k^* = \ln e_k - \sum_i t_i(\mathbf{d}) \ln p_i$. The demographic functions are simply defined as $t_i(\mathbf{d}) = \sum_r \tau_{ir} d_r$ for $r = 1, \dots, R$. Note that from the above demand system, we can estimate, for each good i , income parameters ($\beta_i^1, \beta_i^2, \lambda_i^1$ and λ_i^2) at individual level while the rest at household level (i.e. the intercepts α_i , price parameters γ_{ij} and demographic scaling effects $t_i(\mathbf{d})$).

Price elasticities remain the same as in the unitary setting. However, income elasticities capturing Engle effects for $x_i = c_i, q_i$ and for each household member $k = 1, 2$ are given in the decentralized CQAIDS by:

$$\epsilon_i^{e_k} = \frac{\partial \ln x_i}{\partial \ln e_k} = 1 + \frac{\beta_i^k}{w_i} + \frac{2\lambda_i^k}{B_k(\mathbf{p})} \frac{1}{w_i} (\ln e_k - \ln A_k(\mathbf{p})).$$

A.2 Appendix Tables and Figures

Table A1: Aggregation of consumption expenditure items: ESS 2013/14

Expenditure group/sub-group and item			Recall*	Price type
I. Food at home and alcohol			Monthly	Unit values (For alcoholic drinks: CSA retail prices)
1. Teff	10. Lentils	19. Milk		
2. Wheat	11. Haricot beans	20. Cheese		
3. Barley	12. Niger seed	21. Eggs		
4. Maize	13. Linseed	22. Sugar		
5. Sorghum	14. Onion	23. Salt		
6. Millet	15. Banana	24. Coffee		
7. Horse beans	16. Potato	25. Bula		
8. Chickpea	17. Kocho	26. Chat/Kat		
9. Field pea	18. Meat	27. Alcoholic drinks		
II. Clothing			Annually	CSA retail prices
2.1. Adult clothing				
1. Clothes/shoes/fabric for men				
2. Clothes/shoes/fabric for women				
2.2. Child clothing				
1. Clothes/shoes/fabric for boys				
2. Clothes/shoes/fabric for girls				
2.3. Non-assignable clothing (Linen: sheets, towels, blankets)				
III. Household utilities and energy			Monthly	ESS local prices and CSA retail prices
3.1. Utilities: water, electricity & cell phone/landline use				
3.2. Household energy			Monthly (Annually for lamp)	
1. Matches	4. Charcoal	7. Lamp/torch		
2. Candles (tua'f), incense	5. Firewood			
3. Batteries	6. Kerosene			
IV. Other goods			Monthly	CSA retail prices (For transport: ESS local prices)
4.1. Education: fees, books, uniforms, stationery, assistance, etc.				
4.2. Food away from home and cigarettes			Weekly	
1. Full meals: breakfast, lunch, dinner				
2. Snacks (kolo, bread, biscuits, cakes, etc.)				
3. Dairy products (milk, yoghurt, etc.)				
4. Vegetables and roasted/boiled items				
5. Non-alcoholic drinks (coffee, tea, fruit juice, soda, etc.)				
6. Cigarettes, tobacco, suret and gaya				
4.2. Laundry and personal care			Annually	
4.3. Transport			Monthly	

Notes: *Recall periods here are as available in the ESS; all are finally converted to monthly values. CSA=Central Statistical Agency of Ethiopia

Figure A1: Engel curves of commodity groups by family type

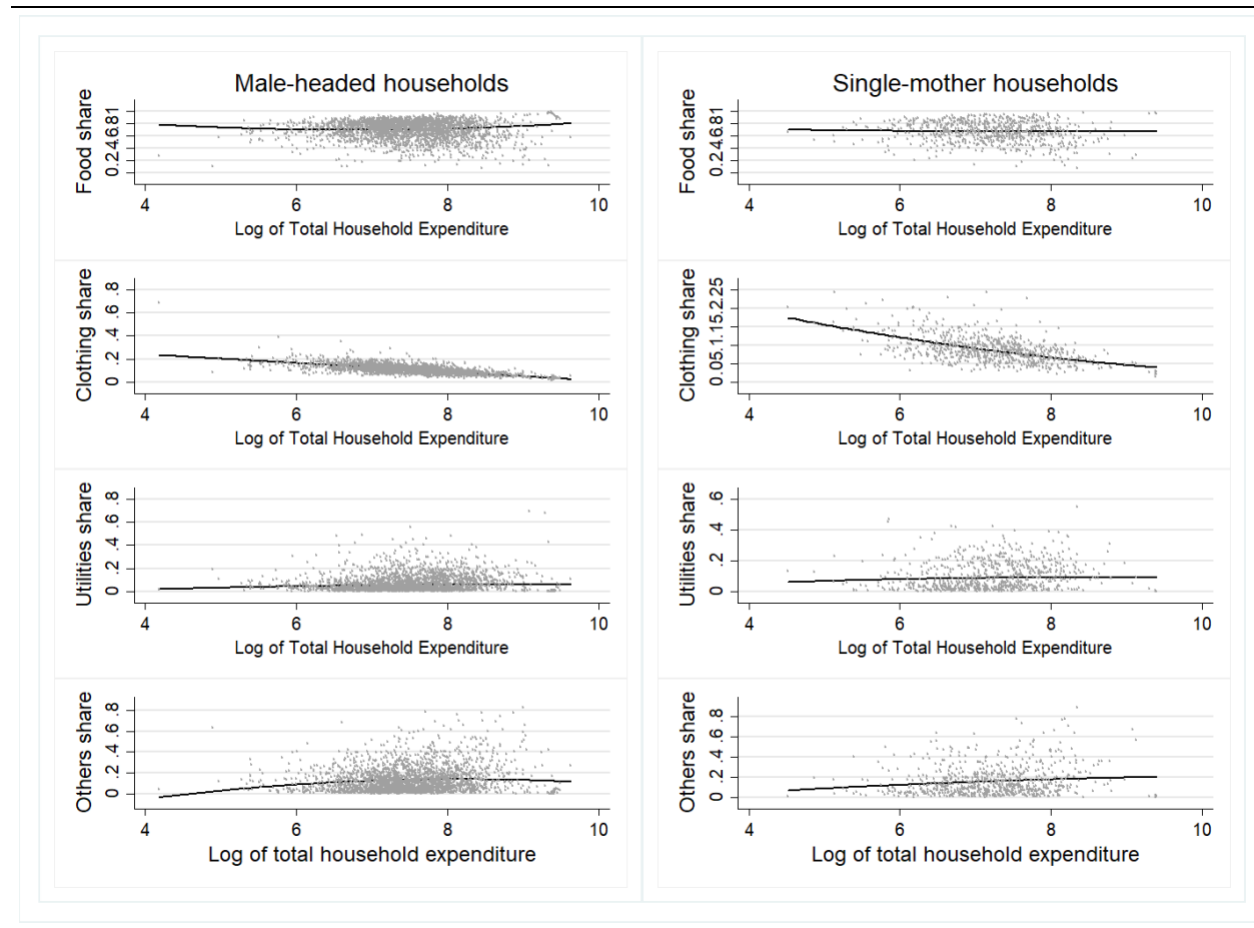


Table A2: Regression of total household expenditure: First stage

Variable	Male-headed HHs			Single-mother HHs		
Log of food prices	0.398	***	(0.034)	0.371	***	(0.061)
Log of clothing prices	-0.073		(0.166)	0.342		(0.215)
Log of utilities prices	0.029	***	(0.010)	0.008		(0.018)
Log of other goods prices	-0.128	***	(0.034)	-0.092	*	(0.053)
Head is Christian	-0.122	*	(0.072)	-0.117		(0.086)
Head sick	-0.039		(0.037)	0.024		(0.063)
# of sick children	0.024		(0.017)	0.055		(0.040)
# of children aged 15-17y	0.081	***	(0.021)	0.155	***	(0.048)
Female employment ratio	-0.098		(0.091)	0.187	*	(0.108)
Other adult in household	0.140	***	(0.032)	0.197	***	(0.063)
HH has safe water source	0.096	**	(0.048)	0.055		(0.081)
HH interviewed in February	-0.075		(0.059)	-0.060		(0.093)
HH faced price shock	-0.115	**	(0.049)	0.059		(0.075)
HH faced natural disaster shock	0.127	**	(0.061)	0.238	**	(0.107)
HH lives in Amhara region	0.186	**	(0.092)	0.161		(0.128)
HH lives in Oromia region	0.243	***	(0.075)	0.302	***	(0.113)
HH lives in SNNP region	0.098		(0.085)	0.139		(0.125)
HH lives in Tigray region	0.322	***	(0.089)	0.318	***	(0.115)
HH lives in other regions	0.217	**	(0.094)	0.321	**	(0.123)
Education diff. of parents (w - h)	-0.015	***	(0.005)	-	-	-
Age diff. of parents (w - h)	-0.003	*	(0.002)	-	-	-
All children in school	0.042		(0.037)	-0.026		(0.077)
Proportion of female children	0.077	*	(0.042)	0.001		(0.079)
Proportion of women	0.065		(0.153)	-0.572	***	(0.163)
Number of non-biological children	0.042	*	(0.023)	-0.020		(0.024)
Wealth index	0.066	***	(0.007)	0.061	***	(0.009)
Constant	6.840	***	(0.936)	4.822	***	(1.154)

*Notes: Dependent variable is log of household total expenditure. *, ** & *** show significance at 10%, 5% & 1% levels respectively. Standard errors, corrected for clustering and sampling weights, are in parentheses. SNNP=Southern Nations, Nationalities and Peoples.*

Table A3: Collective AIDS regression results

Variable	Male-headed households (N = 2367)					Single-mother households (N = 729)					
	Food	Clothing	Utilities	Other goods		Food	Clothing	Utilities	Other goods		
Intercepts α_i	1.175 *** (0.061)	0.177 *** (0.013)	0.027 (0.025)	-0.379 ** (0.053)		1.162 *** (0.116)	0.116 *** (0.023)	0.040 (0.047)	-0.319 *** (0.111)		
Price effects γ_{ij}	-0.055 *** (0.016)	-0.056 *** (0.004)	0.003 (0.004)	0.107 *** (0.015)	-0.032 (0.027)	-0.040 *** (0.005)	-0.004 (0.007)	0.076 *** (0.026)			
		0.028 *** (0.002)	0.006 *** (0.001)	0.022 *** (0.003)		0.023 *** (0.004)	0.004 *** (0.002)	0.013 *** (0.005)			
			0.004 *** (0.002)	-0.013 (0.004)				0.003 (0.003)	-0.004 (0.005)		
				-0.116 *** (0.015)					-0.085 *** (0.027)		
Adults' income effects β_i^1	-0.107 *** (0.012)	-0.046 *** (0.004)	0.020 *** (0.005)	0.133 *** (0.011)	-0.098 *** (0.023)	-0.031 *** (0.006)	0.022 ** (0.010)	0.106 *** (0.023)			
Children's income effects β_i^2	-0.110 *** (0.012)	-0.038 *** (0.004)	0.020 *** (0.005)	0.128 *** (0.011)	-0.070 *** (0.024)	-0.024 *** (0.006)	0.011 (0.010)	0.084 *** (0.023)			
Head is Christian	-0.046 *** (0.012)	-0.001 (0.002)	-0.001 (0.004)	0.048 *** (0.011)	-0.035 (0.028)	0.002 (0.003)	-0.002 (0.011)	0.036 (0.028)			
Head sick	0.017 ** (0.008)	-0.002 * (0.001)	-0.005 ** (0.003)	-0.010 (0.007)	0.006 (0.018)	-0.008 *** (0.002)	-0.015 *** (0.006)	0.017 (0.016)			
Number of sick children	-0.013 *** (0.004)	0.002 *** (0.001)	0.001 (0.002)	0.010 ** (0.004)	0.016 (0.011)	0.004 ** (0.002)	-0.006 (0.005)	-0.014 (0.010)			
Number of children aged 15-17y	-0.009 * (0.005)	0.007 *** (0.001)	-0.002 (0.002)	0.004 (0.005)	0.003 (0.018)	0.008 *** (0.002)	-0.002 (0.006)	-0.009 (0.016)			
Female employment ratio	0.021 (0.021)	-0.005 (0.004)	0.004 (0.006)	-0.021 (0.020)	-0.021 (0.028)	0.017 *** (0.004)	0.019 * (0.011)	-0.015 (0.027)			
Other adult in household	0.004 (0.008)	0.014 *** (0.001)	0.000 (0.002)	-0.019 ** (0.008)	0.044 ** (0.019)	0.014 *** (0.003)	-0.008 (0.008)	-0.049 *** (0.019)			
Household has safe water source	0.002 (0.010)	0.000 (0.001)	0.020 *** (0.003)	-0.022 ** (0.010)	-0.048 ** (0.022)	0.001 (0.003)	0.046 *** (0.009)	0.001 (0.022)			
Household interviewed in February	0.004 (0.015)	0.003 * (0.002)	-0.003 (0.006)	-0.004 (0.013)	0.014 (0.029)	0.004 (0.003)	-0.014 (0.014)	-0.004 (0.025)			
Household faced price shock	-0.031 *** (0.011)	-0.002 (0.002)	0.010 ** (0.005)	0.022 ** (0.010)	-0.001 (0.025)	-0.004 * (0.002)	0.000 (0.010)	0.005 (0.026)			
Household faced natural disaster shock	0.037 *** (0.012)	0.000 (0.002)	-0.018 *** (0.003)	-0.020 * (0.012)	0.033 (0.030)	-0.004 (0.003)	-0.030 *** (0.009)	0.001 (0.032)			
Household lives in Amhara region	0.118 ** (0.025)	0.021 *** (0.002)	-0.083 *** (0.010)	-0.055 *** (0.020)	0.036 (0.039)	0.013 *** (0.004)	-0.104 *** (0.018)	0.055 (0.038)			
Household lives in Oromia region	0.124 *** (0.026)	0.036 *** (0.002)	-0.080 *** (0.010)	-0.081 *** (0.020)	0.084 ** (0.036)	0.021 *** (0.004)	-0.098 *** (0.018)	-0.006 (0.036)			
Household lives in SNNP region	0.117 *** (0.026)	0.021 *** (0.002)	-0.072 *** (0.010)	-0.066 *** (0.021)	0.080 ** (0.036)	0.005 (0.004)	-0.108 *** (0.016)	0.024 (0.036)			
Household lives in Tigray region	0.092 *** (0.027)	0.047 *** (0.003)	-0.073 *** (0.011)	-0.066 * (0.022)	0.025 (0.037)	0.036 *** (0.005)	-0.086 *** (0.018)	0.026 (0.038)			
Household lives in other regions	0.087 *** (0.028)	0.033 *** (0.003)	-0.055 *** (0.012)	-0.066 *** (0.023)	0.023 (0.040)	0.024 *** (0.005)	-0.050 ** (0.023)	0.003 (0.037)			
Endogeneity of total expenditure	0.155 *** (0.014)	-0.002 (0.004)	-0.031 *** (0.006)	-0.122 * (0.012)	0.110 *** (0.029)	-0.007 (0.006)	-0.035 *** (0.010)	-0.067 ** (0.029)			

Notes: *, ** & *** show significance at 10%, 5% & 1% levels respectively. Standard errors, corrected for clustering and sampling weights, are in parentheses. 'Other regions' includes the small regions of Afar, Benishangul-Gumuz, Dire Dawa, Gambella, Harari and Somali; the left-out category is the capital, Addis Ababa. SNNP=Southern Nations, Nationalities and Peoples.

Table A4: Income and price elasticity estimates

	Male-headed households				Single-mother households			
	Food	Clothing	Utilities	Others	Food	Clothing	Utilities	Others
<i>Income elasticities:</i>								
Adults	0.92*** (0.032)	0.65** (0.274)	1.03*** (0.310)	1.67*** (0.470)	0.92*** (0.013)	0.70*** (0.143)	1.11*** (0.130)	1.52*** (0.551)
Children	0.93*** (0.008)	0.63*** (0.213)	0.98*** (0.184)	1.65*** (0.386)	0.92*** (0.013)	0.59*** (0.198)	1.093*** (0.114)	1.59*** (0.625)
<i>Uncompensated price elasticities:</i>								
Food	-0.94*** (0.012)	-0.03*** (0.005)	-0.02*** (0.005)	0.06*** (0.012)	- 0.95*** (0.009)	-0.03*** (0.005)	-0.02** (0.007)	0.08*** (0.021)
Clothing	-0.07 (0.106)	-0.58 (1.968)	0.04 (0.070)	0.03 (0.379)	-0.13 (0.914)	-0.41 (4.097)	0.02 (0.211)	-0.02 (0.279)
Utilities	-0.30 (0.746)	0.07 (0.172)	-0.82 (0.448)	0.05 (0.104)	-0.30 (0.626)	0.01 (0.030)	-0.91*** (0.204)	0.08 (0.176)
Other goods	-0.25 (0.263)	-0.06 (0.059)	0.03 (0.063)	-1.37*** (0.175)	-0.13 (0.267)	-0.09 (0.092)	0.05 (0.128)	-1.40*** (0.368)
<i>Compensated price elasticities:</i>								
Food	-0.28*** (0.792)	0.04* (0.022)	0.05 (0.045)	0.19*** (0.052)	- 0.34*** (0.104)	0.04* (0.023)	0.08 (0.059)	0.22*** (0.073)
Clothing	0.33 (0.075)	-0.53 (1.964)	0.08 (0.083)	0.11 (0.073)	0.23 (0.171)	-0.36 (4.094)	0.08 (0.217)	0.05 (0.626)
Utilities	0.41 (0.692)	0.15 (0.171)	-0.75* (0.437)	0.19* (0.106)	0.45 (0.436)	0.10*** (0.035)	-0.80*** (0.187)	0.2609 (0.229)
Other goods	0.94*** (0.178)	0.07** (0.032)	0.13*** (0.050)	-1.15*** (0.206)	0.94*** (0.314)	-0.02 (0.044)	0.21 (0.132)	-1.17*** (0.404)

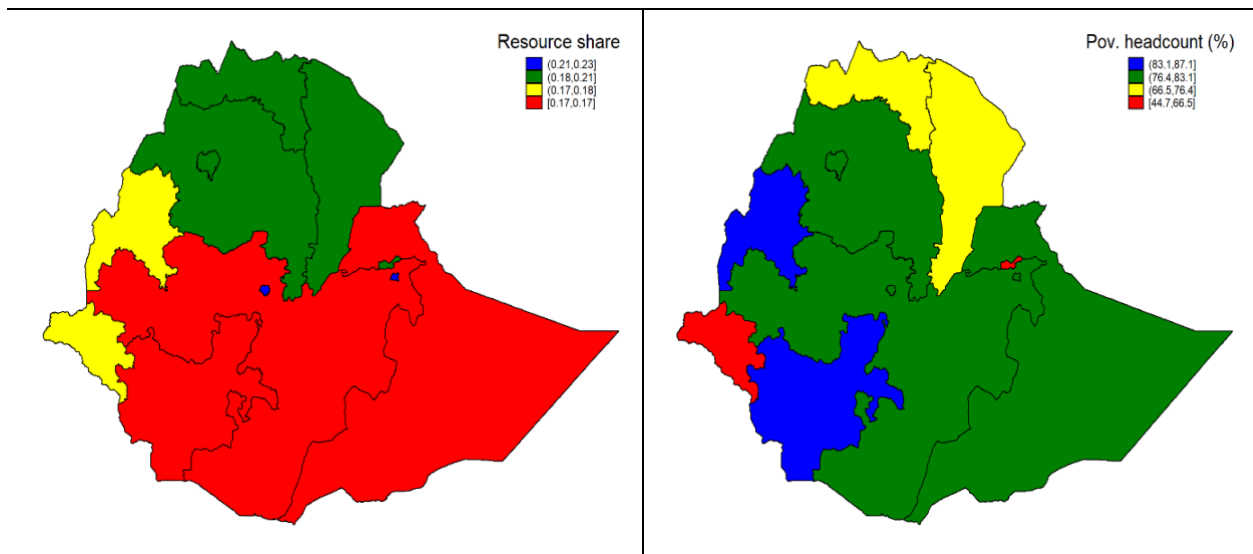
Notes: *, ** & *** show significance at 10%, 5% & 1% levels respectively. Bootrapped standard errors in parentheses.

Figure A2: Sharing rules of children and adults over the income distribution



Notes: Shaded areas represent 95% confidence intervals. Observations are weighted to make estimates nationally representative.

Figure A3: Regional distribution of child resource shares and poverty headcount rates (%)



Note: Estimates are representative only to regions of Addis Ababa, Amhara, Oromia, SNNP and Tigray.

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