SUPPLEMENTARY MATERIALS:
Heritage of Hunger: Ethnicity, Intrahousehold Resource Allocation and Child Poverty

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May 27, 2025

Abstract

Researchers and policymakers increasingly recognize the importance of cultural and traditional practices in shaping economic development outcomes. In this paper, I examine how ethnic characteristics may shape child poverty and malnutrition in Ethiopia, Ghana, Malawi and Nigeria. I show that children's intrahousehold resource allocation, poverty rates and nutrition outcomes vary significantly across ethnic groups. Using a supervised machine learning technique, I identify six key ethnic characteristics that drive these differences and analyze how these traits influence child poverty and malnutrition outcomes. I demonstrate that differences in intrahousehold resource distribution (rather than differences in other socioeconomic traits) serve as an important mechanism. This study provides empirical evidence that effective policies for alleviating child poverty and malnutrition must account for the specific cultural context.

Keywords: Culture, Intrahousehold Resource Allocation, Individual Poverty, Child Malnutrition

JEL Classification: D13, I32, J12, J13, O15, Z13

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Appendix A: Model & Methodology

The unequal sharing of resources within households is widely acknowledged. Chiappori (1992) seminal contribution proposed the collective household model that explicitly considers the different preferences of several members. Following the literature, I define the resource share of a household member as the fraction of household expenditure allocated to that household member, determining the intrahousehold resource allocation following the within-household bargaining process.[1] Data availability and quality make the estimation of resource shares difficult. However, Browning et al. (2013) (BCL) and Dunbar et al. (2013) (DLP) develop non-linear structural models to estimate resource shares with routinely collected data. Lechene et al. (2022) (LPW) propose a linear estimation strategy for DLP's model, which I use in this paper and layout in Section A.1 and A.2.

A.1: The Model

Let t denote the type of member in the household - m for an adult male, f for an adult female, and c for a child. Estimating resource shares separately for boys and girls is possible, but I assign them to one member type, given the data constraints. The model allows for multiple members of any type and complex household structures, such as multigenerational, multifamily, polygamous, and single-parent households, all prevalent in developing countries. Let a household consist of N^t members of each type such that $\sum_t N^t = N$ is the total number of household members. Let y denote the observed household consumption (budget). Let η_t denote the resource share or each household member type such that

$$\sum_t \eta_t = 1. \tag{1}$$

Similarly to LPW, I assume resources are distributed equally within types.[2] Hence, per-individual resource shares are defined as $\frac{\eta_t}{N^t}$. The total shadow budget of all the people of a given type t in a household is $\eta_t y$ and the individual shadow budget for a person of type t is

$$\frac{\eta_t y}{N^t}. \tag{2}$$

Each of the N^t individuals of type t in a household consumes a quantity vector $\boldsymbol{q}^t$. Therefore, a household purchases the quantity vector $\boldsymbol{Q}$, given by

$$\boldsymbol{Q} = \boldsymbol{A} \sum_t N^t \boldsymbol{q}^t, \tag{3}$$

where $\boldsymbol{A}$ is a square matrix that embodies the consumption technology relating quantities purchased to goods consumed by individuals. Let $\boldsymbol{p}$ denote the market price vector of goods and $\tilde{\boldsymbol{p}}$ the shadow price

[1] Resource shares can be in terms of expenditure or consumption, depending on whether shareable goods are present. Shareable goods imply that the sum of the quantities consumed by all household members is greater than the quantity purchased by the household (e.g., shelter). Nonshareable goods are goods for which the quantities consumed by each person add up to the total quantity the household purchases (e.g., food). In this paper, resource shares are individual fractions of total household expenditure at shadow (not market) prices due to the context and available data.

[2] This assumption is not restrictive if we only have one member of each type.

vector of goods (within-household prices of consumption), then the consumption technology matrix implies that

$$\tilde{\boldsymbol{p}} = \boldsymbol{A}\boldsymbol{p}.$$

The main requirement is that A is a block-diagonal matrix satisfying

$$\boldsymbol{A} = \begin{bmatrix} A_1 & 0 \\ 0 & A_2 \end{bmatrix}. \tag{4}$$

The matrix A_1 is a diagonal matrix whose elements give the price scale between the market and shadow price of a person's assignable good. An assignable good is one for which the expenditure of each type of individual can be observed. No restrictions are applied to the A_2 matrix. The A matrix is block-diagonal since it rules out any complementarities in consumption between the assignable goods and all other goods.

Assuming that all covariates and the number of household members of each type (N_t) are constant across households, only prices $\boldsymbol{p}$ and budgets y will vary. Hence, I can define the intrahousehold resource share of type t as $\eta_t(\boldsymbol{p}, y)$. Furthermore, if I define $q^t(\boldsymbol{p}, y)$ as a scalar-valued demand function of type t for their assignable good, a member of type t's demand within the household (evaluated at their shadow budget constraint) equals $q^t\left(\boldsymbol{A}\boldsymbol{p}, \eta_t(\boldsymbol{p},y)y/N^t\right)$. Using this expression, (4) and (3), the household quantity demand functions for assignable goods are

$$\boldsymbol{Q}(\boldsymbol{p}, y) = A_1^t N^t q^t\left(\boldsymbol{A}\boldsymbol{p}, \eta_t(\boldsymbol{p},y)y/N^t\right).$$

Using Engel curves, prices are held constant at some vector $\bar{\boldsymbol{p}}$, which allows one to evaluate the fraction of expenditure as a function of the total household budget. Therefore, let $\eta_t(y) = \eta_t(\bar{\boldsymbol{p}}, y$. Then, the household Engel curve function for the assignable good of member type t is

$$W^t(y) = \frac{\bar{\boldsymbol{p}}_1^t \boldsymbol{Q}(\bar{\boldsymbol{p}}, y)}{y} = \frac{\bar{\boldsymbol{p}}_1^t A_1^t N^t q^t\left(\boldsymbol{A}\bar{\boldsymbol{p}}, \eta_t(y)y/N^t\right)}{y}. \tag{5}$$

Then, the individual Engel curve function at fixed shadow price vector $\boldsymbol{A}\bar{\boldsymbol{p}}$ for a person of type t for their assignable good at budget y is

$$w^t(y) = \frac{\bar{\boldsymbol{p}}_1^t A_1^t q^t(\boldsymbol{A}\bar{\boldsymbol{p}}, y)}{y}$$

Substituting this expression and (2) into (5) yields

$$W^t(y) = \eta_t(y) w^t\left(\eta_t(y)y/N^t\right). \tag{6}$$

This implies that a household's Engel curve (at fixed market prices) for the assignable goods is equal to the product of the resource share of the relevant household member type and the individual Engel curve of a person of that type facing the shadow price vector and their shadow budget.

Similar to DLP, LPW impose the following restrictions: (1) The consumption technology matrix $\boldsymbol{A}$ is block diagonal. This implies that no complementarities exist between the consumption of assignable goods and all other goods; (2) Resource shares do not depend on the household budget, implying that $\eta_t(y) = \eta_t$; (3) Individual Engel curve functions are linear in $ln(y)$, implying that $w^t(y) = \alpha^t + \beta^t ln(y)$; (4) Preferences are similar - but not identical - across people, implying that $\beta^t = \beta$.

Using these restrictions, (6) can be rewritten as

$$W^t(y) = \eta_t\left[\alpha^t + \beta\left(ln(y) + ln(\eta_t) - ln(N^t)\right)\right], \tag{7}$$

which is the non-linear econometric model proposed by DLP. Since (7) does not include any covariates, minor adjustments are needed to incorporate all variables affecting preferences and resource shares. Let $z = \begin{bmatrix}\boldsymbol{N} & \tilde{z}\end{bmatrix}$ be the covariate matrix where $\boldsymbol{N} = \left\{N^t\right\}$ and $\tilde{z}$ includes all factors other than the number of household member types. One of the goals of this paper is to investigate how resource shares are influenced by different ethnic characteristics and which ethnic characteristics matter most. Therefore, I utilize a two-step procedure. First, I estimate the model without ethnic characteristics and use the baseline results to identify six ethnic characteristics that are important for child welfare outcomes. Second, I denote these ethnic characteristics by θ and decompose the covariate matrix as

$$z = \begin{bmatrix}\boldsymbol{N} & \tilde{z}_{-\theta} & \theta\end{bmatrix}. \tag{8}$$

Using the covariate matrix as defined in 8, I re-estimate the model to analyze the influence of θ. In both cases, the covariates can be added to the model and by expanding out (7), one gets

$$\begin{aligned} W^t(y,z) =& \eta_t(z)\alpha^t(z) + \eta_t(z)\beta(z)ln(y) + \eta_t(z)\beta(z)ln(\eta_t(z)) \\ &- \eta_t(z)\beta(z)ln(N^t), \end{aligned} \tag{9}$$

which resembles DLP's proposed framework with covariates.

A.2: Linear Reframing

Next, I provide a brief overview of the linear reframing proposed by LPW. Denoting all observables with the subscript h and letting ε_h^t be an additive error term, (9) can be written as

$$W_h^t = a_h^t + b_h^t ln(y_h) + \varepsilon_h^t, \tag{10}$$

where

$$a_h^t = \eta_t(z_h)\alpha^t(z_h) + \eta_t(z_h)\beta(z_h)ln(\eta_t(z_h)) - \eta_t(z_h)\beta(z_h)ln(N_h^t) \tag{11}$$

and

$$b_h^t = \eta_t(z_h)\beta(z_h). \tag{12}$$

By rearranging (12), an equation for the resource shares is

$$\eta_t(z_h) = \frac{b_h^t}{\beta(z_h)}. \tag{13}$$

Given the number of categories for some ethnographic atlas variables, I will encounter a high-dimensional conditioning vector z_h. Therefore, estimating (11) and (12) will not be feasible. Hence, I follow LPW's strategy of approximating[3] these equations with the linear indices

$$a_h^t = a_0^t + a_{lnN^t}^t ln(N_h^t) + \boldsymbol{a}_z^{t'} \boldsymbol{z}_h \tag{14}$$

and

$$b_h^t = b_0^t + \boldsymbol{b}_z^{t'} \boldsymbol{z}_h. \tag{15}$$

Substituting (14) and (15) into (10) yields

$$W_h^t = a_0^t + a_{lnN^t}^t ln(N_h^t) + \boldsymbol{a}_z^{t'} \boldsymbol{z}_h + b_0^t ln(y_h) + \boldsymbol{b}_z^{t'} \boldsymbol{z}_h ln(y_h) + \varepsilon_h^t,$$

which are the individual assignable goods Engel curve for each household member type. Using seemingly unrelated regression (SUR), I get the estimates $\hat{b}_h^t = \hat{b}_0^t + \hat{\boldsymbol{b}}_z^{t'} \boldsymbol{z}_h$ and along with (1), $\sum_{t=1}^T \hat{b}_h^t$ it can be used as an estimate for $\beta(z_h)$.[4] Lastly, using these estimates and (13), resource shares can be estimated by

$$\hat{\eta}_t(z_h) = \frac{\hat{b}_h^t}{\sum_{t=1}^T \hat{b}_h^t} = \frac{\hat{b}_0^t + \hat{\boldsymbol{b}}_z^{t'} \boldsymbol{z}_h}{\sum_{t=1}^T \left(\hat{b}_0^t + \hat{\boldsymbol{b}}_z^{t'} \boldsymbol{z}_h \right)}. \tag{16}$$

LPW provide a note of caution on using (16) since resource shares are vulnerable to a denominator with a lot of variation or one close to zero. For this reason, and to keep the results comparable with the literature, I impose the linear restriction

$$\sum_t b_{\tilde{z}}^t = 0, \tag{17}$$

which implies that $\sum_{t=1}^T \hat{b}_h^t = \sum_t \left(\hat{b}_0^t + \hat{b}_{N_m}^t N_h^m + \hat{b}_{N_f}^t N_h^f + \hat{b}_{N_c}^t N_h^c \right)$. Using this restriction, I estimate resource shares using

$$\hat{\eta}_t(z_h) = \frac{\hat{b}_0^t + \hat{\boldsymbol{b}}_z^{t'} \boldsymbol{z}_h}{\sum_t \left(\hat{b}_0^t + \hat{b}_{N_m}^t N_h^m + \hat{b}_{N_f}^t N_h^f + \hat{b}_{N_c}^t N_h^c \right)}$$

separately for each household composition in each country.[5]

A.3: Tests of Identification

I perform two tests and one sanity check to ensure the resource shares are identified. First, from (13), it is clear that resource shares cannot be identified if $\beta(z_h) = 0$. The overall household assignable-goods Engel curve can be written as

$$W_h = a_h + b_h ln(y_h) + \varepsilon_h, \tag{18}$$

which is the sum of individual member Engel curves.[6] Therefore, estimating (18) with ordinary least squares (OLS) provides an estimate $\hat{b}_h$ of $\beta(z_h)$. When performing this identification test, I assume the

[3] This approximation for b_h^t is exact if η_t is linear in z_h and β is independent of z_h - i.e., if β is a constant.

[4] To see this, notice that $\sum_t \eta_t(z_h) = \frac{\sum_t b_h^t}{\beta(z_h)} = 1$ which implies that $\beta(z_h) = \sum_t b_h^t$.

[5] In order to get the test statistics (e.g., Wald test of the per capita model), one sums the χ^2 test statistics across the estimation of each composition.

[6] By sum of individual member Engel curves, I mean: $W_h = \sum_t W_h^t$; $a_h = \sum_t a_h^t$; $b_h = \sum_t b_h^t$; and $\varepsilon_h = \sum_t \varepsilon_h^t$.

linear restriction, i.e. (17), holds. For every household in the sample, I test whether $\hat{b}_h$ is zero and report the total fraction of households for which it is not.

The second test is whether the overall assignable-goods Engel curve, evaluated at the mean value of $\boldsymbol{z}_h$ is either decreasing or increasing. Therefore, letting $\bar{z}_h$ denote the mean value,

$$E[\hat{b}_h] = \hat{b}_0 + \hat{\boldsymbol{b}}_z' \bar{z}_h$$

can be used to perform a Z-test. With the assumption that resource shares sum to 1 across member types, one can perform a sanity check on the resource shares. Specifically, a large fraction of estimated resource shares that do not fall within $[0,1]$ may indicate that the sample is inappropriate for the methodology. Resource shares typically fall outside $[0,1]$ if the individual assignable good Engel curve is increasing for one type of member and decreasing for another.

Appendix B: Data & Descriptive Statistics

This section outlines information about the data in the analysis. It contains information on the samples from each country, assignable goods, descriptive statistics and the steps used to match households to ethnic groups.

B.1: Data

Table B1 displays information on the sample size and household compositions included for each country. LPW use data from previous rounds of the LSMS for Ethiopia, Ghana, Malawi, Nigeria, Tanzania, and Uganda but only included Malawi in their analysis due to identification restrictions. After performing similar identification tests to ensure robust results, I include Ethiopia, Ghana, Malawi, and Nigeria in the analysis. Over the past decade, technology such as computer-assisted personal interviewing (CAPI) has improved the quality and quantity of household-level data. Furthermore, the LSMS has a methodological research agenda that constantly strives to improve the quality and availability of household survey data (Carletto & Gourlay, 2019). All these improvements led to more accurate and detailed information on individual and household expenditures. The assignable good for all countries is clothing. Some data sets contain more disaggregated clothing expenditures than others. For uniformity, I focus on men, women, and children as household member types, and I combine all clothing types that are assignable to each of these members. Table B2 shows the information available on clothing expenditures for each sample.

I exclude households where members have missing age, sex, or adult education. Households with missing or implausible aggregate consumption or clothing expenditure data are also excluded. Households can consist of adult males, m, adult females, f, and children, c. I restrict the maximum number of each member type in a household to four, four, and six, respectively. For a household composition to be included, at least 200 households must be present. Notice that almost half of the households in each country are not nuclear - this indicates the multigenerational nature of households. The latest available waves of the LSMS data

Table B1: Sample Size & Household Compositions

Country	Survey Year	Total Sample	Single-Adult Sample	Nuclear Sample	Estimation Sample	Household Compositions
Ethiopia	2019	6415	880	2652	5250	mfc, mf, fc
Ghana	2016-2017	13629	3266	2742	9736	mfc, mf, fc
Malawi	2019-2020	11332	980	4436	10092	mfc, mf, fc
Niger	2014	3591	152	1311	3015	mfc, mf, fc
Nigeria	2019	4922	629	1250	3833	mfc, mf, fc
Tanzania	2020-2022	4122	472	1471	3416	mfc, mf, fc
Uganda	2019-2020	2804	259	1069	2338	mfc, mf, fc
All	2014-2022	46815	6638	14931	37680	mfc, mf, fc

The total sample does not include households with missing interview dates, missing roster information (age, sex, and education), and households with non-relatives present. Furthermore, it excludes households with missing or implausible total consumption and clothing expenditure data. m, f, and c implies a man, woman, or child is present. For a household composition to be present, the number of households must exceed 200. The maximum number of men, women, and children per household can be at most four, four, and six, respectively. The estimation sample excludes households that do not satisfy these requirements, as well as single-member households.

Table B2: Information on Assignable Good

	Member Type						Clothing Type				Children's Ages
	Men	Women	Children	Boys	Girls	Infants	Clothes	Footwear	Materials	Repairs	
Ethiopia	Y	Y	N	Y	Y	N	Y^a	Y^a	Y^a	N	< 18
Ghana	Y	Y	Y	S	S	S	Y	Y	Y	Y	< 14
Malawi	Y	Y	N	Y	Y	S^c	Y	Y	N	N	$< 16^b$
Niger	Y	Y	Y	N	N	N	Y	Y	N	Y	< 15
Nigeria	Y	Y	N	Y	Y	S^c	Y	Y	N	N	< 15
Tanzania	Y	Y	Y	N	N	N	Y	Y	N	N	< 16
Uganda	Y	Y	Y	N	N	N	Y	Y	N	N	$< 18^b$

Y - Yes, N - No, and S - Some. The table depicts the information on assignable goods that are available. S indicates that some assignable goods can be distinguished between household member types. [a] Ethiopia combines these categories into one clothing expenditure that cannot be separated. [b] age of children is not clearly defined. [c] Footwear or cloth materials and repairs for infants are not given.

for each country, occurring between 2014 and 2022, are used.[7] The number of households included in the estimation for each country ranges from 2804 in Uganda to 13629 in Ghana.

[7] Data for the fifth wave of the Ethiopian LSMS (2021-2022) is available. However, I focus on the previous wave since the latest is not nationally representative due to security concerns in the Tigray region.

B.2: Descriptive Statistics

I display summary statistics of covariates used in the baseline model and the average number of each member type per household in Table B3. These values are only for households in the estimation sample. As expected, the average age of women is slightly higher than men except in Niger. The average age of children is correlated with the ages that children are defined in the survey. Children are those with ages less than 18 in Ethiopia and Uganda, less than 16 in Malawi and Tanzania, less than 15 in Niger and Nigeria, and 14 in Ghana. Most households in each sample are in rural areas except for Ethiopia, where the distribution is about $50-50$. Malawi and Uganda are predominantly rural samples, as expected. For the other countries, the fraction of rural households is between $55-70\%$. Lastly, the average number of women in a household is about 1.4 compared to the number of men around 1.2. The average number of children in a household is around 2.2. For Ghana and Niger, this number is closer to 3.

Table B3: Descriptive Statistics of Covariates

	Ethiopia	Ghana	Malawi	Niger	Nigeria	Tanzania	Uganda	Total
Mean Age	32.28	30.83	29.52	36.21	36.22	31.66	31.86	31.80
of Men	(17.70)	(18.32)	(18.11)	(16.85)	(16.53)	(16.41)	(19.05)	(17.91)
Mean Age	34.75	37.21	35.38	35.80	37.13	35.44	38.98	36.21
of Women	(11.75)	(13.15)	(13.78)	(11.72)	(13.01)	(12.32)	(13.44)	(13.01)
Mean Age	6.842	5.301	6.471	6.083	5.913	5.761	7.564	6.136
of Children	(4.916)	(3.830)	(4.097)	(3.515)	(4.112)	(4.088)	(4.407)	(4.184)
Minimum Age	4.487	3.508	3.999	3.251	3.869	3.427	4.457	3.844
of Children	(4.733)	(3.765)	(3.986)	(3.607)	(4.055)	(3.880)	(4.425)	(4.061)
Mean Education	4.904	5.732	5.958	2.388	7.651	6.315	6.150	5.684
of Men	(5.266)	(4.971)	(4.278)	(4.045)	(5.397)	(4.038)	(4.317)	(4.845)
Mean Education	3.752	5.257	5.753	1.771	6.483	6.407	5.538	5.148
of Women	(4.631)	(4.452)	(3.649)	(3.281)	(5.210)	(3.598)	(3.719)	(4.353)
Area Type	0.502	0.398	0.170	0.356	0.319	0.453	0.224	0.334
(0 - Rural, 1 - Urban)	(0.500)	(0.490)	(0.376)	(0.479)	(0.466)	(0.498)	(0.417)	(0.472)
Number of Men	1.082	1.305	1.114	1.320	1.451	1.229	1.158	1.223
in a Household	(0.688)	(0.929)	(0.773)	(0.849)	(0.903)	(0.818)	(0.825)	(0.841)
Number of Women	1.230	1.595	1.308	1.511	1.562	1.405	1.332	1.423
in a Household	(0.537)	(0.809)	(0.585)	(0.767)	(0.773)	(0.699)	(0.619)	(0.705)
Number of Children	2.230	1.919	2.220	2.884	2.245	2.204	2.743	2.230
in a Household	(1.648)	(1.459)	(1.409)	(1.718)	(1.693)	(1.575)	(1.660)	(1.568)

This table displays the means and standard deviations (in parentheses) for households in the estimation sample. Values for mean age and mean education are the average age and education across member types within each household. Values for minimum child age are for the youngest child per household. Values for the number of men, women, and children are averages per household. Note that children's ages (as defined by the surveys) vary across samples.

Table B4 displays summary statistics for the average household budget and clothing shares relative to the total budget and clothing budget. Importantly, the standard deviation of the total consumption in most countries falls just below the mean, indicating high variation. This is desirable since the identification strategy of the Engel curves depends on budget variation. Even though clothing shares compromise a small

Table B4: Descriptive Statistics of Budget Information

	Ethiopia	Ghana	Malawi	Niger	Nigeria	Tanzania	Uganda	Total
Total Consumption	5484.0	6700.5	3321.8	7640.7	6653.6	6281.4	5764.5	5600.5
(2017 US$ PPP)	(4742.9)	(6015.9)	(2652.6)	(5744.6)	(4453.0)	(6724.1)	(5151.9)	(5192.7)
Share of Men's Clothes	0.015	0.024	0.004	0.012	0.008	0.010	0.005	0.012
of Total Budget	(0.020)	(0.032)	(0.011)	(0.016)	(0.012)	(0.015)	(0.008)	(0.022)
Share of Women's Clothes	0.015	0.027	0.008	0.012	0.013	0.014	0.007	0.015
of Total Budget	(0.020)	(0.029)	(0.014)	(0.016)	(0.015)	(0.016)	(0.009)	(0.021)
Share of Children's Clothes	0.018	0.023	0.009	0.011	0.017	0.012	0.006	0.015
of Total Budget	(0.023)	(0.025)	(0.016)	(0.014)	(0.020)	(0.014)	(0.008)	(0.020)
Share of Men's Clothes	0.248	0.285	0.089	0.294	0.162	0.249	0.242	0.209
of Clothes Budget	(0.255)	(0.248)	(0.206)	(0.254)	(0.206)	(0.225)	(0.280)	(0.249)
Share of Women's Clothes	0.255	0.362	0.244	0.322	0.310	0.363	0.295	0.303
of Clothes Budget	(0.245)	(0.224)	(0.337)	(0.239)	(0.274)	(0.244)	(0.278)	(0.277)
Share of Children's Clothes	0.384	0.330	0.326	0.336	0.413	0.318	0.327	0.344
of Clothes Budget	(0.347)	(0.246)	(0.387)	(0.274)	(0.336)	(0.286)	(0.302)	(0.323)

This table displays the means and standard deviations (in parentheses) for households in the estimation sample. Total consumption (2017 US PPP) is derived from spatially adjusted/real consumption (LCY) using the final household consumption expenditure PPP measure in 2017. Clothes and budget shares are the mean values summed across household member types.

Table B5: Descriptive Statistics of Child Anthropometrics

	Ethiopia	Ghana	Malawi	Nigeria	Total
Sex (Male=0,	0.492	0.489	0.501	0.502	0.496
Female=1)	(0.500)	(0.500)	(0.500)	(0.500)	(0.500)
Age	32.18	32.67	30.20	32.14	31.58
(completed months)	(14.47)	(16.41)	(16.68)	(17.14)	(16.39)
Weight	11.76	12.19	11.76	11.68	11.87
(kg)	(3.107)	(3.571)	(3.236)	(3.615)	(3.393)
Height	85.08	88.05	84.35	84.88	85.64
(cm)	(11.87)	(14.02)	(12.91)	(13.57)	(13.30)
Height-for-Age	-1.845	-0.857	-1.348	-1.554	-1.320
Z-score	(1.935)	(1.817)	(1.478)	(1.731)	(1.737)
Weight-for-Age	-1.076	-0.744	-0.636	-0.993	-0.801
Z-score	(1.409)	(1.245)	(1.128)	(1.330)	(1.259)
Weight-for-Height	-0.0704	-0.372	0.181	-0.129	-0.0751
Z-score	(1.850)	(1.561)	(1.246)	(1.449)	(1.502)
Sample Size	2572	4724	6022	2881	16199

This table shows the means and standard deviations (in parentheses) for children under five years old. The sample includes children with plausible Z-scores ($[-5, 5]$).

part of the overall budget, this is not a concern since estimating resource shares depends on the response of assignable good expenditure to the total household budget expenditure.[8] Total household consumption in 2017 PPP US$ varies from $3321 for Malawi to $7640 for Niger. On average, all households have an annual budget higher than the $3139 extreme poverty line for a four-person household. Expenditure on women's and children's clothing exceeds expenditure on men's clothing. However, this is expected since, on average, there are more women and children in a household.

In Table B5, I display descriptive statistics of child nutrition data for the four countries included in the analysis. I also display the number of children and the fraction of children in the sample that falls under specific categories of malnourishment in Table B6. Notice that this data is for all children ages $0-5$ years. In all the countries, the ratio of boys to girls is nearly 1. The average age is around 32 months. Averages for children's Z-scores are also shown. Height-for-age Z-scores (HAZ) corresponds to children being stunted for their age and sex, weight-for-age Z-scores (WAZ) correspond to children being underweight for their age and sex, and weight-for-height Z-scores (WHZ) correspond to children being wasted for their age and sex. The World Health Organization (WHO) designates a child as stunted, underweight, or wasted if their HAZ, WAZ, or WHZ are below -2, respectively. On average, children are closer to being classified as stunted than wasted. Concerningly, the average child in Ethiopia has a HAZ (-1.845) close to the threshold.

B.3: Matching to Ethnic Groups

Matching households to ethnic groups - specifically those in the Ethnographic Atlas - has been done in the literature before(Alesina et al., 2013; Aminjonov et al., 2023; Ashraf et al., 2020; Nunn & Wantchekon, 2011). Usually, it takes on one of the following strategies: (1) direct ethnic reports, (2) language spoken, or (3) location information. These aspects are found in the LSMS data to varying degrees. Ethiopia and Nigeria supply detailed location details, including the GPS coordinates. The household's primary language and location information (including GPS coordinates) are available for Malawi. For Ghana, household members directly report their ethnicity, language information is available, and administrative zones can be used (no GPS coordinates are available). Considering this, I match households to ethnic groups using a household's GPS coordinates for Ethiopia, Malawi, and Nigeria using the Ethnologue shapefile of Giuliano and Nunn (2018). I plot the ethnic groups' polygons and household locations covering Ethiopia, Ghana, Malawi, and Nigeria in Figure B1.[9]

For Ghana, I use the ethnicity directly reported by household members. The reported ethnicity does not match the Ethnographic Atlas one-to-one. To overcome this, I employ a similar strategy as Aminjonov et al. (2023), proposed by Nunn and Wantchekon (2011). First, I match the member directly if there is a one-to-one match. Second, I use synonyms or known variations of the ethnic groups' names in the Afrobarometer, Demographic and Health Survey, and Joshua Project. Third, some members report the ethnolinguistic group found in the Ethnologue data. Hence, I use the data compiled by Giuliano and Nunn (2018) to

[8] Resource shares do not conform to the consumption ratios of the assignable good but rather measure household members' access to the total household budget.

[9] The GPS coordinates of household locations are offset by $0-2km$ for urban areas, $0-5km$ for rural areas, and $0-10km$ in extreme cases, which is about 1% of enumeration areas (EAs). Therefore, the locations represent a set of coordinates, representative at the EA level, that fall within known limits of accuracy. Given that households of similar ethnic groups usually reside in the same communities and areas, I am confident that these offsets do not affect the matching process in any significant way.

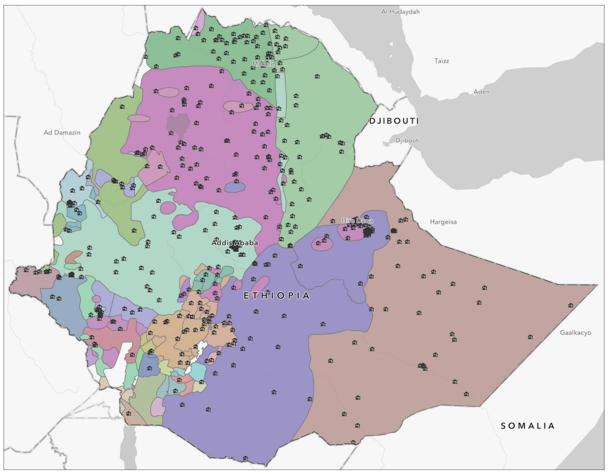
Table B6: Descriptive Statistics of Child Malnutrition Categories

	Ethiopia	Ghana	Malawi	Nigeria	Total
		Stunting			
Healthy	815	2381	2236	1097	6529
($HAZ > -1$)	(0.32)	(0.50)	(0.37)	(0.38)	(0.40)
Marginal	493	1117	1865	667	4142
($-1 > HAZ > -2$)	(0.19)	(0.24)	(0.31)	(0.23)	(0.26)
Moderate	478	698	1227	514	2917
($-2 > HAZ > -3$)	(0.19)	(0.15)	(0.20)	(0.18)	(0.18)
Severe	786	528	694	603	2611
($HAZ < -3$)	(0.31)	(0.11)	(0.12)	(0.21)	(0.16)
		Underweight			
Healthy	1235	2588	3664	1461	8948
($WAZ > -1$)	(0.48)	(0.55)	(0.61)	(0.51)	(0.55)
Marginal	667	1378	1632	769	4446
($-1 > WAZ > -2$)	(0.26)	(0.29)	(0.27)	(0.27)	(0.27)
Moderate	383	498	525	400	1806
($-2 > WAZ > -3$)	(0.15)	(0.11)	(0.09)	(0.14)	(0.11)
Severe	245	140	97	207	689
($WAZ < -3$)	(0.10)	(0.03)	(0.02)	(0.07)	(0.04)
Overweight	42	120	104	44	310
($WAZ > 2$)	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)
		Wasting			
Healthy	1490	2872	4764	2016	11142
($WHZ > -1$)	(0.58)	(0.61)	(0.79)	(0.70)	(0.69)
Marginal	374	923	656	438	2391
($-1 > WHZ > -2$)	(0.15)	(0.20)	(0.11)	(0.15)	(0.15)
Moderate	204	374	144	159	881
($-2 > WHZ > -3$)	(0.08)	(0.08)	(0.02)	(0.06)	(0.05)
Severe	168	235	74	82	559
($WHZ < -3$)	(0.07)	(0.05)	(0.01)	(0.03)	(0.03)
Overweight	336	320	384	186	1226
($WHZ > 2$)	(0.13)	(0.07)	(0.06)	(0.06)	(0.08)

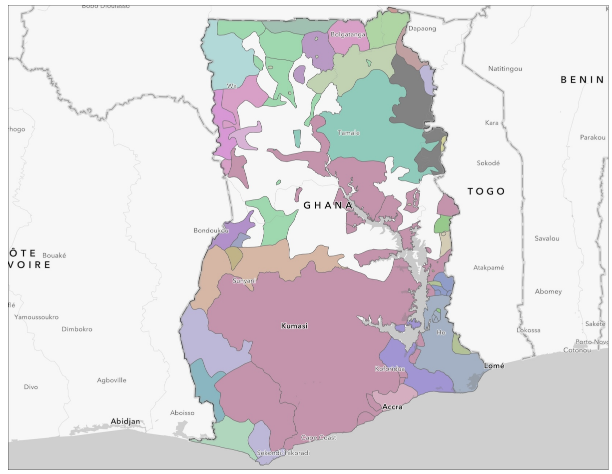
This table displays the frequencies and fraction of the total sample (in parentheses) for children's malnutrition rates. The sample only includes children under five years whose Z-scores are plausible ($[-5, 5]$). There are 16199 children in the sample, with Ethiopia, Ghana, Malawi, and Nigeria contributing 2572, 4724, 6022, and 2881 children, respectively.

match these individuals.[10] These strategies allow me to match around 95% of each country's estimation sample. There are 28, 23, 8, and 54 ethnic groups in the sample for Ethiopia, Ghana, Malawi, and Nigeria, respectively. Although some ethnic groups have similar characteristics, I do have variation across 113 ethnic groups when combing the samples.

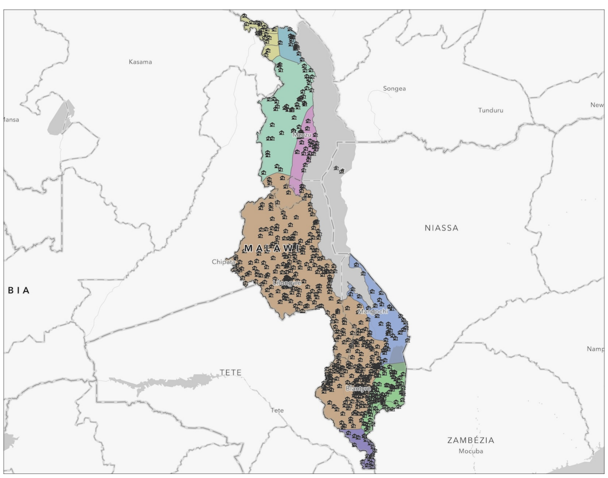
Figure B1: Ethnic Groups



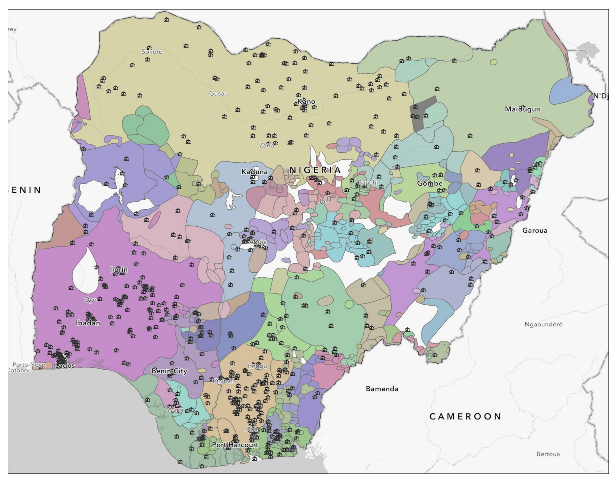
(a) Ethiopia



(b) Ghana



(c) Malawi



(d) Nigeria

Note: These figures depict the boundaries of ethnic groups in Ethiopia, Ghana, Malawi, and Nigeria. Household locations for Ethiopia, Malawi, and Nigeria are also shown. Note that household locations are offset by $0-2km$ for urban areas, $0-5km$ in rural areas, and $0-10km$ in extreme cases (1% of EAs). Therefore, it represents a set of coordinates, representative at the EA level, that fall within known limits of accuracy.

[10]Since some members of the same household might be from different ethnic groups, I use the mode of reported ethnicity per household. I compare this to using the household head's ethnic group. In almost all cases, this is the same ethnic group. However, some household heads have missing reported ethnic groups. Therefore, I prefer to use the mode.

Appendix C: Results

The main focus of this section is to highlight the influence of ethnic characteristics on child poverty. I start by mentioning identification and baseline results, the correlations between malnutrition, poverty and resource shares as well as differences across ethnic groups. Next, I discuss the feature selection process to identify six ethnic characteristics that have the most influence on child welfare outcomes. Lastly, I use local polynomial graphs to highlight differences in poverty rates due to the influence of ethnic characteristics.

C.1: Identification

Table C1 displays the results of the identification tests outlined in Section A.3. For every country, the table provides the number of households, the mean and standard deviation of total assignable-goods budget shares, the slope of the clothing Engel curve (at average household characteristics), and the associated z-test. The last two columns provide the fraction of households in each sample whose estimated slope - conditional on their covariates - is statistically significantly different from zero (based on a 5% significance level) and the fraction of estimated resource shares that fall outside the $[0,1]$ interval. In all countries except Malawi, clothing is a necessity. Niger is the only country for which we do not reject the Z-test of the slope. Since the slope is the denominator in the estimation of resource shares, it should come as no surprise that 0% of Niger's sample is significant.

I exclude Tanzania and Uganda from the analysis by using 75% as a cutoff value for the fraction of households with significant Engel curves. Although Nigeria passes the identification test with 80.77% of the sample significant, 15% of households have estimated resource shares outside the $[0,1]$ interval.[11] For the other three countries that passed the test, Ethiopia has 89.33% of its sample significant and only 7.3% of the estimated resource shares are outside the $[0,1]$ interval. Both Ghana and Malawi have samples with more than 95% significance and below 3% of estimated resource shares that fall outside the $[0,1]$ interval. The countries passing the identification tests also have the four largest sample sizes. Comparing the latest waves to LPW, the fraction of samples significant in Ethiopia, Ghana, and Nigeria increases from 63%, 63%, and 51%, respectively, to above 80%.[12]

C.2: Baseline Results

The baseline results are estimated with the covariates outlined in Section B.2 excluding θ - the ethnic characteristics. In Table C2, I display the estimated per-person resource shares of men, women, and children.Similarly to LPW, I show these results at the average value of the covariates ($\bar{z}$) and the mean value of estimated resource shares evaluated at all z_h. Comparing Malawi to LPW, the results suggest a move toward women having a larger resource share than men. LPW finds that per-man resource shares are about 31% and per-woman's is about 27%. Women in my sample have a slightly higher per-person resource share of

[11] LPW notes that resource shares fall outside this interval if the slope of the clothing Engel curves for household members differ. This implies clothing might be a luxury for men but a necessity for women. Therefore, one of these household members will have a negative clothing share.

[12] Although not included in the analysis, the fraction of households with significant Engel curves improves from 14% to 67% and from 5% to 73% in Tanzania and Uganda.

Table C1: Tests of Identification

Country	Sample	Budget Share	Slope at $\bar{z}$	Z-Test of Slope	% of Sample Significant	Fraction η Outside $[0,1]$
Ethiopia	5250	0.047	−0.012	−6.97*	89.33	0.073
		(0.045)	(0.002)			
Ghana	9736	0.073	−0.015	−7.67*	99.37	0.029
		(0.060)	(0.001)			
Malawi	10092	0.021	0.011	11.53*	97.27	0.009
		(0.030)	(0.001)			
Niger	3015	0.035	−0.000	−0.17	0.00	0.898
		(0.032)	(0.002)			
Nigeria	3833	0.038	−0.010	−5.00*	80.77	0.151
		(0.035)	(0.002)			
Tanzania	3416	0.036	−0.006	−2.41	67.15	0.254
		(0.032)	(0.002)			
Uganda	2338	0.018	−0.005	−3.56*	72.67	0.139
		(0.019)	(0.001)			

The values for the budget shares are the mean and standard deviation (in parentheses) of assignable-goods budget shares summed across household members. The Engel curve's slope is given at each country's average characteristics with standard error in parenthesis. Z-test critical value is for the hypothesis that the overall assignable-goods Engel curve, evaluated at $\bar{z}_h$, is either upward or downward sloping. * - significant even when using the square root of 10 - Staiger and Stock (1997)'s recommended threshold due to possible weak identification. Sample significance is the fraction of households whose estimated slope (conditional on covariates) is statistically significantly different from zero ($\alpha = 5\%$). The final column provides the fraction of households whose resource shares fall outside the $[0,1]$ interval, with the standard deviation in parentheses.

28%, and men have a lower per-person resource share of about 25%, corroborating the results in Aminjonov et al. (2023).

Table C3 displays the individual poverty rates for each member type based on their per-person resource shares. I use two poverty lines: the extreme poverty line of \$2.15/day in 2017 PPP US\$ and the societal poverty line, a country-income-specific poverty line (World Bank, 2018). Since Ethiopia and Malawi are both low-income economies, the higher poverty line of \$3.65/day in 2017 PPP US\$ applies only to Ghana and Nigeria - both lower-middle-income economies. In this table, I only use the rough estimate that a child requires 0.6 of what adult men and women require.[13] For all countries except Malawi, accounting for individual expenditure increases the overall number of people classified as poor by a couple of percentage points.

[13] This implies the extreme poverty line for children are \$1.29/day in 2017 PPP US\$ and the LMIC poverty line for children is \$2.19/day in 2017 PPP US\$.

Table C2: Predicted Resource Shares

Country	Sample	Evaluated at $\bar{z}$: Estimated Men (SE)	Women (SE)	Children (SE)	Evaluated at All z_h: Mean Men (SD)	Women (SD)	Children (SD)	Wald Per Capita Test, dof (p-Value)
Ethiopia	5250	0.284	0.238	0.181	0.288	0.235	0.179	106, 45
		(0.035)	(0.053)	(0.026)	(0.266)	(0.436)	(0.405)	(0.000)
Ghana	9736	0.185	0.220	0.219	0.189	0.213	0.216	221, 45
		(0.028)	(0.033)	(0.022)	(0.117)	(0.169)	(0.132)	(0.000)
Malawi	10092	0.250	0.282	0.159	0.251	0.287	0.155	246, 45
		(0.028)	(0.032)	(0.012)	(0.152)	(0.144)	(0.100)	(0.000)
Nigeria	3833	0.104	0.249	0.209	0.109	0.241	0.207	108, 45
		(0.040)	(0.048)	(0.027)	(0.215)	(0.398)	(0.172)	(0.000)

This table displays estimated per-person resource shares, η_h^t/N_h^t, of men, women, and children. Only countries that pass the identification threshold are displayed. Resource shares estimated at the mean of observed covariates ($\bar{z}$) and the mean of the resource shares evaluated at all z_h are shown. The Wald test statistic, degrees of freedom, and p-value (in parentheses) are for the test of whether the samples reject the per-capita model, i.e., resource shares are such that $\eta_h^t/N_h^t = 1/\sum N_h^t$.

Table C3: Predicted Poverty Rates

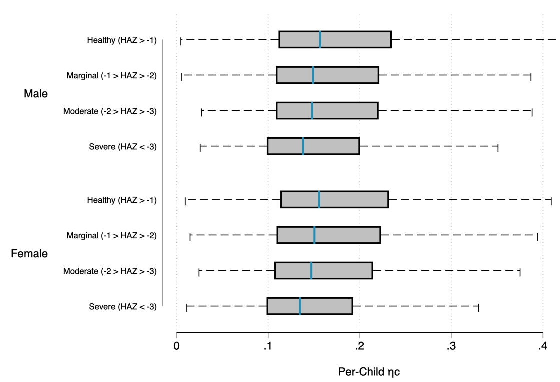
Country	Extreme Poverty ($2.15/day): Per-Capita (SE)	Individual Poverty Rates: Men (SE)	Women (SE)	Children (SE)	All (SE)	Country Income-Level ($2.15/day or $3.65/day): Per-Capita (SE)	Individual Poverty Rates: Men (SE)	Women (SE)	Children (SE)	All (SE)
Ethiopia	0.344	0.286	0.417	0.366	0.361	0.344	0.286	0.417	0.366	0.361
	(0.006)	(0.038)	(0.040)	(0.036)	(0.015)	(0.006)	(0.038)	(0.040)	(0.036)	(0.015)
Ghana	0.314	0.435	0.433	0.235	0.355	0.555	0.711	0.641	0.428	0.575
	(0.005)	(0.055)	(0.032)	(0.020)	(0.016)	(0.005)	(0.042)	(0.027)	(0.021)	(0.010)
Malawi	0.662	0.597	0.538	0.641	0.601	0.662	0.597	0.538	0.641	0.601
	(0.005)	(0.030)	(0.031)	(0.027)	(0.006)	(0.005)	(0.030)	(0.031)	(0.027)	(0.006)
Nigeria	0.249	0.727	0.316	0.157	0.362	0.593	0.880	0.571	0.391	0.579
	(0.006)	(0.066)	(0.066)	(0.038)	(0.023)	(0.008)	(0.037)	(0.051)	(0.043)	(0.014)

This table displays the estimated fraction of each (type of) individual who is poor based on 2017 PPP US$. Whether an individual is poor or not is based on the estimated individual resource shares. Per-capita estimates are also shown. Standard errors in parentheses are bootstrapped standard errors. Ghana and Nigeria are classified as low-middle income economies ($3.65/day), and Ethiopia and Malawi are low-income economies ($2.15/day).

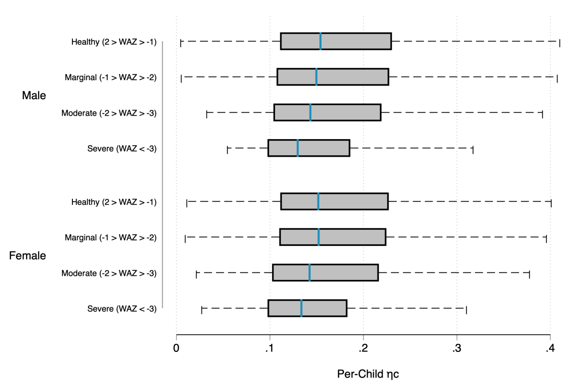
C.3: Resource Shares, Poverty and Child Malnutrition

Suppose within-household resource distribution is a mechanism through which ethnic characteristics influence child malnutrition. In that case, there should be an indication that a higher resource share and more income lead to better child nutrition outcomes. I empirically investigate this with boxplots across different malnutrition categories for the full sample, i.e., combining data from Ethiopia, Ghana, Malawi, and Nigeria.[14] Figures C1a, C1b, and C1c display results for both boys and girls for stunting, underweight, and wasting, respectively. The World Health Organization (WHO) classifies children according to their z-score outcomes. These categories are healthy (z-score > -1), marginal ($-3 <$ z-score < -2), moderate ($-2 <$ z-score < -1), and severe (z-score < -3). For wasting and underweight, children can also be overweight (z-score> 2). Frequencies and fractions of children in each category of all samples can be found in Table B6.

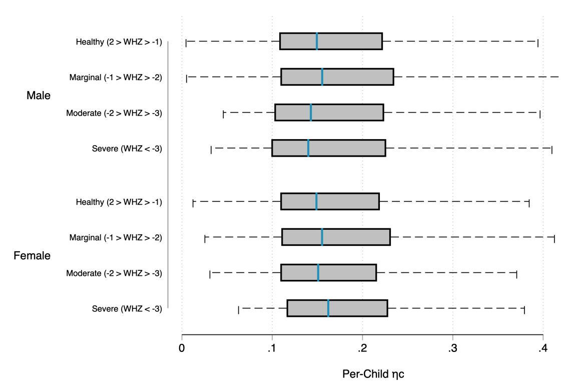
Figure C1: Children Malnutrition Categories & Resource Shares



(a) Stunting



(b) Underweight



(c) Wasting

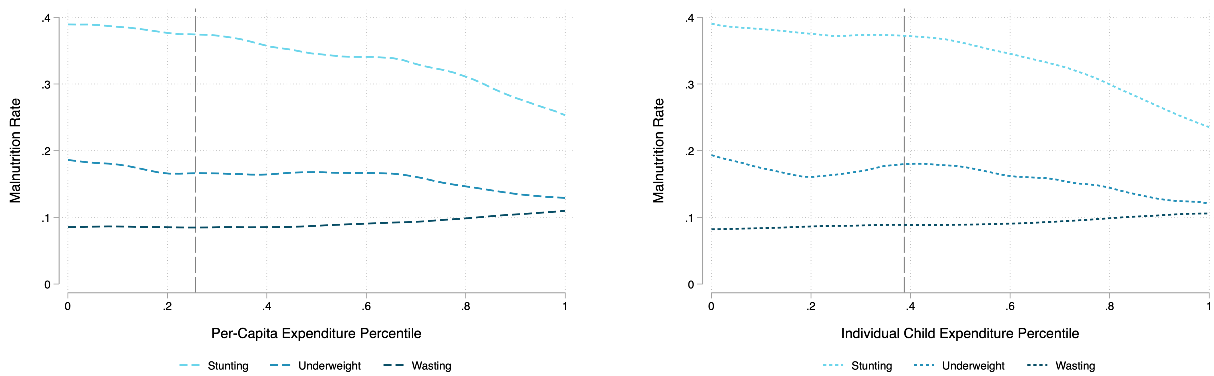
Note: These figures display the relationship between per-child resource shares and the malnutrition classification of a child. (a) stunting categories, (b) underweight categories, and (c) wasting categories. The sample is all children from Ethiopia, Ghana, Malawi, and Nigeria aged $0-5$ with plausible z-scores ($[-5, 5]$).

As noted by Brown et al. (2019), stunting, underweight, and wasting have different causes and effects. Stunting and underweight are indicators of more prolonged and persistent malnutrition. Recovering from

[14] Separate results for each country is available on request.

these conditions is much more complicated and can lead to adverse long-term consequences. Wasting is short-term malnutrition due to food deprivations or illnesses that are usually seasonal and recovery can be relatively quick. Figure C2b displays malnutrition prevalence across per-captia and per-individual expenditure percentiles. As expected, for stunting and underweight prevalence, there is a decrease in the fraction of malnourished children as income increases. For stunting, this decrease is from around 38% to 24% and from around 40% to 22% from the lowest to the highest per-capita and individual expenditure percentiles, respectively.

Figure C2: Malnutrition Prevalence by Expenditure Percentile



(a) Per-Capita Expenditure

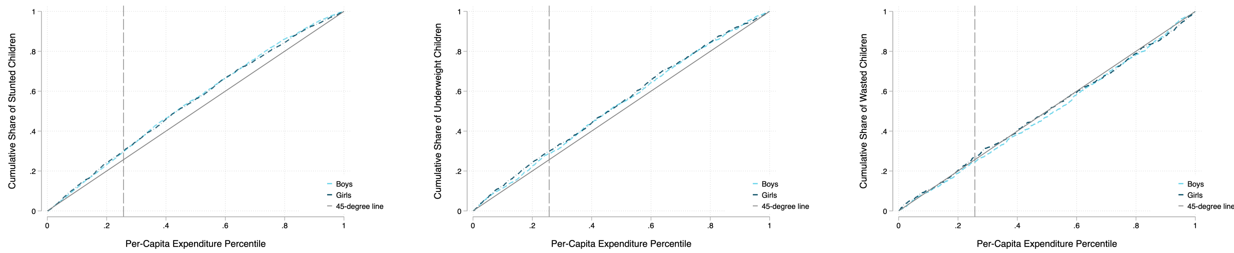
Note: This figure depicts the malnutrition rates of children ages 0-5 at each household per-capita expenditure percentile. A child is malnourished if his/her Z-score is less than −2. Children with implausible Z-scores are excluded. The dashed grey vertical line represents the rough estimate of WB extreme poverty line for children of US$1.29/day.

(b) Individual Child Expenditure

Note: This figure depicts the malnutrition rates of children ages 0-5 at each child's individual expenditure percentile. A child is malnourished if his/her Z-score is less than −2. Children with implausible Z-scores are excluded. Individual child expenditure is calculated by multiplying total annual household expenditure (PPP $) by individual child resource shares. The dashed grey vertical line represents the rough estimate of WB extreme poverty line for children of US$1.29/day.

Figure C3 shows the distribution of malnourished children by income percentile in the form of concentration curves. Both the per-capita and per-individual expenditure percentiles are used. The curves show that poor children are less likely to be malnourished than non-poor children. On the contrary, poor and non-poor individuals are mostly equally likely to be malnourished. This result is similar to those found by Brown et al. (2021) and Brown et al. (2019). Two explanations are relevant. The countries in the sample are low-income or lower-middle-income countries. Therefore, even households in the top percentile of expenditure do not have high expenditure levels compared to global standards. Secondly, these children are all exposed to the same harsh health and disease conditions. Therefore, malnourishment can be due to illness and not just low expenditure. Results for each country separately are available on request.

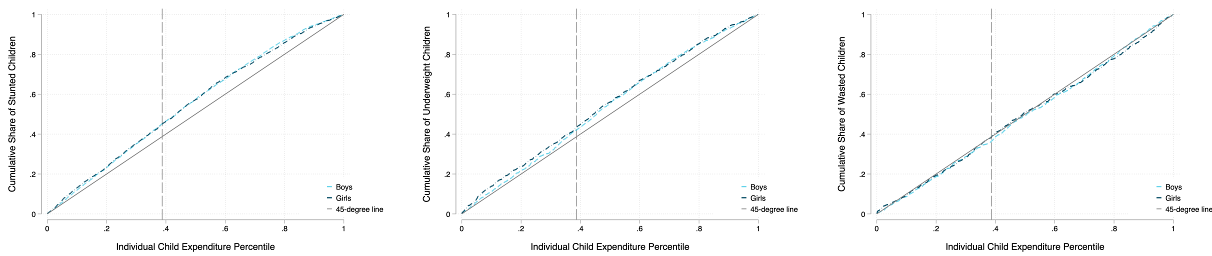
Figure C3: Malnutrition Concentration Curves for Total Sample



(a) Stunting at Per-Capita Expenditure

(b) Underweight at Per-Capita Expenditure

(c) Wasting at Per-Capita Expenditure



(d) Stunting at Individual Child Expenditure

(e) Underweight at Individual Child Expenditure

(f) Wasting at Individual Child Expenditure

Note: This figure depicts the concentration curves of malnutrition rates for children ages $0-5$ and those with plausible z-scores (between -5 and 5). The blue dashed lines represent boys, and the red dashed lines represent girls. Figures C3a, C3b, and C3c are concentration curves of stunted, underweight, and wasted children at the per-capita expenditure percentile, respectively. Figures C3d, C3e, and C3f are concentration curves of stunted, underweight, and wasted children at the per-child individual expenditure percentile, respectively. Individual child expenditure is calculated by multiplying total annual household expenditure (PPP dollars) by individual child resource shares. The dashed grey vertical line represents the percentile corresponding to the rough estimate of the World Bank extreme poverty line for children of US$1.29/day. Children are stunted if their height-for-age z-score (HAZ) is less than -2. Children are underweight if their weight-for-age z-score (WAZ) is less than -2. Children are wasted if their weight-for-height z-score (WHZ) is less than -2.

C.4: Differences Across Ethnic Groups

One of the main questions I address in this paper is whether child malnutrition, poverty, and intrahousehold resource shares differ across ethnic groups. If no differences exist, it is questionable that ethnic characteristics matter. Table C4 displays the ANOVA test results for per-individual men, women, and children resource shares and the per-household resource share of children. For every country, the ANOVA tests reject that the means of per-individual resource shares for every household member type across ethnic groups are equal. Similarly, Table C5 displays ANOVA test results for whether the means of children's HAZ, WAZ, and WHZ, as well as the prevalence rate of stunting, underweight, and wasting across ethnic groups, are equal. These hypotheses are rejected for every country sample. Therefore, there is a strong indication that resource shares and child malnutrition outcomes differ across ethnic groups.

I also inspect Kernel densities of per-individual resource shares and child z-scores to ensure differences in distributions exist. These are shown in Figures C4 and C5, respectively. In some cases, the within-country per-individual resource shares kernel densities have similar shapes, but there are apparent differences across ethnic groups. The Kernel densities of child Z-scores differ more profoundly across ethnic groups. Therefore, one is inclined to reject the notion that per-individual resource shares for every member

Table C4: ANOVA Tests for Intrahousehold Resource Shares

Country	Number of Ethnic Groups	η_m	η_w	η_c	Per-Household η_c
Ethiopia	28	3.12, 27	4.59, 27	12.98, 27	11.56, 27
		(0.000)	(0.000)	(0.000)	(0.000)
Ghana	23	5.36, 22	15.81, 22	61.94, 22	76.25, 22
		(0.000)	(0.000)	(0.000)	(0.000)
Malawi	8	6.73, 7	30.42, 7	10.94, 7	23.45, 7
		(0.000)	(0.000)	(0.000)	(0.000)
Nigeria	54	1.87, 53	2.93, 53	25.92, 53	25.89, 53
		(0.000)	(0.000)	(0.000)	(0.000)

This table displays the F-statistic, degrees of freedom, and p-value (in parentheses) of the ANOVA tests of whether the means of per-person estimated resource shares are equal across ethnic groups in each country. The last column shows the test results of whether the means of the total share of household resources allocated to children are equal across ethnic groups. Only countries that pass the identification threshold are displayed. All households where $\eta_t \notin [0,1]$ for $t = m, w, c$ are excluded.

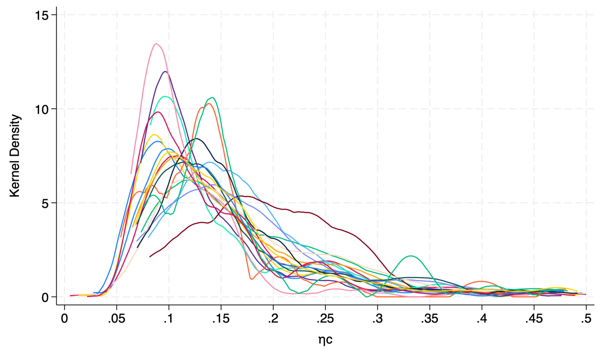
Table C5: ANOVA Tests for Child Malnutrition

Country	Number of Ethnic Groups	HAZ	WAZ	WHZ	Stunted	Underweight	Wasted
Ethiopia	27	3.77, 26	6.52, 26	4.96, 26	3.93, 26	4.10, 26	2.96, 26
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ghana	23	7.70, 22	5.88, 22	4.19, 22	8.88, 22	4.05, 22	4.56, 22
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Malawi	8	4.18, 7	7.93, 7	8.57, 7	2.73, 7	3.67, 7	3.67, 7
		(0.000)	(0.000)	(0.000)	(0.008)	(0.001)	(0.001)
Nigeria	54	6.97, 53	4.13, 53	2.61, 53	7.27, 53	4.57, 53	1.47, 53
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.016)

This table displays the F-statistic, degrees of freedom, and p-value (in parentheses) of the ANOVA tests to determine whether the means of children's anthropometric measurements are equal across ethnic groups in each country. Only countries that pass the identification threshold are displayed. The first three columns display the ANOVA test result for children's HAZ (height-for-age Z-score), WAZ (weight-for-age Z-score), and WHZ (weight-for-height Z-score). Only children with Z-scores in the interval $[-5,5]$ are included. Stunted, underweight, and wasted are indicators for children with HAZ, WAZ, and WHZ that are less than -2, respectively. Therefore, the last three columns display the ANOVA tests of whether the fraction of children who are stunted, underweight, and wasted are equal across ethnic groups.

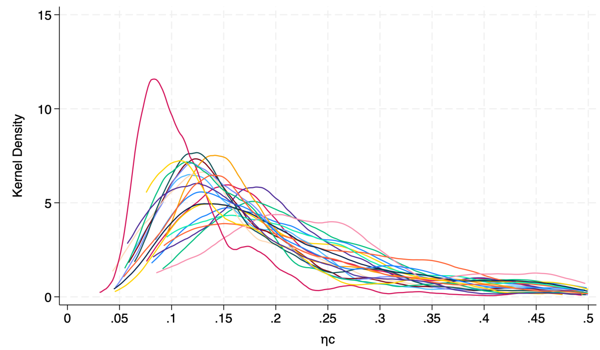
type and child malnutrition outcomes are distributed equally across ethnic groups within a country. When comparing results between countries, distributions are mainly different, but some similarities exist, which could indicate that ethnic groups with similar traits have similar distributions.

Figure C4: Predicted Per-Child Resource Shares Across Ethnic Groups



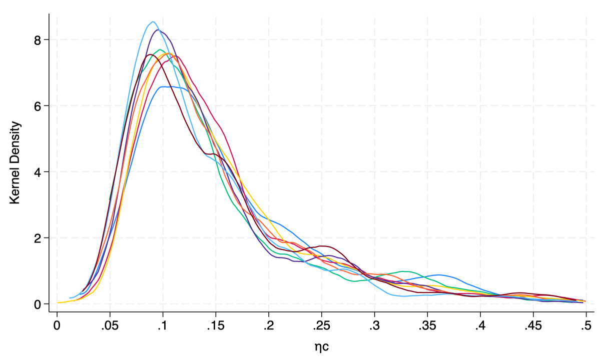
(a) Ethiopia

Note: This figure depicts the kernel densities of resource shares per child across 20 ethnic groups in Ethiopia. I restrict resource shares to fall in the range $[0, 0.5]$. Only ethnic groups containing more than 20 observations of children's resource shares are shown.



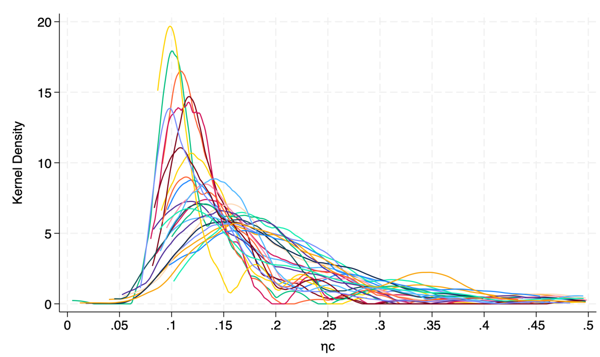
(b) Ghana

Note: This figure depicts the kernel densities of resource shares per child across 21 ethnic groups in Ghana. I restrict resource shares to fall in the range $[0, 0.5]$. Only ethnic groups containing more than 20 observations of children's resource shares are shown.



(c) Malawi

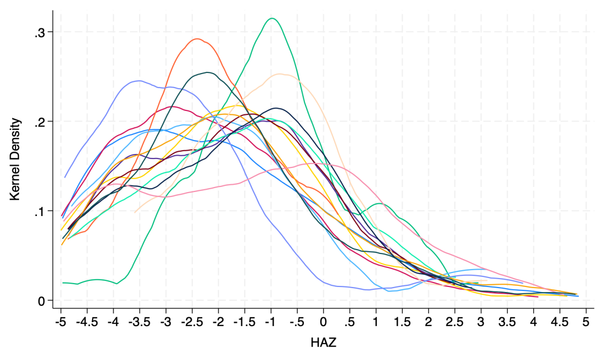
Note: This figure depicts the kernel densities of resource shares per child across 8 ethnic groups in Malawi. I restrict resource shares to fall in the range $[0, 0.5]$. Only ethnic groups containing more than 20 observations of children's resource shares are shown.



(d) Nigeria

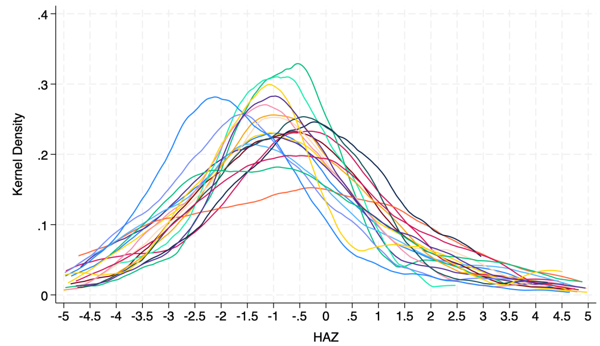
Note: This figure depicts the kernel densities of resource shares per child across 26 ethnic groups in Nigeria. I restrict resource shares to fall in the range $[0, 0.5]$. Only ethnic groups containing more than 20 observations of children's resource shares are shown.

Figure C5: Height-for-Age Z-Scores (HAZ) Across Ethnic Groups



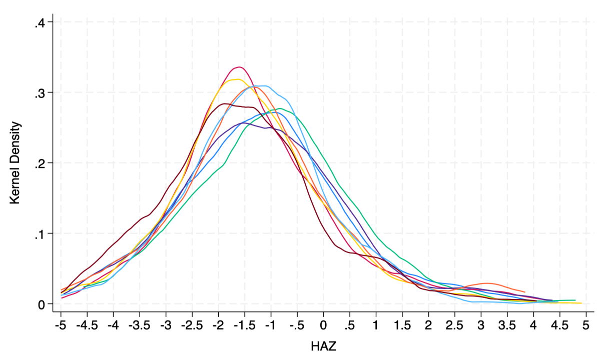
(a) Ethiopia

Note: This figure depicts the kernel densities of children's height-for-age Z-scores (HAZ) across 16 ethnic groups in Ethiopia. I restrict HAZ to fall in the range $[-5, 5]$. Only ethnic groups containing more than 20 observations of children's HAZ are shown.



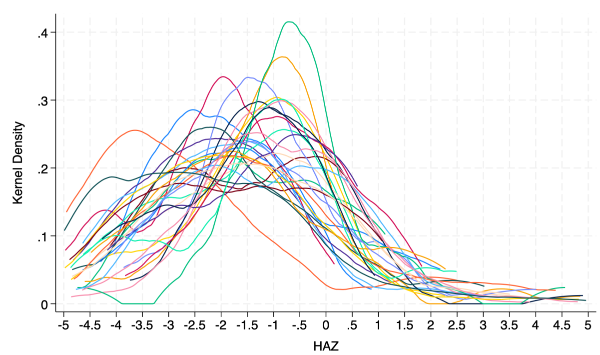
(b) Ghana

Note: This figure depicts the kernel densities of children's height-for-age Z-scores (HAZ) across 21 ethnic groups in Ghana. I restrict HAZ to fall in the range $[-5, 5]$. Only ethnic groups containing more than 20 observations of children's HAZ are shown.



(c) Malawi

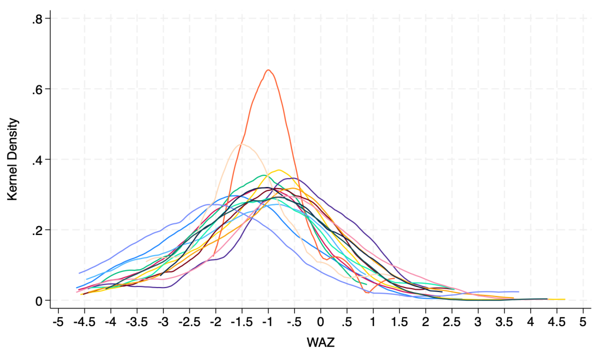
Note: This figure depicts the kernel densities of children's height-for-age Z-scores (HAZ) across 8 ethnic groups in Malawi. I restrict HAZ to fall in the range $[-5, 5]$. Only ethnic groups containing more than 20 observations of children's HAZ are shown.



(d) Nigeria

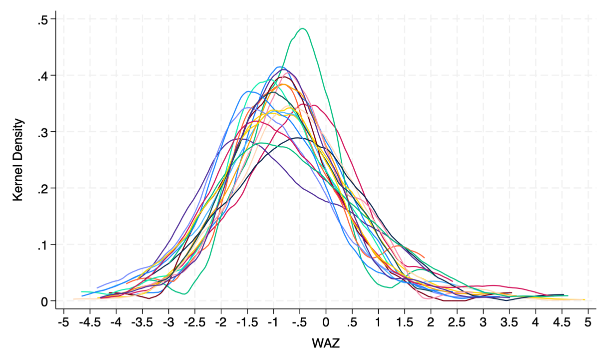
Note: This figure depicts the kernel densities of children's height-for-age Z-scores (HAZ) across 30 ethnic groups in Nigeria. I restrict HAZ to fall in the range $[-5, 5]$. Only ethnic groups containing more than 20 observations of children's HAZ are shown.

Figure C6: Weight-for-Age Z-Scores (WAZ) Across Ethnic Groups



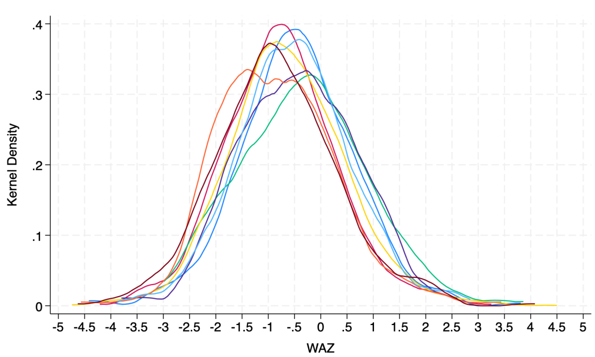
(a) Ethiopia

Note: This figure depicts the kernel densities of children's weight-for-age Z-scores (WAZ) across 18 ethnic groups in Ethiopia. I restrict WAZ to fall in the range $[-5,5]$. Only ethnic groups containing more than 20 observations of children's WAZ are shown.



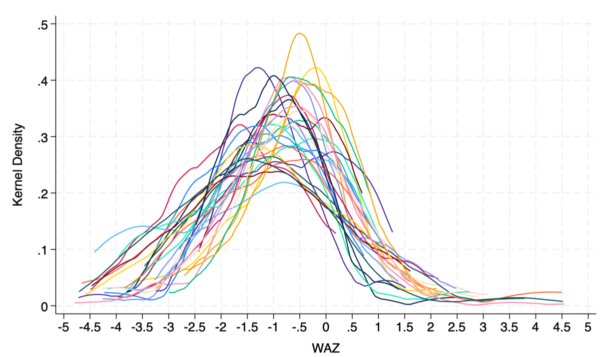
(b) Ghana

Note: This figure depicts the kernel densities of children's weight-for-age Z-scores (WAZ) across 21 ethnic groups in Ghana. I restrict WAZ to fall in the range $[-5,5]$. Only ethnic groups containing more than 20 observations of children's WAZ are shown.



(c) Malawi

Note: This figure depicts the kernel densities of children's weight-for-age Z-scores (WAZ) across 8 ethnic groups in Malawi. I restrict WAZ to fall in the range $[-5,5]$. Only ethnic groups containing more than 20 observations of children's WAZ are shown.



(d) Nigeria

Note: This figure depicts the kernel densities of children's weight-for-age Z-scores (WAZ) across 30 ethnic groups in Nigeria. I restrict WAZ to fall in the range $[-5,5]$. Only ethnic groups containing more than 20 observations of children's WAZ are shown.

C.5: Feature Selection

This section outlines the results regarding the feature selection process. First, I highlight the categories of ethnic characteristics used in the feature selection process. I then display results for each 20 feature selection "runs" - the results across outcome variables and samples. Lastly, I also show robust results regarding the feature selection using a group lasso model with imputed values as well as the recursive feature elimination with cross-validation method.

C.5.1: Variables from the Ethnographic Atlas

Table C6 displays the 56 ethnic characteristic categories from the Ethnographic Atlas on which I ran the feature selection process. I chose these ethnic categories by first removing all categories for which the sample has no variation across characteristics. Secondly, I remove all categories that are secondary in nature - for example, alternative forms of marriage. Lastly, I removed ethnic variables with many missing values in my sample and those without an intuitive explanation to influence child welfare outcomes. Although some ethnic categories are ordinal ($v1$ - $v5$, $v31$, $v32$, and $v33$), most categories include individual characteristics. I create dummy variables that indicate whether a child's ethnic group has the characteristic. I rescaled all ordinal variables to fall within the $[0,1]$ interval. For a complete list of each characteristic and other ethnic characteristic categories not included, please refer to Murdock et al. (1999).

Table C6: Ethnic Characteristics

Identifier	Ethnic Characteristic Category	Identifier	Ethnic Characteristic Category
v1	gathering	v40	predominant type of animal husbandry
v2	hunting	v42	subsistence economy
v3	fishing	v43	descent: major type
v4	animal husbandry	v44	sex differences: metal working
v5	agriculture	v45	sex difference: weaving
v6	mode of marriage	v46	sex differences: leather working
v8	domestic organization	v47	sex differences: pottery making
v9	marial composition: monogamy and polygamy	v48	sex differences: boat building
v11	transfer of residence at marriage: after first years	v49	sex difference: house building
v12	marital residence with kin: after first years	v50	sex differences: gathering
v15	community marriage organization	v51	sex differences: hunting
v17	largest patrilineal kin group	v52	sex differences: fishing
v19	largest matrilineal exogamous group	v53	sex differences: animal husbandry
v21	largest martrilineal kin group	v54	sex differences: agriculture
v23	cousin marriages (allowed)	v66	class stratification
v25	preferred rather than just permitted cousin marriages	v70	type of slavery
v27	kin terms for cousins	v71	former presence of slavery
v28	intensity of agriculture	v72	succession to the office of local headman
v29	major crop type	v73	hereditary succession type to the local headman office
v30	settlement patterns	v74	inheritance rule for real property (land)
v31	mean size of local communities	v75	inheritance distribution for real property (land)
v32	jurisdictional hierarchy of local community	v76	inheritance rule for movable property
v33	jurisdictional hierarchy beyond local community	v77	inheritance distribution for movable property
v34	high gods	v78	norms of premarital sexual behavior of girls
v35	games	v90	political integration
v36	post	v94	political succession for the local community
v37	male genital mutilations	v112	trance states
v38	segregation of adolescent boys	v113	societal rigidity

This table depicts the 56 variable categories selected from the Ethnographic Atlas that is used for feature selection. For the full list of categories and each characteristic within these categories, please refer to Murdock et al. (1999).

C.5.2: Random Forest Regressor

This section displays the feature selection results. Note that for every characteristic, I denote it as $v\kappa\_\rho$, where κ is the ethnic variable identifier according to Murdock et al. (1999) and ρ represents the specific subcategory. For example, v6_1 represents bride price or bride wealth as the prevailing type of exchange or transfer at marriage. Similarly, v6_7 represents that dowry payments are the prevailing type of exchange or transfer at marriage. I use a random forest regressor algorithm with 10000 and 20000 trees, respectively (depending on the sample).Table C7 displays the results using a random forest algorithm. Panel A displays the characteristics that appear most in the top ten of each feature selection run, while Panel B displays the sum of feature importance scores across the different runs. I also show the number of households with this characteristic out of the total number of households for which the variable is non-missing. For example, variable $v37\_5$ (male genital mutilations occurring at ages 6 to 10) appears in the top 10 of the most important features four out of twenty times. It also has a total feature importance score of 0.3401. Out of the total 28207 households, 25726 households have non-missing values for the male genital mutilations variable and 2761 households have the characteristic that male circumcision occurs at ages 6 to 10. Characteristics appearing at least 4 times in the top 10 have summed feature importance scores ranging from 0.0973 to 0.6113. Characteristics with summed feature importance scores greater than 0.25 appear in the top 10 one to seven times.

C.5.3: Feature Selection Robustness

I perform recursive feature elimination with cross-validation and list the results in Table C8. It displays the number of times a variable was chosen as one of the optimal features across all the feature selection "runs". The characteristics broadly align with jurisdictional hierarchy, subsistence economy indicators, community/marriage organizations, sex differences, religion, and major crop types. These results support the findings and conclusions made in the main text.

Similar to Table C7, Table C9 displays the feature selection results using a Group Lasso Model instead. The results are an aggregate of 20 feature selection "runs" across samples and outcome variables.[15] A limitation of the group lasso model is that it cannot deal with missing values. Given the nature of historical data, there is, unfortunately, ample data not available for certain societies in the Ethnographic Atlas. My sample is no exception, and I must impute values for ethnic characteristics to use the group lasso model. I do this by using the closest neighbor algorithm. I find similar results to the random forest regressor.

However, differences do exist, and these differences are mainly due to characteristics that contain a lot of missing values within my sample. Some characteristics not picked up with the random forest regressor include the type and former presence of slavery, the social rigidity of society, and the segregation of adolescent boys. These differences can either be a by-product of the imputed values or the methodology of the group lasso model. An interesting test will examine ethnicities with no missing values for these characteristics and see if the random forest regressor emphasizes these more prominently. Nevertheless, the group lasso model still highlights characteristics such as the major crop type, mode of marriage, and jurisdictional hierarchy as important.

[15] For the results of each individual feature selection "run" with the group lasso model, please contact the author.

Table C7: Random Forest Regressor Feature Selection

Label	Ethnic Characteristic	Sample Size	Frequency	Sum of Feature Importance Scores
	Panel A: By Frequency			
v4	Subsistence economy: dependence on animal husbandry	28207	7	0.2666
v33	Jurisdictional hierarchy beyond local community	26904	7	0.1949
v32	Jurisdictional hierarchy of local community	26942	5	0.1582
v54_2	Agriculture sex differences: males appreciably more	6655 (22553)	4	0.6113
v34_4	High gods: supportive of human morality	3329 (14786)	4	0.4951
v37_5	Male genital mutilations: 6 to 10 years	2761 (25726)	4	0.3401
v53_1	Animal husbandry sex differences: males only	2551 (8640)	4	0.3102
v6_1	Mode of marriage: bride price or wealth, to bride's family	16931 (28207)	4	0.2017
v46_3	Leather working sex differences: activity present	1901 (8165)	4	0.1112
v74_2	Inheritance rule for real property (land): Inheritance by matrilineal heirs (sister's sons)	1721 (25313)	4	0.1082
v74_6	Inheritance rule for real property (land): Inheritance by patrilineal heirs (sons)	7021 (25313)	4	0.0973
	Panel B: By Sum of Scores			
v66_3	Class stratification: dual	6691 (25060)	2	0.6659
v54_2	Agriculture sex differences: males appreciably more	6655 (22553)	4	0.6113
v34_4	High gods: supportive of human morality	3329 (14786)	4	0.4951
v29_2	Major crop type: roots or tubers	8066 (27026)	3	0.4634
v30_2	Settlement patterns: seminomadic	429 (26996)	3	0.4488
v54_5	Agriculture sex differences: females appreciably more	8417 (22553)	3	0.3865
v37_5	Male genital mutilations: 6 to 10 years	2761 (25726)	4	0.3401
v47_5	Pottery making sex differences: activity present	2736 (21590)	1	0.3304
v53_1	Animal husbandry sex differences: males only	2551 (8640)	4	0.3102
v25_1	Preferred Cousin Marriages: duolateral, symmetrical preference	8115 (26106)	1	0.2720
v54_6	Agriculture sex differences: females alone	542 (22553)	2	0.2669
v4	Subsistence economy: dependence on animal husbandry	28207	7	0.2666

This table displays ethnic characteristics identified by feature selection using a random forest regressor algorithm. I denote each characteristic as vx_y, where x is the ethnic variable identifier according to Murdock et al. (1999) and y represents the specific subcategory. Feature selection is performed on four outcome variables - child poverty, child stunting, child underweight, and child wasting - across five samples - all countries for which identification holds and each country separately (Ethiopia, Ghana, Malawi, and Nigeria). Panel A displays ethnic characteristics ranked in the top 10 features of each test at least four times. Panel B includes ethnic characteristics for which the sum of their feature importance score across samples is greater than 0.25. The sample size is the total number of households with the reported ethnic characteristics. The number of households out of the total sample of 28207 with non-missing values for the ethnic variable category is noted in parentheses. The total sample of 28207 is those households that can be matched to ethnic groups and are in the estimation sample.

Table C8: Recursive Feature Elimination with Cross-Validation

Identifier	Ethnic Characteristic	Count
v33	Jurisdictional hierarchy beyond local community	7
v5	Subsistence economy: Dependence on agriculture	4
v66_3	Class differentiation: Dual stratification	3
v15_2	Community marriage organization: Segmented communities	3
v34_4	High gods: Present, active, and supportive of human morality	3
v4	Subsistence economy: Dependence on animal husbandry	3
v46_1	Leatherworking sex differences: Only males	2
v32	Jurisdictional hierarchy of local community	2
v42_3	Dominant subsistence economy: extensive agriculture	2
v11_1	Transfer of residence at marriage: patrilocal (wife to husband)	2
v15_3	Community marriage organization: Agamous communities	2
v74_6	Inheritance rule for real property: Patrilineal heirs	2
v31	Mean size of local communities	2
v37_5	Male genital mutilations: Late childhood (6-10 years of age)	2
v72_6	Succession to the office of local headman: Nonhereditary through election	2
v34_2	High gods: Present but unconcerned with human affairs	2
v53_1	Animal husbandry sex differences: Males only	2
v8_6	Domestic organization: Minimal extended or "stem" families	2
v29_2	Major crop type: Roots or tubers	2
v54_5	Agriculture sex differences: females appreciably more	2

This table displays ethnic characteristics that are optimal according to the recursive feature elimination with cross-validation process, at least twice across the feature selection "runs". Feature selection is tested on four outcome variables - child poverty, child stunting, child underweight, and child wasting - across five samples - all countries for which identification holds and each country separately (Ethiopia, Ghana, Malawi, and Nigeria). Count represents the number of times an ethnic characteristic is seen as optimal.

Table C9: Group Lasso Feature Selection

Label	Ethnic Characteristic	Sample Size	Frequency	Sum of Absolute Coefficients
	Panel A: By Frequency			
v29_2	Major crop type: roots or tubers	8066 (27026)	6	0.2376
v29_3	Major crop type: cereal grains	18515 (27026)	5	0.2296
v34_4	High gods: supportive of human morality	3329 (14786)	5	0.1224
v70_3	Type of slavery: reported but type not identified	3977 (18078)	5	0.0947
v70_4	Type of slavery: hereditary and socially significant	13417 (26960)	5	0.0734
v71_1	Former presence of slavery: absent or exists currently and in past	12664 (26960)	5	0.0638
v34_2	High gods: not active in human affairs	9556 (14786)	4	0.0832
v38_1	Segregation of adolescent boys: Absence of segregation	3881 (10679)	4	0.0699
v71_2	Former presence of slavery: formerly present but not currently existing	14296 (26960)	4	0.0638
v6_1	Mode of marriage: bride price or wealth, to bride's family	16931 (28207)	4	0.0614
	Panel B: By Sum of Absolute Coefficients			
v29_2	Major crop type: roots or tubers	8066 (27026)	6	0.2376
v29_3	Major crop type: cereal grains	18515 (27026)	5	0.2296
v34_4	High gods: supportive of human morality	3329 (14786)	4	0.1224
v113_1	Societal rigidity: rigid	600 (5557)	2	0.1036
v113_2	Societal rigidity: flexible	4957 (5557)	2	0.1036
v70_3	Type of slavery: reported but type not identified	7630 (26960)	5	0.0947
v52_2	Fishing sex differences: males appreciably more	1611 (19637)	2	0.0945
v32	Jurisdictional hierarchy of local community	26942	3	0.0927
v34_2	High gods: not active in human affairs	9556 (14786)	4	0.0832
v47_5	Pottery making sex differences: activity present	2736 (21590)	1	0.0764
v70_4	Type of slavery:: Hereditary slavery	13417 (26960)	5	0734
v53_1	Animal husbandry sex differences: males only	2551 (8640)	2	0.0725

This table displays ethnic characteristics identified by feature selection using a group lasso model and imputing missing values. Feature selection is performed on four outcome variables - child poverty, child stunting, child underweight, and child wasting - across five samples - all countries for which identification holds and each country separately (Ethiopia, Ghana, Malawi, and Nigeria). Panel A displays ethnic characteristics which is ranked in the top 10 features of each test at least four times. Panel B includes ethnic characteristics for which the sum of their absolute coefficients across samples is greater than 0.07. The sample size is the total number of households with the reported ethnic characteristics. The number of households out of the total sample of 28207 with non-missing values for the ethnic variable category is noted in parentheses. The total sample of 28207 is those households that can be matched to ethnic groups and are in the estimation sample.

C.6: Differences Across Ethnic Characteristics

Table C10 displays the sample sizes, means, and standard deviations of per-child resource share, children's overall resource shares, poverty rates, and malnutrition rates under each characteristic for the full sample.[16] Tables C11 and C12 shows the estimated resource shares and poverty rates for the second-stage estimation (including θ and region controls). Figure C7 displays the Kernel densities of child per-member resource shares as well as the mean values per ethnic characteristic. Results support those in the main text and in some cases - like in the case of marriage transactions - differences are accentuated. I also explore differences in child malnutrition due to ethnic characteristics by mainly focusing on the prevalence rate of stunting and underweight in children across individual child expenditure percentiles (shown in Figure C8).[17] Regardless of ethnic characteristics, malnutrition rates decrease as children have higher expenditures. However, malnutrition is prevalent across all expenditure percentiles, implying that malnutrition does not only affect the poor.

There exists a positive trend between child welfare outcomes and the degree to which the ethnic group depends on agriculture as a subsistence economy. There is a 0.16 difference between the lowest and highest dependence rates in average per-child resource share. Only 10.7% of children are poor in the highest dependence category, while 55.7% of children in the lowest dependence category are poor. There is also a large discrepancy in malnutrition prevalence between these two categories as stunting, underweight, and wasting prevalence differ by about 19, 15, and 11 percentage points. For societies where male circumcision occurs at young ages, resource shares are higher, and poverty rates are about 38 percentage points lower. However, malnutrition prevalence are similar regardless of the age when circumcision occurs. Circumcisions can lead to adverse health effects, especially when medical professionals do not perform the procedure which is the case in many of these rituals. Lastly, children in societies with bride/token bride price marriage transactions and societies with non-nomadic settlement patterns have better child welfare outcomes.

To provide empirical evidence of the influence of these characteristics on child welfare outcomes, I include indicator variables for each of the following characteristics - defined as θ - into the structural model: extended families, clan-barrios, easy-harvestable principal crop, $26-75\%$ and $76-100\%$ dependence on agriculture, male genital mutilations at young ages ($0-5$ years), bride/token bride price transactions, and nomadic-type societies. I also control for the region of a household on top of all other controls used in the baseline results. I display the estimated resource shares results in Table C11 and the estimated poverty rates in Table C12. There are no qualitative changes, but on average, children have slightly less access to resources within the household and fewer people are classified as poor.

[16] Similar tables per country are available on request.

[17] I also provide evidence on the influence of ethnic characteristics by looking at the differences in the kernel densities of child z-scores and child malnutrition prevalence over per-capita expenditure (available on request).

Table C10: Summary Statistics by Ethnic Characteristic

	Number of Children	Per-child η_c	Per-Household η_c	Child Poor	Child Stunted	Child Underweight	Child Wasted
	(Number of Households)	Mean (sd)	Mean (sd)	Mean (sd)	Mean (sd)	Mean (sd)	Mean (sd)
Total Sample	63032 (24007)	0.197 (0.153)	0.475 (0.194)	0.421 (0.494)	0.352 (0.478)	0.170 (0.376)	0.094 (0.292)
Jurisdictional Hierarchy							
2 - Independent Families	5994 (2122)	0.209 (0.145)	0.529 (0.219)	0.393 (0.488)	0.393 (0.489)	0.198 (0.398)	0.096 (0.295)
3 - Extended families	37929 (14093)	0.174 (0.137)	0.448 (0.182)	0.490 (0.500)	0.388 (0.487)	0.182 (0.386)	0.086 (0.280)
4 - Clan-Barrios	15928 (6627)	0.254 (0.181)	0.528 (0.198)	0.226 (0.418)	0.249 (0.433)	0.138 (0.345)	0.116 (0.320)
Principal Type of Crop							
Easy-Harvestable Crops	16066 (6695)	0.260 (0.183)	0.537 (0.209)	0.177 (0.381)	0.271 (0.444)	0.136 (0.343)	0.098 (0.297)
Other	46966 (17312)	0.176 (0.135)	0.453 (0.184)	0.504 (0.500)	0.380 (0.485)	0.183 (0.387)	0.093 (0.290)
Dependence on Agriculture							
0 – 25%	3352 (1030)	0.129 (0.104)	0.405 (0.175)	0.546 (0.498)	0.472 (0.500)	0.299 (0.458)	0.213 (0.410)
26 – 75%	54073 (20668)	0.192 (0.147)	0.467 (0.190)	0.445 (0.497)	0.354 (0.478)	0.167 (0.373)	0.088 (0.284)
76 – 100%	5607 (2309)	0.289 (0.196)	0.594 (0.201)	0.107 (0.309)	0.282 (0.450)	0.150 (0.357)	0.100 (0.300)
Male Genital Mutilations							
0 – 5 Years of age	10327 (4224)	0.265 (0.183)	0.575 (0.195)	0.188 (0.391)	0.328 (0.470)	0.188 (0.391)	0.107 (0.309)
Absent/Older Ages	52705 (19783)	0.184 (0.143)	0.455 (0.188)	0.466 (0.499)	0.357 (0.479)	0.167 (0.373)	0.092 (0.289)
Transactions at Marriage							
Bride/Token Bride Price	37867 (14310)	0.215 (0.168)	0.509 (0.205)	0.308 (0.462)	0.334 (0.472)	0.183 (0.387)	0.118 (0.322)
Other Transactions	25165 (9697)	0.170 (0.123)	0.428 (0.167)	0.589 (0.492)	0.377 (0.485)	0.152 (0.359)	0.060 (0.238)
Settlement Patterns							
Nomadic-Type Societies	3704 (1115)	0.124 (0.101)	0.398 (0.170)	0.575 (0.494)	0.487 (0.500)	0.320 (0.467)	0.214 (0.410)
Non-Nomadic-Type Societies	59328 (22892)	0.202 (0.155)	0.479 (0.195)	0.411 (0.492)	0.346 (0.476)	0.164 (0.370)	0.089 (0.285)

This table displays the sample sizes, means, and standard deviations (in parentheses) of per-child resource shares, children's overall resource shares per household, children's poverty rates, and children's malnutrition rates. These statistics are for the full sample combining all countries of interest (Ethiopia, Ghana, Malawi, and Nigeria). Statistics are shown across ethnic characteristics and for the complete sample. Child poverty, stunting, underweight, and wasting are indicator variables. The sample is reduced to children with resource shares between $[0,1]$. There are $N = 18359$ children (in 13882 households) with anthropometric data and $N = 61199$ children (in 22521 households) with estimated resource shares.

Table C11: Predicted Resource Shares Accounting for Ethnic Characteristics

Country	Sample	Evaluated at $\bar{z}$ Estimated Men (SE)	Women (SE)	Children (SE)	Evaluated at All z_h Mean Men (SD)	Women (SD)	Children (SD)	Wald Per Capita Test, dof (p-Value)
Ethiopia	5051	0.288	0.195	0.187	0.303	0.287	0.143	404, 170
		(0.089)	(0.096)	(0.024)	(0.603)	(1.325)	(0.941)	(0.000)
Ghana	9362	0.124	0.203	0.248	0.059	0.315	0.221	508, 153
		(0.036)	(0.060)	(0.047)	(3.499)	(5.251)	(4.187)	(0.000)
Malawi	9961	0.239	0.285	0.156	0.261	0.326	0.127	545, 286
		(0.031)	(0.035)	(0.012)	(3.341)	(3.291)	(0.856)	(0.000)
Nigeria	3833	0.073	0.221	0.193	0.089	0.243	0.219	380, 211
		(0.044)	(0.066)	(0.044)	(0.354)	(1.188)	(0.714)	(0.000)

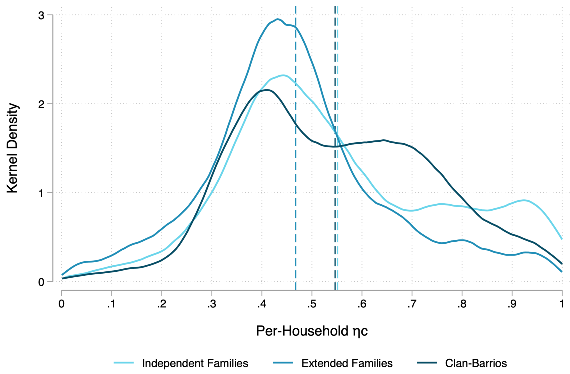
This table displays estimated per-person resource shares, η_h^t/N_h^t, of men, women, and children. Only countries that pass the identification threshold are displayed. Resource shares estimated at the mean of observed covariates ($\bar{z}$) and the mean of the resource shares evaluated at all z_h are shown. The Wald test statistic, degrees of freedom, and p-value (in parentheses) are for the test of whether the samples reject the per-capita model, i.e., resource shares are such that $\eta_h^t/N_h^t = 1/\sum N_h^t$. Controls added in addition to baseline estimates include different regions, number of girls in a household, and the ethnic characteristics.

Table C12: Predicted Poverty Rates Accounting for Ethnic Characteristics

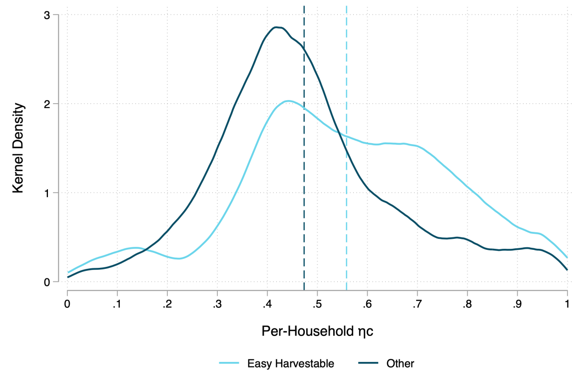
Country	Extreme Poverty ($2.15/day) Per-Capita (SE)	Individual Poverty Rates Men (SE)	Women (SE)	Children (SE)	All (SE)	Country Income-Level ($2.15/day or $3.65/day) Per-Capita (SE)	Individual Poverty Rates Men (SE)	Women (SE)	Children (SE)	All (SE)
Ethiopia	0.308	0.350	0.399	0.398	0.387	0.308	0.350	0.399	0.398	0.387
	(0.006)	(0.028)	(0.027)	(0.029)	(0.011)	(0.006)	(0.028)	(0.027)	(0.029)	(0.011)
Ghana	0.252	0.521	0.425	0.281	0.400	0.453	0.657	0.567	0.422	0.540
	(0.003)	(0.027)	(0.023)	(0.029)	(0.009)	(0.004)	(0.022)	(0.022)	(0.028)	(0.006)
Malawi	0.619	0.574	0.523	0.640	0.590	0.619	0.574	0.523	0.640	0.590
	(0.004)	(0.019)	(0.023)	(0.022)	(0.006)	(0.004)	(0.019)	(0.023)	(0.022)	(0.006)
Nigeria	0.217	0.666	0.404	0.175	0.385	0.528	0.778	0.578	0.341	0.538
	(0.006)	(0.029)	(0.026)	(0.034)	(0.010)	(0.007)	(0.023)	(0.024)	(0.030)	(0.008)

This table displays the estimated fraction of each (type of) individual who is poor based on 2017 PPP US$. Whether an individual is poor or not is based on the estimated individual resource shares when controlling for ethnic characteristics. Per-capita estimates are also shown. Standard errors in parentheses are bootstrapped standard errors. Ghana and Nigeria are classified as low-middle income economies ($3.65/day), and Ethiopia and Malawi are low-income economies ($2.15/day).

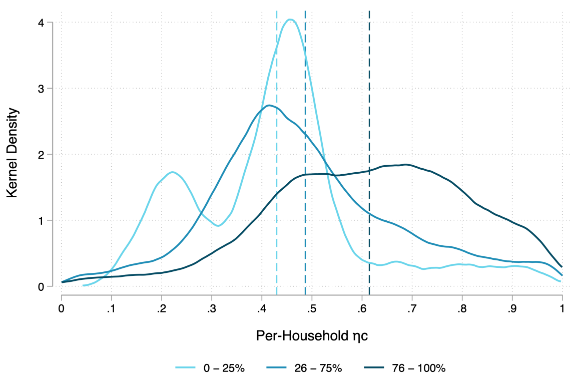
Figure C7: Children Per-Member Resource Shares



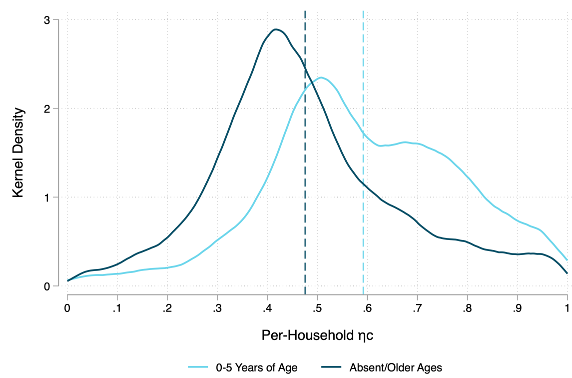
(a) Jurisdictional Hierarchy



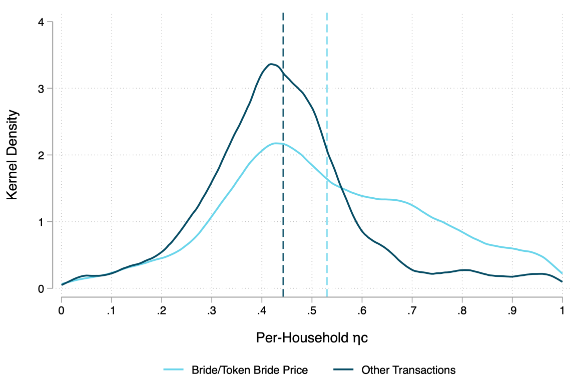
(b) Principal Type of Crop



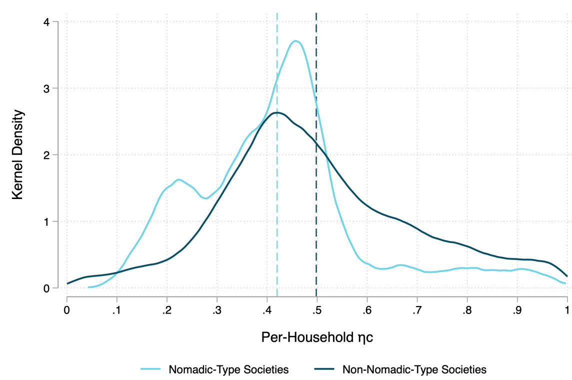
(c) Dependence on Agriculture



(d) Male Genital Mutilations



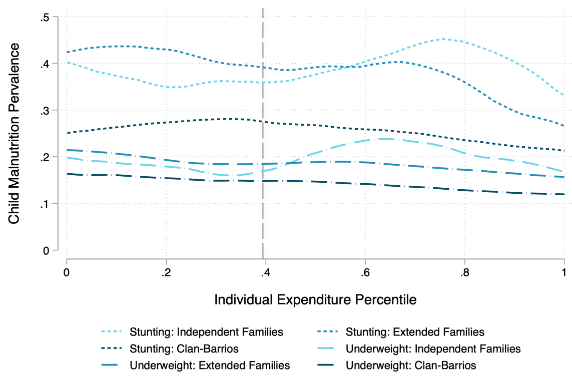
(e) Transactions at Marriage



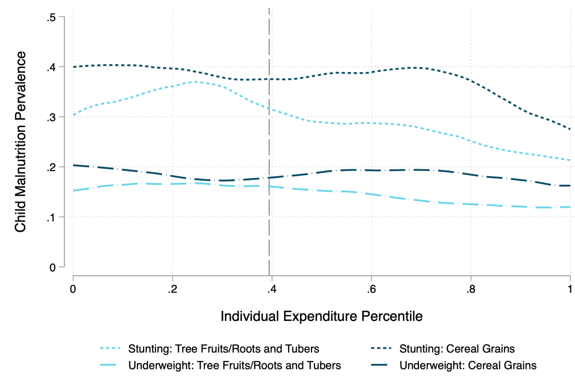
(f) Settlement Patterns

Note: This figure depicts kernel densities of the estimated per-member resource shares for children. The full sample is used, i.e., a combination of data from Ethiopia, Ghana, Malawi and Nigeria. Only children with per-member resource shares between $[0,1]$ are included. The vertical dashed lines represent the mean per-member resource share for children for each ethnic characteristic subgroup.

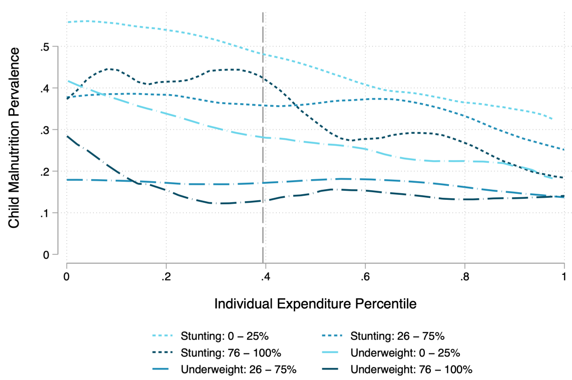
Figure C8: Malnutrition Prevalence by Individual Child Expenditure Percentile



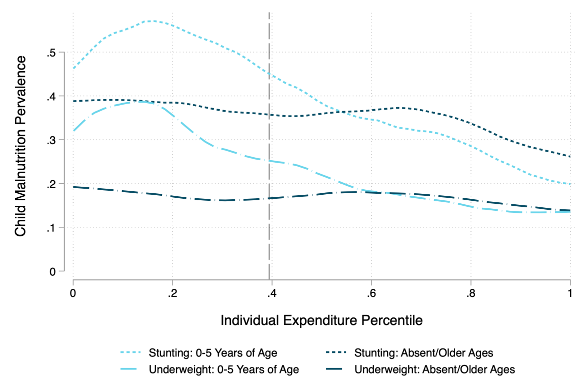
(a) Jurisdictional Hierarchy ($v32$)



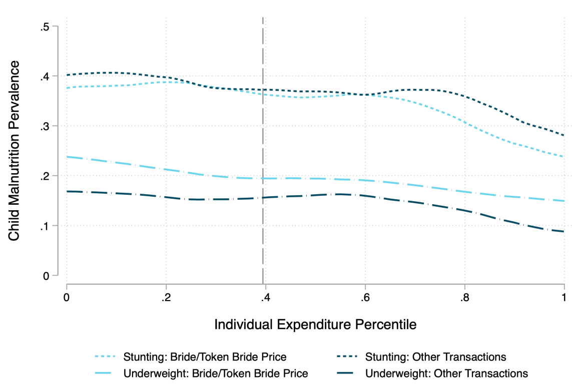
(b) Principal Type of Crop ($v29$)



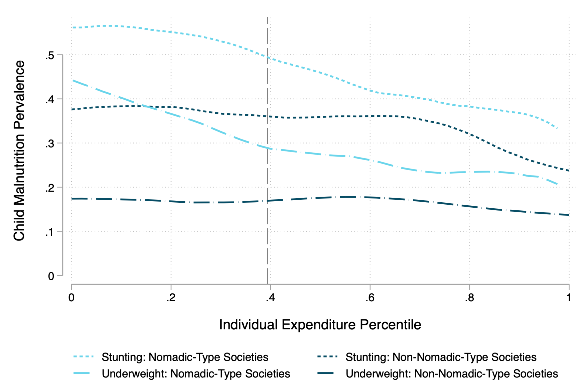
(c) Dependence on Agriculture ($v5$)



(d) Male Genital Mutilations ($v37$)



(e) Transactions at Marriage ($v6$)



(f) Settlement Patterns ($v30$)

Note: These figures display the malnutrition prevalence rate for stunted and underweight children across individual child expenditure percentiles. Individual child expenditure is calculated as total household expenditure times the child's estimated resource share. The dashed grey vertical line represents the rough estimate of the World Bank's extreme poverty line for children of US\$1.29/day. The sample includes all children with valid z-scores ($[-5, 5]$).

C.7: Robustness

This section outlines the robustness results concerning per-child resource shares and children's height-for-age z-scores (HAZ). I use Kolmogorov-Smirnoff tests to ensure that differences in the distribution of these two child welfare outcomes are due to ethnic characteristics and not other spatial or socioeconomic factors correlated with ethnicity. The null hypothesis of equal distribution is rejected throughout for per-child resource shares. Furthermore, equality of distribution of children's HAZ is also rejected in most cases. Exceptions for the male genital mutilation characteristics are noted and discussed in the main text.

Table C13: Resource Share Robustness - Border Analysis

	Kolmogorov-Smirnov Tests						
	$1km$	$5km$	$10km$	$15km$	$20km$	$25km$	$50km$
	D-Stat (p-value)	D-Stat (p-value)	D-Stat (p-value)	D-Stat (p-value)	D-Stat (p-value)	D-Stat (p-value)	D-Stat (p-value)
Jurisdictional Hierarchy							
4 - Clan-Barrios	0.212***	0.120***	0.123***	0.123***	0.138***	0.195***	0.246***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Principal Type of Crop							
Easy-Harvestable Crops	0.186***	0.110***	0.122***	0.150***	0.155***	0.169***	0.182***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Dependence on Agriculture							
$76-100\%$	0.158***	0.137***	0.151***	0.172***	0.199***	0.239***	0.309***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Male Genital Mutilations							
$0-5$ Years of age	0.113***	0.133***	0.131***	0.140***	0.160***	0.180***	0.216***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Transactions at Marriage							
Bride/Token Bride Price	0.102***	0.076***	0.053***	0.034***	0.036***	0.049***	0.059***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Settlement Patterns							
Nomadic-Type Societies	0.298***	0.255***	0.234***	0.238***	0.238***	0.259***	0.272***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

This table displays the D-Statistic and corresponding p-values (in parentheses) from the Kolmogorov-Smirnov test for equality of distribution for per-child resource shares across ethnic characteristics. Only children with per-child resource shares in the interval $[0,1]$ are in the sample. Only children from Ethiopia, Malawi, and Nigeria are included. ***, **, * - indicates significance at a 1%, 5%, and 10% level.

Table C14: Resource Share Robustness - All Socioeconomic Indicators

	Kolmogorov-Smirnov Tests										
	Household Head Employed	Services/ High Skilled Job	Owns Financial Asset	Owns House	Meter Solar Electricity	Owns Livestock	Owns Bed	Owns Television	Owns Sattelite Dish	Owns Plough	Owns Non-Agri Business
	D-Stat (p-value)	D-Stat (p-value)	D-Stat (p-value)	D-Stat (p-value)	D-Stat (p-value)	D-Stat (p-value)	D-Stat (p-value)	D-Stat (p-value)	D-Stat (p-value)	D-Stat (p-value)	D-Stat (p-value)
Jurisdictional Hierarchy											
4 - Clan-Barrios	0.148*** (0.000)	0.258*** (0.000)	0.219*** (0.000)	0.171*** (0.000)	0.189*** (0.000)	0.185*** (0.000)	0.246*** (0.000)	0.193*** (0.000)	0.162*** (0.000)	0.123*** (0.000)	0.295*** (0.000)
Principal Type of Crop											
Easy-Harvestable Crops	0.263*** (0.000)	0.245*** (0.000)	0.252*** (0.000)	0.224*** (0.000)	0.247*** (0.000)	0.210*** (0.000)	0.235*** (0.000)	0.223*** (0.000)	0.234*** (0.000)	0.209*** (0.000)	0.323*** (0.000)
Dependence on Agriculture											
76 – 100%	0.262*** (0.000)	0.238*** (0.000)	0.264*** (0.000)	0.303*** (0.000)	0.250*** (0.000)	0.383*** (0.000)	0.285*** (0.000)	0.202*** (0.000)	0.181*** (0.000)	0.304*** (0.000)	0.297*** (0.000)
Male Genital Mutilations											
0 – 5 Years of age	0.331*** (0.000)	0.261*** (0.000)	0.222*** (0.000)	0.214*** (0.000)	0.163*** (0.000)	0.161*** (0.000)	0.258*** (0.000)	0.228*** (0.000)	0.158*** (0.000)	0.094*** (0.000)	0.335*** (0.000)
Transactions at Marriage											
Bride/Token Bride Price	0.285*** (0.000)	0.161*** (0.000)	0.190*** (0.000)	0.097*** (0.000)	0.150*** (0.000)	0.087*** (0.000)	0.037*** (0.000)	0.158*** (0.000)	0.199*** (0.000)	0.201*** (0.000)	0.213*** (0.000)
Settlement Patterns											
Nomadic-Type Societies	0.433*** (0.000)	0.390*** (0.000)	0.264*** (0.000)	0.311*** (0.000)	0.335*** (0.000)	0.353*** (0.000)	0.248*** (0.000)	0.304*** (0.000)	0.321*** (0.000)	0.357*** (0.000)	0.361*** (0.000)

This table displays the D-Statistic and corresponding p-values (in parentheses) from the Kolmogorov-Smirnov test for equality of distribution for per-child resource shares across ethnic characteristics. Only children with per-child resource shares in the interval $[0,1]$ are in the sample. ***, **, * - indicates significance at a 1%, 5%, and 10% level.

Table C15: Malnutrition Robustness - All Socioeconomic Indicators

	Kolmogorov-Smirnov Tests										
	Household Head Employed	Services/ High Skilled Job	Owns Financial Asset	Owns House	Meter Solar Electricity	Owns Livestock	Owns Bed	Owns Television	Owns Sattelite Dish	Owns Plough	Owns Non-Agri Business
	D-Stat (p-value)	D-Stat (p-value)	D-Stat (p-value)	D-Stat (p-value)	D-Stat (p-value)	D-Stat (p-value)	D-Stat (p-value)	D-Stat (p-value)	D-Stat (p-value)	D-Stat (p-value)	D-Stat (p-value)
Jurisdictional Hierarchy											
4 - Clan-Barrios	0.115*** (0.000)	0.172*** (0.000)	0.148*** (0.000)	0.172*** (0.000)	0.165*** (0.000)	0.187*** (0.000)	0.162*** (0.000)	0.107*** (0.000)	0.127*** (0.000)	0.174*** (0.000)	0.149*** (0.000)
Principal Type of Crop											
Easy-Harvestable Crops	0.085*** (0.000)	0.140*** (0.000)	0.121*** (0.000)	0.119*** (0.000)	0.136*** (0.000)	0.128*** (0.000)	0.172*** (0.000)	0.102*** (0.000)	0.135*** (0.000)	0.104*** (0.000)	0.156*** (0.000)
Dependence on Agriculture											
76 – 100%	0.027 (0.670)	0.155*** (0.000)	0.088*** (0.000)	0.043 (0.127)	0.098*** (0.000)	0.036 (0.650)	0.113*** (0.000)	0.094*** (0.000)	0.137*** (0.000)	0.047 (0.379)	0.099*** (0.000)
Male Genital Mutilations											
0 – 5 Years of age	0.061*** (0.003)	0.093*** (0.008)	0.049*** (0.007)	0.031 (0.152)	0.027 (0.285)	0.069*** (0.000)	0.065*** (0.000)	0.038* (0.091)	0.026 (0.846)	0.096*** (0.000)	0.099*** (0.000)
Transactions at Marriage											
Bride/Token Bride Price	0.153*** (0.000)	0.122*** (0.000)	0.123*** (0.000)	0.099*** (0.000)	0.139*** (0.000)	0.086*** (0.000)	0.068*** (0.000)	0.117*** (0.000)	0.150*** (0.000)	0.207*** (0.000)	0.114*** (0.000)
Settlement Patterns											
Nomadic-Type Societies	0.131 (0.933)	0.163 (0.128)	0.169*** (0.000)	0.171*** (0.000)	0.140*** (0.000)	0.199*** (0.000)	0.128*** (0.000)	0.078 (0.325)	0.076 (0.415)	0.206*** (0.001)	0.159** (0.014)

This table displays the D-Statistic and corresponding p-values (in parentheses) from the Kolmogorov-Smirnov test for equality of distribution for children's height-for-age z-scores (HAZ) across ethnic characteristics. Only children with HAZ in the interval $[-5,5]$ are in the sample. ***, **, * - indicates significance at a 1%, 5%, and 10% level.

Table C16: Malnutrition Robustness - Border Analysis

	Kolmogorov-Smirnov Tests						
	$1km$	$5km$	$10km$	$15km$	$20km$	$25km$	$50km$
	D-Stat (p-value)	D-Stat (p-value)	D-Stat (p-value)	D-Stat (p-value)	D-Stat (p-value)	D-Stat (p-value)	D-Stat (p-value)
Jurisdictional Hierarchy							
4 - Clan-Barrios	0.088	0.102***	0.095***	0.100***	0.105***	0.120***	0.132***
	(0.559)	(0.009)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Principal Type of Crop							
Easy-Harvestable Crops	0.077	0.088***	0.096***	0.102***	0.109***	0.121***	0.139***
	(0.600)	(0.006)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Dependence on Agriculture							
$76-100\%$	0.070	0.054	0.039	0.066	0.075**	0.096***	0.117***
	(0.952)	(0.774)	(0.824)	(0.101)	(0.028)	(0.000)	(0.000)
Male Genital Mutilations							
$0-5$ Years of age	0.111	0.048	0.048	0.065***	0.065***	0.071***	0.073***
	(0.139)	(0.377)	(0.160)	(0.005)	(0.002)	(0.000)	(0.000)
Transactions at Marriage							
Bride/Token Bride Price	0.137**	0.060*	0.045*	0.048**	0.045**	0.047***	0.045***
	(0.027)	(0.073)	(0.091)	(0.019)	(0.013)	(0.004)	(0.001)
Settlement Patterns							
Nomadic-Type Societies	0.163	0.190***	0.156***	0.149***	0.144***	0.165***	0.163***
	(0.746)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

This table displays the D-Statistic and corresponding p-values (in parentheses) from the Kolmogorov-Smirnov test for equality of distribution for children's height-for-age z-scores (HAZ) across ethnic characteristics. Only children with HAZ in the interval $[-5,5]$ are in the sample. Only children from Ethiopia, Malawi, and Nigeria are included. ***, **, * - indicates significance at a 1%, 5%, and 10% level.

Table C17: Malnutrition Robustness - Socioeconomic Status Analysis

	Kolmogorov-Smirnov Tests			
	Electricity, Non-Agriculture Business, and Phone	Employed, Own a Home, and Phone	No Plough, Low Skilled, and No Financial Asset	PCA Groups
	D-Stat (p-value)	D-Stat (p-value)	D-Stat (p-value)	D-Stat (p-value)
Jurisdictional Hierarchy				
4 - Clan-Barrios	0.137*** (0.000)	0.117*** (0.000)	0.192*** (0.000)	0.152*** (0.000)
Principal Type of Crop				
Easy-Harvestable Crops	0.076*** (0.001)	0.114*** (0.000)	0.057 (0.431)	0.096*** (0.005)
Dependence on Agriculture				
$76-100\%$	0.066 (0.163)	0.064** (0.048)	0.042 (0.975)	0.148*** (0.004)
Male Genital Mutilations				
$0-5$ Years of age	0.031 (0.828)	0.039 (0.292)	0.052 (0.763)	0.080 (0.126)
Transactions at Marriage				
Bride/Token Bride Price	0.178*** (0.000)	0.124*** (0.000)	0.168*** (0.000)	0.169*** (0.000)
Settlement Patterns				
Nomadic-Type Societies	0.190 (0.866)	0.217*** (0.009)	0.366*** (0.005)	0.254 (0.990)

This table displays the D-Statistic and corresponding p-values (in parentheses) from the Kolmogorov-Smirnov test for equality of distribution for children's height-for-age z-scores (HAZ) across ethnic characteristics. Only children with HAZ in the interval $[-5, 5]$ are in the sample. ***, **, * - indicates significance at a 1%, 5%, and 10% level.

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