Gender Discrimination, Intrahousehold Resource Allocation, and Importance of Spouses' Fathers: Evidence on Expenditure from Rural Andhra Pradesh

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Abstract Data collected from rural India was used to examine the rules governing intrahousehold resource allocations. Testing for gender-age discrimination among household members using Deaton (1989)'s method, results suggest a general bias favoring boys over girls in allocation of consumption goods, however, the findings are not always statistically significant. Intrahousehold resource allocation rules are then examined to see if such discrimination is based on unanimous decision of parents. The novelty in our test on allocation rule are: (1) use of grandparental variables as extra-household environmental parameters (EEP's) in expenditure estimation, (2) derivation of a test of the unitary model that only requires EEP's, and (3) semi-formal use of survival status of grandparents in testing collective models. It is interesting yjay spouse's father characteristics are importantly correlated with greater mother and child goods expenditure shares, and smaller father goods shares. Their survival status matters, and this is a stronger evidence for collective as opposed to unitary model.

I Introduction

Data on household consumption expenditures form the core of a database for assessing poverty and distribution of welfare among households. They thus play a critical role for policy making. For understanding intrahousehold resource allocation, it would be ideal to obtain data on consumption at the level of individual members within the household. However, the basic unit of data collection and analysis of data on consumption has been primarily at the aggregate household level. This is due in part to very high costs and to various difficulties (conceptual and practical) involved in collecting consumption data by individual members (Fuwa, 2005). Unlike some information that is collected at the level of individual household members (labor activities, education, and health information), all the consumption expenditure modules of the World Bank's Living Standard Measurement Studies include consumption expenditure data collected at the household level (Deaton and Grosh, 2000).

Despite the relative paucity of data on allocation of consumption goods among household members, evidence accumulated in the last two decades suggests the potential importance of understanding household behavior leading to such outcomes (Fuwa, 2005). Two major reasons for the increased potential importance of intrahousehold analysis for policymakers are discussed by Fuwa et al. (2006). Both are directly related to household behavior leading to the allocation of consumption goods (including food, nonfood consumption, and other services) among household members.

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The first concerns the measurement of individual welfare and the identification of potential target populations when policy interventions are seen as necessary for poverty reduction. Questions have been raised that whether female members (especially female children) within the household tend to be discriminated against in consumption allocation within the household. A dramatic consequences of gender bias appears to be the low sex ratio of women to men in some parts of the world such as South and West Asia and China (see Sen, 1990, Rosenzweig and Schultz, 1982).

Negligence of such intrahousehold variation in consumption is known to inhibit understanding of the severity of poverty at the individual level. In their simple yet insightful analysis, Haddad and Kanbur (1990) show that, by using the household average of member welfare and neglecting the intrahousehold welfare variations, poverty levels are underestimated. Since poverty is ultimately an individual phenomenon, it must be measured at the individual level. This implies that knowing the rules governing intrahousehold resource allocation is crucial in understanding poverty and its alleviation.

Once discrimination against women (or girls) is found in resource allocation within households, there may be potential room for policy interventions. In addition, micro level consumption data can potentially be used to monitor changes in the welfare level of the population during policy changes or other exogenous shocks such as weather. If there is a class of individual members of the household who are identified as particularly vulnerable, the changes in their welfare level may not be revealed by the aggregate household level consumption data alone.

Once such a target population is identified, the second aspect of policy implications will be in the design of policy interventions by focusing on household behavior, This can include possible reactions by the households to policy interventions. This latter aspect is important. Even when target groups are properly identified, interventions may have little impact on intended beneficiaries, unless policies are well designed to reach them. It has been found, for example, that some targeted policies toward individuals (such as school food programs) can be offset by changes in intrahousehold consumption in response to such policies. This can potentially leave negligible net effects on targeted individuals (see Beaton and Ghassemi, 1979 on school food programs and Alderman et al., 1995 for a general discussion). Consideration of policy instruments with such potentials requires an analysis of consumption allocation behavior within the household.

Because of the relative lack of data on individual consumption allocation and the necessity for understanding intrahousehold resource allocation behavior from policymaker viewpoints, there have been a few methodologies proposed in the literature that allow inference of aspects of intrahousehold resource allocation by utilizing aggregate household-level consumption data alone. This paper includes a combination of such methodological approaches to the dataset, specifically analytical methodologies for making inferences about household behavior in intrahousehold resource allocation from the household-level consumption expenditure data. The paper has two primary points; (1) detecting potential biases in allocating consumption goods between female and male children, and (2) assessing the roles played by various potential sources of 'bargaining powers' of the husband and the wife in determining the allocation of goods and services consumed by household members.

In general, characteristics of the parents affect household expenditure decisions in a way consistent with intrahousehold bargaining. Further, literacy and land holdings of the surviving fathers of spouses are correlated with greater expenditures directed to adult females and children. This provides some support of collective models. Section II of the paper provides descriptive statistics of data is presented. In section III, gender-age discrimination in consumption is tested, showing weak evidence of bias against girls. To understand the bias, Section IV includes a brief review of existing literature on intrahousehold resource allocation. A model of the household is analysed to obtain testable predictions for both unitary and collective models. Estimation issues on intrahousehold resource allocation are discussed in Section V. Estimation results are presented in Section VI, and the last section offers a summary of results and conclusions.

II Data

Data was collected by the IDE-MVF team in 2005. Details of sampling are explained in Fuwa et al. (2006). Households were asked on food and nonfood items consumed over last two weeks and teh last year, repsectively. For expenditure regressions in section III, detailed information on assignable goods for each household's demographic groups are necessary to know "who consumed how much." Three demographic groups are used: adult males, adult females, and children. The term 'nonfood father goods' are used for adult male clothing and adult male footwear. 'Father goods' are defined as nonfood father goods and 'vice' items such as todi (liquor made from coconuts), beer, other alcohol drinks, beedi (local cigars), and cigarettes. 'Mother goods' are defined as adult female clothing, adult female footwear, and adult female personal care items. 'Child goods' include school fees, school uniform fees, school textbook fees, school transportation fees, and toys. All expenditures are normalized to a two week period.

Table 1 shows the descriptive statistics for the data. Median expenditures on nonfood father goods and mother goods are roughly the same. The inclusion of vices significantly increases the median father goods expenditure by more than 100%. This may explain why there is general hostility against alcoholic drinks in rural India. Sampled households are characterized as having low literacy rates. About 32% of heads of households and 13% of spouses are literate in an area where the literacy rates are 59% for males and 30% for females. This is primarily due to the variable probability sampling scheme that oversampled households with child labor. Less educated parents are more likely to let children work.

Looking at the demographic structure, on average, there are 3 adults, 3 children, and 0.5 infants, and 0.5 elderly persons in a household. Viewing blood relatives of the head, on average there is 1.1 extended family members in a household, 0.1 member coming from distant relatives such as nephew or cousin. Education of grandmothers is rare, and this indicates any significant estimates on these variables need to be interpreted with caution. Such estimates may have been tilted toward influential observations. Thus, they are not used for testing collective models.

The probability of the grandfather being alive is lower than that of the grandmother. This is natural in an area where marriages generally occur between older males and younger females. The higher survival probability of spousal parents is also explained by this age gap. In general, the greater the gap, the greater the difference in survival probabilities between head of household's parents and the spouse's parents. This fact is interesting since it has been argued that a greater age gap is correlated with a higher incidence (and a stronger degree) of gender discrimination against female spouses. If the collective models hold, then early marriage, a symptom of gender inequality, is also a stabilizing device. This is because female spouse's parents live longer to support her when head of household's parents have already passed away. This may partly explain why poorer parents tend to choose early marriage for their daughters.

The values of the indicator variables of coresidence and proximate residence of grandparents are smaller than the survival probabilities of these members, as these are conditional on grandparent survival. The mean age gaps of grandparents are 4.5 and 4.9 for head of household and spouse, respectively. This is smaller than the sampled household's mean age gap of 7.3. A general rise in dowry payment in the last two decades analyzed in Rao (1993) may be contributing to this. A younger bride is considered to be more valuable, and parents of brides may save on the rising value of dowries by accepting matrimony earlier. A greater age gap is also consistent with the greater land holdings of head of household's parents. This means that an average woman 'marries up' to upper land holding classes. It results in lower-class women competing with upper class women in the marriage market by bidding up dowries; men from the lowest land holding class (landless) have a hard time finding brides. It indicates that the intergenerational transition in wealth quantile is upwardly mobile for women but not for men. This also suggests that spouses are, on average, from poorer families and thus do not have strong bargaining power in the household. The number of siblings is greater for parents than for current youth, with a mean of approximately 5 for both head of household and spouse.[*1]

[*1] This suggests that some undocumented change in household structure has taken place in the last two to three decades. This is important, however, analyzing such a structural change is beyond the scope of this paper.

Table 1: Descriptive Statistics

variable name	variable description	min	25%	median	75%	max	mean	std	0s	NAs	*n*
fg0	nonfood father goods (Rs.)	0	18	31	50	309	42	40	17	0	387
fg	father goods (Rs.)	0	38	84	147	1472	130	177	13	0	387
mg	mother goods (Rs.)	2	23	35	65	272	51	44	0	0	387
kg	child goods (Rs.)	0	0	10	33	767	36	85	109	0	387
subtotal_food	total food (Rs.)	67	698	968	1539	29231	1350	1817	0	0	387
subtotal_nonfood	total nonfood (Rs.)	49	279	428	640	3071	520	389	0	0	387
total	total (Rs.1000)	0.116	1.054	1.474	2.182	29.461	1.871	1.889	0	0	387
landval	land value (Rs.)	0	1250	30000	92500	4800000	102135	296129	93	0	387
dry_acre	acreage (rainfed)	0	0	2	4	160	4.336	10.395	142	0	387
irr_acre	acreage (irrigated)	0	0	0	0	18	0.654	1.949	316	0	387
fg0share	nonfood father goods (as % of total)	0	0.013	0.021	0.032	0.269	0.025	0.022	18	0	387
fgshare	father goods (as % of total)	0	0.026	0.056	0.097	0.546	0.076	0.079	13	0	387
mgshare	mother goods (as % of total)	0	0.017	0.029	0.04	0.194	0.031	0.021	0	0	387
kgshare	child goods (as % of total)	0	0	0.006	0.021	0.235	0.018	0.034	109	0	387
hd_sex	head sex (male=0, female=1)	0	0	0	0	1	0.075	0.264	356	2	387
hd_age	head age	20	36	43	50	82	44.577	10.804	0	2	387
hd_lit	head literacy	0	0	0	1	1	0.319	0.467	260	5	387
hd_yrs	head year of education	0	0	0	2	14	1.733	3.16	269	5	387
sp_sex	spouse sex (male=0, female=1)	0	1	1	1	1	0.948	0.223	18	44	387
sp_age	spouse age	1	30	35	41.5	70	37.294	9.869	0	44	387
sp_lit	spouse literacy	0	0	0	0	1	0.125	0.332	300	44	387
sp_yrs	spouse year of education	0	0	0	0	14	0.685	1.938	293	44	387
sp_alive	spouse is in HH	0	1	1	1	1	0.891	0.312	42	2	387
amales	adult males	0	1	1	2	6	1.571	0.919	18	2	387
afemales	adult females	0	1	1	2	5	1.452	0.799	7	2	387
b_lop	boys, class 1-5	0	0	0	1	5	0.512	0.711	227	2	387
g_lop	girls, class 1-5	0	0	0	1	3	0.504	0.711	235	2	387
b_upp	boys, class 6-8	0	0	0	1	2	0.483	0.595	219	2	387
g_upp	girls, class 6-8	0	0	0	1	3	0.46	0.633	236	2	387
b_sec	boys, class 9-12	0	0	0	1	4	0.54	0.692	214	2	387
g_sec	girls, class 9-12	0	0	0	1	3	0.494	0.642	225	2	387
imales	infant males	0	0	0	0	3	0.234	0.523	312	2	387
ifemales	infant females	0	0	0	0	3	0.249	0.582	313	2	387
emales	elderly males	0	0	0	0	1	0.161	0.368	323	2	387
efemales	elderly females	0	0	0	0	2	0.247	0.444	292	2	387
infants	infants	0	0	0	1	5	0.483	0.814	261	2	387
lowerprim	lower primary	0	0	1	2	8	1.016	1.041	144	2	387
upperprim	upper primary	0	0	1	1	4	0.943	0.765	115	2	387
secondary	secondary	0	0	1	2	4	1.034	0.846	108	2	387
adeld	adults and elderly	1	2	3	4	12	3.431	1.654	0	2	387
hhsize	household size	3	5	6	8	29	6.906	2.764	0	2	387
blood1	children of head	0	3	4	5	14	3.587	1.701	10	2	387
blood2	+ parents, sibling, grand children and grand parents of head	0	3	4	5	19	4.527	2.281	2	2	387
blood3	+ other blood relatives of head	0	3	4	5	23	4.605	2.367	2	2	387
hdf_alive	head's father alive	0	0	0	0	1	0.218	0.413	302	1	387
hdm_alive	head's mother alive	0	0	0	1	1	0.477	0.5	202	1	387
spf_alive	spouse's father alive	0	0	0	1	1	0.347	0.477	252	1	387
spm_alive	spouse's mother alive	0	0	1	1	1	0.588	0.493	159	1	387
hdf_cores	head's father in HH	0	0	0	0	1	0.085	0.28	353	1	387
hdm_cores	head's mother in HH	0	0	0	1	1	0.264	0.442	284	1	387
spf_cores	spouse's father in HH	0	0	0	0	1	0.039	0.194	371	1	387
spm_cores	spouse's mother in HH	0	0	0	0	1	0.052	0.222	366	1	387
hdf_vill	head's father in village	0	0	0	0	1	0.096	0.295	349	1	387
hdm_vill	head's mother in village	0	0	0	0	1	0.142	0.35	331	1	387
spf_vill	spouse's father in village	0	0	0	0	1	0.047	0.211	368	1	387
spm_vill	spouse's mother in village	0	0	0	0	1	0.093	0.291	350	1	387
hdf_lit	head's father literare	0	0	0	1	1	0.271	0.445	274	11	387
hdm_lit	head's mother literate	0	0	0	0	1	0.021	0.145	367	12	387
spf_lit	spouse's father literare	0	0	0	0	1	0.239	0.427	293	2	387
spm_lit	spouse's mother literate	0	0	0	0	1	0.021	0.143	376	3	387
hd_bro	number of head's brothers	0	2	3	4	16	2.853	1.693	12	5	387
hd_sis	number of head's sisters	0	1	2	3	9	2.085	1.644	55	9	387
sp_bro	number of spouse's brothers	0	1	2	3	10	2.284	1.52	36	7	387
sp_sis	number of spouse's sisters	0	2	3	4	9	2.771	1.575	22	3	387
hdf_irr	head's father irrigated land	0	0	0	0	80	1.838	7.055	249	84	387
hdf_dry	head's father rainfed land	0	0	4	10	100	10.848	18.869	92	24	387
spf_irr	spouse's father irrigated land	0	0	0	0	15	0.775	2.328	263	71	387
spf_dry	spouse's father rainfed land	0	0	3	10	100	8.49	15.748	124	42	387
hdp_adiff	head's parents' age difference	0	0	5	10	30	4.968	4.756	138	13	387
spp_adiff	spouse's parents' age difference	0	0	5	8.5	25	4.541	4.618	159	8	387
hdf_alit	head's father alive and literate	0	0	0	0	1	0.082	0.275	345	11	387
spf_alit	spouse's father alive and literate	0	0	0	0	1	0.094	0.292	349	2	387
hdf_adry	living head's father's rainfed land (acre)	0	0	0	0	85	2.284	8.833	302	24	387
hdf_airr	living head's father's irrigated land (acre)	0	0	0	0	40	0.403	2.973	286	84	387
spf_adry	living spouse's father's rainfed land (acre)	0	0	0	0	100	2.319	7.685	270	42	387
spf_airr	living head's father's irrigated land (acre)	0	0	0	0	1	0.094	0.292	349	2	387
clflag	belongs to child labor stratum	0	0	1	1	1	0.652	0.477	134	2	387

III Gender Discrimination in Intrahousehold Consumption Allocation

A general empirical strategy for making inferences about intrahousehold resource allocation processes is to relate the observed variations in household consumption patterns, to observed variations in household characteristics. This approach analyzes the effects of household demographic composition or the relative degree of resource control by individual members, on the patterns of household consumption. This section provides an examinaion of whether there are gender biases in the allocation of household consumption expenditures between female and male children within the household.

III.1 A Methodology for Using Household Consumption Data To Detect Intrahousehold Gender Biases

Household consumption data can typically be analyzed within the framework of household demand function:

$$q_k = q_k(\boldsymbol{p}, m|\mathbf{z}, \mathbf{w}),$$

where q_k is the household aggregate demand for good k, $\boldsymbol{p}$ is a vector of prices, m is a measure of total (per capita/adult equivalent) household income/expenditure or other measure of total resources (assets) available to the household, $\mathbf{z}$ is a vector of household demographic characteristics, and $\mathbf{w}$ is a vector of other household characteristics. Inclusion of $\mathbf{w}$ in the demand function implicitly incorporates household production. For example, if the household is a farm household, then farm assets, land holdings, and irrigation status enter $\mathbf{w}$ in the determination of household income/expenditure m and hence demand q_k.

Presence of gender biases in household aggregate consumption can be examined by the methodology first proposed by Deaton (1989). Following Deaton (1989), we estimate the Engel curve of the following:

$$w_{ik} = \alpha_k + \beta_k \ln\left(\frac{x_i}{n_i}\right) + \eta_k \ln n_i + \sum_l \gamma_{kl}\left(\frac{n_{il}}{n_i}\right) + \boldsymbol{\delta}'\mathbf{z}_{ik} + u_{ik},$$

where w_{ik} is the expenditure share of good k in household i, x_i is the total household expenditure of household i, n_i is household size (capturing economies of scale), n_{il} is the number of household members in the l^{th} age-gender category, and z_{il} is a vector of household characteristics (sex and age of the household head and spouse, acreage of land, and village and caste dummy variables. In this model, the differences in the γ_{kl} parameters indicate the effects on the household consumption of particular good k, by replacing a household member in one age-sex category (a girl of a certain age group) with a member in another category (a boy of the same age group), holding the household size and per-capita expenditure constant. Deaton (1989) proposed an approach to detect boy-girl biases utilizing data on the consumption of 'adult goods.' Suppose certain consumption items that are exclusively consumed by adult members of the household can be identified in the data. Typical examples of such items are alcohol, tobacco, adult clothes, and adult footwear. Now, we define w_{ik} as the expenditure share of such adult goods. Then, if a child is born to a (previously) childless couple (*holding the total expenditure constant*), some portion of the resources previously spent exclusively on adult goods for the couple will have to be diverted from the couple's consumption expenditure in order to feed and clothe the newborn. The main idea is to measure such income effects on adult goods separately for a boy and for a girl and to examine whether such income effects are different between boys and girls. If income effects are significantly larger for a boy than for a girl, then the household will probably make more room for boys' consumption than those of girls. This would indicate a gender bias in total consumption expenditure allocation between a boy and a girl. More specifically, we calculate the 'outlay equivalent ratios' (π-ratios) as follows:

$$\pi_{kr} = \frac{\frac{\partial w_k}{\partial n_r}}{\frac{\partial w_k}{\partial x}} \frac{n}{x} = \frac{(\eta_k - \beta_k) + \gamma_{kr} + \sum_{l=1}^{L-1} \gamma_{kl} \left(\frac{n_{il}}{n_i}\right)}{\beta_k + w_k},$$

for each adult good k and for each gender-age category r. The π-ratio for adult good k for gender-age category r measures the change in the consumption expenditure for the adult good k that is equivalent to the additional person in the gender-age category r. This is expressed as a ratio of total household expenditure per capita. Adult goods we utilize in our analysis are: adult male clothes, adult female clothes, adult male footwear, adult female footwear, adult female personal care items, and cigarettes and alcohol (including beedi, cigarettes, toddy and other alcohol).

While we define those consumption items as 'adult goods' on an a priori basis, it is possible to empirically test whether this definition of adult goods is consistent with the data. As shown in Deaton et al. (1989), since (by assumption) the only effects of adding an additional child (a boy or a girl) on the consumption of adult goods are on income, the π_{kr}-ratio for a given age-gender group r should be the same for all adult goods k. Thus, the null hypothesis is:

$$H_o : \quad \pi_{kr} = \pi_{k'r},$$

for all $k \neq k'$ that refer to adult goods and for all r that refer to children's age-gender categories. The age-gender categories are age groups 0-4 and 5-14 for boys and girls.

III.2 Estimation Results

Estimated outlay equivalent ratios (π_{kr}-ratios), and the test statistic for the difference in the π_k-ratios between boys and girls for each adult good-age category, are summarized in Table 2. If adult goods are identified correctly (i.e. children do not consume those goods directly), then π_{kr}-ratios should be negative, and smaller values (larger absolute values of negative numbers) mean larger reductions in the consumption of adult goods due to the addition of a boy or a girl. This indicates larger amounts of consumption expenditures are being re-allocated to the additional child. As shown in the table, 17 of 24 estimated π_{kr}-ratios are negative (top four rows in Table 2). Among the potential adult goods categories 'adult female footwear' and 'adult personal care,' all π-ratios for older children (age 5 to 14 for both female and male) are positive. This suggests that those goods are

Table 2. Detecting Potential Gender Bias in Intrahouseohld Resource Allocations (1): separate analyses by each adult-good category

	Type of adult goods					
	adult male clothes	adult female clothes	adult male footwear	adult female footwear	adult female personal care	cigarettes & alcohol
			π_j-ratios			
male 0-4	-0.695	-0.937	-5.361	-0.504	-0.523	1.117
Female 0-4	-0.549	-0.530	-0.961	-0.390	-0.684	0.726
male 5-14	0.194	-0.704	-0.743	0.430	0.112	-0.412
Female 5-14	-0.242	-0.931	-0.113	0.569	0.961	-1.396
	F-test: F(1, 289) boys vs. girls (p-value in parentheses)					
Age 0-4	0.04 (0.84)	0.09 (0.77)	0.59 (0.44)	0.02 (0.90)	0.01 (0.92)	0.05 (0.82)
Age 5-14	1.42 (0.23)	0.12 (0.72)	0.33 (0.56)	0.06 (0.81)	1.49 (0.22)	2.45 (0.12)

Table 3. Detecting Potential Gender Bias in Intrahouseohld Resource Allocations (2): aggregated adult-goods with alternative groupings

	(1) all adult good candidates		(2) cigarettes & alcohol excluded		(3) cigarettes & alcohol, adult female personal care excluded		(4) cigarettes & alcohol, adult female footwear excluded		(5) cigarettes & alcohol, adult female footwear, adult female personal care excluded	
	pi-ratio	equality of pi-ratio	pi-ratio	equality of pi-ratio	pi-ratio	equality of pi-ratio	pi-ratio	equality of pi-ratio	pi-ratio	equality of pi-ratio
					π_j-ratios					
male 0-4	0.423	0.86 (0.50)	-1.127	0.39 (0.82)	-1.224	0.44 (0.73)	-1.163	0.51 (0.67)	-1.274	0.62 (0.54)
female 0-4	0.338	0.67 (0.65)	-0.588	0.55 (0.70)	-0.573	0.37 (0.76)	-0.600	0.70 (0.55)	-0.585	0.19 (0.83)
male 5-14	-0.217	1.13 (0.34)	-0.149	1.17 (0.32)	-0.191	1.51 (0.21)	-0.183	1.08 (0.36)	-0.284	1.06 (0.35)
female 5-14	-0.919	2.55 (0.03)	-0.222	3.03 (0.02)	-0.413	2.92 (0.03)	-0.269	2.94 (0.03)	-0.481	0.18 (0.83)
	F-test: F(1. 289) boys vs. girls (p-value in parentheses)									
Age 0-4	0.00 (0.95)	---	0.41 (0.52)	---	0.55 (0.46)	---	0.41 (0.52)	---	0.55 (0.46)	---
age 5-14	2.68 (0.10)	---	0.03 (0.85)	---	0.31 (0.58)	---	0.05 (0.83)	---	0.36 (0.55)	---

potentially not 'adult goods' as expected. Especially for older girls, this is not surprising given the reasonable possibility that both footwear and personal care items for older girls may be shared by adult female members. Indeed, the positive π -ratios are larger for girls than for boys. In addition, the π-ratios for 'cigarettes and alcohol' are also positive for both infant boys and infant girls. This again suggests that these goods are not behaving as theoretcally expected.[*2]

Based on point estimates of the π -ratios in Table 2, there is an indication that the allocation of household consumption goods tends to be biased toward boys and against girls. Among the eight girl-boy pairs of π-ratios that are both negative, in the majority of the cases (five, including: adult male clothes-age 0 to 4; adult female clothes-age 0 to 4; adult male footwear-age 0 to 4 and age to 14; adult female footwear-age 0 to 4) the absolute value of the π-ratio is larger for boys than for

[*2] In fact, this is not the first time that household consumption of tobacco/cigarettes has been found to behave differently from the way 'it should.' Deaton's (1989) original study, based on Thai data, produces positive equivalent ratio estimates for two out of three age categories of male children. More recently, similar results are obtained by Case and Deaton (2002) based on the NSS data from India and by Fuwa (2005) based on a household survey data from the rural Philippines. Why the consumption of tobacco often does not behave the way adult goods should is not clear. It might be that the addition of children put stress on fathers who are then compelled to consume more tobacco; this is a clear violation of the 'demographic separability' assumption.

girls. This suggests that the adult household members 'sacrifice' of adult good purchases in order to make room for consumption goods for boys than for girls. Intriguingly, the estimated π-ratio for cigarettes and alcohol is larger (absolute value) for older girls than for older boys. However, the appropriateness of this category as adult goods has been somewhat unclear in other empirical studies (see footnote above). Further, almost all cases (four out of five) in which the absolute value of the π-ratio is larger for boys than for girls, are in the lower age category (age 0 to 4). Thus, to the extent that any anti-girl bias exists in the allocation of consumption goods within the household, such biases are likely to be more serious for infant girls than for older girls.

Table 3 summarizes similar results using the share of the aggregated adult goods (rather than each adult good category in a separate regression) as the dependent variable, with alternative definitions of the adult goods. Alternative definitions of the 'adult goods' are used since some of these may not be the same as those defined in the Deaton (1989). The 2nd, 4th, 6th, 8th and 10th columns of Table 3 show the F-test statistics (with p-values in parentheses) for testing the null hypothesis of equality of π-ratios across all the adult good categories taken together (as alternatively defined in the top row). In particular, for the 'female 5-14' category (4th row), the null hypothesis of equality of π-ratios among all adult good items is rejected when the three dubious adult good categories as identified in Table 2 (adult female footwear, adult female personal care, and cigarettes & alcohol) are included. When those three categories of goods are excluded (the last column of Table 3), the equality of π-ratios is not rejected. The 1st, 3rd, 5th, 7th and 9th columns of Table 3 shows the point estimates of π-ratios for aggregated adult goods with alternative definitions of the 'adult goods'. The qualitative results are essentially the same as those in Table 2. Point estimates suggest a possibility that anti-girl bias may exist in the intrahousehold allocation of consumption goods among infants. Restricting attention to the three candidate adult goods that passed the 'equality of π-ratios tests' (the last column of Table 3), individually (Table 2) or in aggregate (Table 3), all the point estimates of π-ratios for infant children suggest a possibility of anti-girl biases.

Similar to most past studies from South Asia as well as from elsewhere in the world, none of the observed differences in π-ratios between girls and boys is statistically significant. A recent analysis by Case and Deaton (2002), using the Indian NSS data from the 55th round, provides some point estimates of 'correct' signs but no significant difference in the outlay equivalent ratios between boys and girls. Combined with the earlier studies reporting similar results (e.g., Ahmad and Morduch, 1993; Subramanian and Deaton, 1990), findings in this paper appear to support the view that the power of the 'adult goods approach' in detecting gender biases in the intrahousehold allocation of consumption goods is rather weak (see also Strauss and Beagle, 1996).

IV Testing Alternative Models of Intrahousehold Resource Allocation

We have so far examined possible gender biases in the allocation of consumption expenditures between boys and girls within the household, and have found that there is indeed some evidence (albeit weak) suggesting some biases against girls of young ages. We now shift our focus to the issue of how such potential biases may arise in the process of intrahousehold resource allocation. Such an inquiry requires explicit modeling of the household decision making.

Some aspects of intrahousehold resource allocation can be inferred by specifying demographic characteristics $\mathbf{z}$ (gender and by age) or individual income m_i (differentiating income recipients), and by adding identifying assumptions about the underlying utility functions of the household members that lead to the demand function. Following the tradition of household budget analysis, the price vector $\boldsymbol{p}$ will not be included because the dataset is cross-sectional and thus it is assumed that all the households face the same prices. Under this general framework, one approach is to exploit the relationships between variations in the household consumption of various goods and services and variations in demographic composition of the household. This approach was taken in the previou section. Another strategy is to exploit the effects of variations in economic resource control by different household members within the household by decomposing the variable m in the equation above, identifying resource owners, and examining their effects on the patterns of household consumption demand. This approach can provide tests of alternative theoretical models of intrahousehold decision making processes. We will apply this approach in the analysis reported in the next section.

Household models are generally divided into two main branches: the unitary and the non-unitary, often termed as the collective household models (Alderman et al. (1995)). Unitary household models consider a household as a single unit maximizing their aggregated utility. Collective household models allow household members to have different preferences, and differences in preferences are allowed to affect how resources are allocated within a household. Collective models are increasingly employed to analyze intrahousehold resource allocation in developing countries (Haddad et al. (1997)).

In unitary models, a household maximizes the household utility function under resource constraints. One example of such models is as follows:

$$\begin{aligned} \max_{\{\boldsymbol{q}_i\}} \quad & u(\boldsymbol{q}_1, \cdots, \boldsymbol{q}_n | \mathbf{w}, \mathbf{z}) \\ \text{s.t.} \quad & \sum_i \left[m_i(\theta_i, \boldsymbol{s}_1 | \mathbf{w}, \mathbf{z}) - \boldsymbol{p}' \boldsymbol{q}_i \right] \leqslant 0 \end{aligned}$$

where $\boldsymbol{q}_i$ is now a consumption vector of member i, m_i is income of member i, θ_i is productivity of member i affecting m_i, and $\boldsymbol{s}_1$ is a vector of other factors tha affect earnings such as wage rates and labor market conditions. m_i is also affected by household demographic variables $\mathbf{z}$ and household assets $\mathbf{w}$. Maximization gives a vector of Walrasian demand functions for each person:

$$\boldsymbol{q}_i = \boldsymbol{q}_i(\boldsymbol{p}, \boldsymbol{s}_1, m | \boldsymbol{\theta}, \mathbf{w}, \mathbf{z}) \qquad \text{for } i = 1, \cdots, n,$$

where $m = \sum_i m_i$ is sum of individual incomes, or a household income. An important prediction of unitary models is that household demand behavior is only affected by total household income m and not by the distribution of income among household members. Therefore, a test of unitary models checks if incomes earned by each individual affect all demands in the same way.

Income pooling, a prediction of unitary model, may not be appropriate for households in developing countries. For example, we often observe situations where resources are allocated as a result of bargaining among adult household members. Therefore, whether the unitary approach can be accepted as a proxy for reality in rural settings in developing countries must be tested empirically.

An alternative way to model household behavior is to embed such bargaining processes in household decision making. Models sharing this intrahousehold perspective can be called non-unitary household models. In contrast to unitary models, these do not assume the existence of an aggregated household welfare function. Espescially in the collective models, individuals of a household not only have different preferences, but they also act as autonomous subeconomies, conditional on the actions of others. It is often assumed that individuals have a choice of remaining single or forming a separate household or other grouping; such threats can be used in the bargaining process.[*3] The bargaining powers of individuals in the household decision making are therefore assumed to be influenced by outside options. These are functions of distribution factors or extra-household environmental parameters (EEP's). An important prediction of collective models is that incomes are not pooled and that intrahousehold resource allocation is affected by EEP's. Examples of EEP's include local sex ratios, divorce law legislation, and the degree of prohibition on market work by gender.

There are two variants in the non-unitary models: Pareto-efficient (collective) models and Pareto-inefficient, non-cooperative models. In the former, household decisions are assumed to be Pareto efficient, but without being explicit on how such an outcome is reached. This includes cooperative bargaining models and other models that result in Pareto efficiency. The latter assumes individuals cannot enter into binding and enforceable contracts with each other under asymmetric information. Because of such information asymmetry, resource allocation within the household may not achieve Pareto efficiency under the non-cooperative approach. Thus, a test for the Pareto efficiency within a household (Udy, 1996; Duflo and Udry, 2004) is a test for Pareto-efficient household models including both unitary and collective models, against non-unitary, and non-cooperative household models.[*4] In this paper, we assume Pareto efficiency is satisfied. We thus ignore noncoopeative models, and test between Pareto-efficient collective models and unitary models. In this paper we will use 'collective models' only for Pareto-efficient non-unitary models.

To derive testable implications for this paper, an example of a collective household models is given below. This is a model with the assumption of 'egoistic' preferences (see Chiappori, 1992; member's utility depends only on own consumption). A household allocates resources optimally, and maximizes:

$$\begin{aligned} \max_{\{\boldsymbol{q}_i\}} \quad & \sum_i \mu_i(\boldsymbol{\theta}, \boldsymbol{s}) u(\boldsymbol{q}_i | \mathbf{w}, \mathbf{z}) \\ \text{s.t.} \quad & \sum_i \left[m_i(\theta_i, \boldsymbol{s}_1 | \mathbf{w}, \mathbf{z}) - \boldsymbol{p}' \boldsymbol{q}_i \right] \leqslant 0 \\ & \sum_i \mu_i = 1 \end{aligned} \tag{P1}$$

where $\mathbf{s}$ is a vector of EEP's that influences the income sharing (bargaining) process but not pref-

[*3] The seminal work by Chiappori (1988) makes the minimal assumption of Pareto optimality of household allocations. It does not specify how Pareto optimality is reached. This treatment covers a general class of models that includes cooperative bargaining models and unitary models as special cases.

[*4] There are mixes of the two; threat points in cooperative bargaining are modeled as being determined by outcomes of intrahousehold noncooperative games. See Lundberg and Pollak (1993) and Chen and Woolley (2001).

erences. $\mathbf{s}$ includes $\boldsymbol{s}_1$, but may also contain $\boldsymbol{s}_2$. Examples of $\boldsymbol{s}_2$ (EEP's that are in $\mathbf{s}$ but not in $\boldsymbol{s}_1$) include: local sex ratios and divorce law legislation. If wealth, education, or social status of (grand) parents do not directly affect earnings, then these may also be candidates of EEP's in $\boldsymbol{s}_2$. For later empirical exercises, it is important to note that education of grandparents outside the household is not likely to affect individual earnings once we condition on measures of θ_i such as education, age, and sexes.

As shown in Chiappori (1992), the above optimization problem is equivalent to:

$$\begin{aligned} \max_{\{\boldsymbol{q}_i\}} \quad & u_i(\boldsymbol{q}_i|\mathbf{w},\mathbf{z}) \\ \text{s.t.} \quad & \boldsymbol{p}'\boldsymbol{q}_i \leqslant m_i(\theta_i,\boldsymbol{s}_1|\mathbf{w},\mathbf{z}) + \phi_i \end{aligned} \tag{P2}$$

where ϕ_i is called a sharing rule, an income share of member i. This is a function of prices $\boldsymbol{p}$, individual incomes $\boldsymbol{m}$, household-specific preference reflected in $\mathbf{z}$, and EEP's:

$$\phi_i = \phi_i(\boldsymbol{p},\boldsymbol{m},\mathbf{z},\mathbf{s}), \qquad \sum_i \phi_i = 0.$$

Note that ϕ_i is additional (net) income for member i. Pareto optimal allocation can be interpreted as an outcome of a two-stage decision process. In stage 1, members decide on how to share the income as summarized in ϕ_i. In the second stage, each member maximizes own egoistic utility functions by choosing $\boldsymbol{q}_i$.

Maximization gives the following system of Walrasian demand functions:

$$\boldsymbol{q}_i = \boldsymbol{q}_i\left[\boldsymbol{p}, m_i(\theta_i,\boldsymbol{s}_1|\mathbf{w},\mathbf{z}) + \phi_i(\boldsymbol{p},\boldsymbol{m},\mathbf{z},\mathbf{s})\right], \qquad \text{for } i = 1,\cdots,n.$$

Noting the summing up restriction of sharing rule, any $j \neq i$ satisfies:

$$\boldsymbol{q}_j = \boldsymbol{q}_j\left[\boldsymbol{p}, m_j(\theta_j,\boldsymbol{s}_1|\mathbf{w},\mathbf{z}) - \sum_{i\neq j}\phi_i(\boldsymbol{p},\boldsymbol{m},\mathbf{z},\mathbf{s})\right].$$

If members of the same gender can be treated as a single person of the collective model, then, the above can be simplified into a model with two types of persons, males and females, and the above becomes:

$$\boldsymbol{q}_j = \boldsymbol{q}_j\left[\boldsymbol{p}, m_j(\theta_j,\boldsymbol{s}_1|\mathbf{w},\mathbf{z}) - \phi_i(\boldsymbol{p},\boldsymbol{m},\mathbf{z},\mathbf{s})\right].$$

To emphasize that q_j is a Walrasian demand function, the second argument can be expressed as $\tilde{m}_j$ so that $q_j = q_j(p,\tilde{m}_j)$. $\partial q_j/\partial m_j$ characterizes the marginal increase of demand with respect to one's own income. Then, for an element s_{2l} in $\boldsymbol{s}_2$,

$$\frac{\frac{\partial q_{ik}}{\partial s_{2l}}}{\frac{\partial q_{jk'}}{\partial s_{2l}}} = \frac{\frac{\partial q_{ik}}{\partial m_i}\frac{\partial \tilde{m}_i}{\partial s_{2l}}}{\frac{\partial q_{jk'}}{\partial m_j}\frac{\partial \tilde{m}_j}{\partial s_{2l}}} = -\frac{\frac{\partial q_{ik}}{\partial m_i}\frac{\partial \phi_i}{\partial s_{2l}}}{\frac{\partial q_{jk'}}{\partial m_j}\frac{\partial \phi_i}{\partial s_{2l}}} = -\frac{\frac{\partial q_{ik}}{\partial m_i}}{\frac{\partial q_{jk'}}{\partial m_j}} \qquad \text{for all } s_{2l} \in \boldsymbol{s}_2.$$

Hence, the ratio of l^{th} EEP partials has the same value for all l for any goods $k \neq k'$, for all $s_{2l} \in \boldsymbol{s}_2$. One can test this condition for all EEP's in the regressors by estimating a system of equations. If the goods are assignable, then one drops k, k' subscripts from the above. With assignable goods, one tests for the EEP partial ratio equality on the same pair of goods with respect to all $s_{2l} \in \boldsymbol{s}_2$. So we can use the expenditure data, not the quantity, as the relative prices will be a common multiplicative factor for the same pair of assignable goods i, j:

$$\frac{\frac{\partial p_i q_i}{\partial s_{2l}}}{\frac{\partial p_j q_j}{\partial s_{2l}}} = \frac{p_i \frac{\partial q_i}{\partial m_i} \frac{\partial \tilde{m}_i}{\partial s_{2l}}}{p_j \frac{\partial q_j}{\partial m_j} \frac{\partial \tilde{m}_j}{\partial s_{2l}}} = -\frac{p_i \frac{\partial q_i}{\partial m_i} \frac{\partial \phi_i}{\partial s_{2l}}}{p_j \frac{\partial q_j}{\partial m_j} \frac{\partial \phi_i}{\partial s_{2l}}} = -\frac{p_i \frac{\partial q_i}{\partial m_i}}{p_j \frac{\partial q_j}{\partial m_j}} \qquad \text{for all } s_{2l} \in \boldsymbol{s}_2. \tag{1}$$

Note that the above relation does not hold when households behave in a way consistent with unitary household models. Under the unitary approach, EEP's in $\boldsymbol{s}_2$ have no effect on resource allocation. Therefore, both the denominator and numerator of the above should be zero. Instead, the Pareto efficiency can be tested under the unitary approach by applying a similar test for elements in $\boldsymbol{s}_1$. This is explained in the next section.

V Estimation Method

In estimating expenditure regression models, the dependent variables can be defined in levels or in shares. Levels estimation uses seemingly unrelated regression equations (SURE) with robust covariance matrices. We use SURE because we need to test the cross-equation restrictions of collective (and unitary, see below) household model's equal proportionality conditions.

For the share regression, we follow Papke and Wooldridge (1996) and estimate fractional logit models. Surprisingly many previous works on expenditure shares ignore the fact that shares are limited dependent variables data. Fractional logit model is:

$$y_k = \Lambda\left(\boldsymbol{\beta}'\mathbf{x}\right), \qquad y_k \in [0, 1],$$

and $\Lambda(a) = \frac{1}{1+e^{-a}}$ is a logistic function. Papke and Wooldridge (1996), following the general result of the quasi-maximum likelihood (QML) estimation of Gourieroux, Monfort and Trognon (1984), has shown that maximization of logistic likelihood using y_k as a fraction variable, not a binary variable, gives consistent estimates of $\boldsymbol{\beta}$. The log-likelihood is Bernoulli:

$$l_k(\boldsymbol{\beta}) = y_k \ln\left[\Lambda\left(\boldsymbol{\beta}'\mathbf{x}\right)\right] + (1 - y_k) \ln\left[1 - \Lambda\left(\boldsymbol{\beta}'\mathbf{x}\right)\right].$$

We will use a system version of QML as we need to test cross-equation restrictions. Since we use QML, the estimation of robust covariance matrix is straightforward.

As noted earlier, the conventional way to test the unitary models is to take exogenous variations in incomes earned by individual members, and see if they affect the spending in the same way. The problem with our data, as with other studies using cross-sectional data set, is the lack of intertemporal information. Given there are no repeated observations through time, we cannot consistently estimate exogenous individual income changes. An alternative way is to use EEP's. Suppose that an individual i has an earning capacity given by:

$$m_i = m_i(\theta_i, \boldsymbol{s}_1 | \mathbf{w}, \mathbf{z}).$$

Here, we continue to assume that individual income is affected by some of EEP's, denoted by $\boldsymbol{s}_1$. These may include wage rates and other local labor market conditions. Then, under the null of unitary model, household demand on good k is:

$$q_k = q_k(\boldsymbol{p}, m) = q_k\left(\boldsymbol{p}, \sum_i m_i(\theta_i, \boldsymbol{s}_1|\mathbf{w}, \mathbf{z})\right),$$

where $m = \sum_i m_i$. It can be seen from the above that an EEP cannot be simultaneously significant in one expenditure and not in another. If an EEP significantly affects expenditure on one good, under the null of unitary model, it must also significantly affect the expenditure on other goods. This provides a casual way of examining the unitary model.

A more formal test can be derived using an analogous idea with collective model's EEP proportionality. Taking the first derivative with respect to the l^{th} EEP, we have:

$$\frac{\partial q_k}{\partial s_{1l}} = \frac{\partial q_k}{\partial m} \sum_i \frac{\partial m_i}{\partial s_{1l}}.$$

Then we have an analogous relationship of EEP proportionality as in the collective models, but for elements included in $\boldsymbol{s}_1$:

$$\frac{\frac{\partial q_k}{\partial s_{1l}}}{\frac{\partial q_k}{\partial s_{1l'}}} = \frac{\frac{\partial q_k}{\partial m}\sum_i \frac{\partial m_i}{\partial s_{1l}}}{\frac{\partial q_k}{\partial m}\sum_i \frac{\partial m_i}{\partial s_{1l'}}} = \frac{\sum_i \frac{\partial m_i}{\partial s_{1l}}}{\sum_i \frac{\partial m_i}{\partial s_{1l'}}} = \frac{\frac{\partial q_{k'}}{\partial m}\sum_i \frac{\partial m_i}{\partial s_{1l}}}{\frac{\partial q_{k'}}{\partial m}\sum_i \frac{\partial m_i}{\partial s_{1l'}}} = \frac{\frac{\partial q_{k'}}{\partial s_{1l}}}{\frac{\partial q_{k'}}{\partial s_{1l'}}} \qquad \text{for all } l' \neq l, \quad k' \neq k.$$

Note in collective models that after assuming goods are assignable to an individual such that k is consumed only by j,

$$\frac{\partial q_k}{\partial s_{1l}} = \frac{\partial q_k}{\partial m_j}\left(\frac{\partial m_j}{\partial s_{1l}} + \frac{\partial \phi_j}{\partial s_{1l}}\right).$$

Thus,

$$\frac{\frac{\partial q_k}{\partial s_{1l}}}{\frac{\partial q_k}{\partial s_{1l'}}} = \frac{\frac{\partial m_j}{\partial s_{1l}} + \frac{\partial \phi_j}{\partial s_{1l}}}{\frac{\partial m_j}{\partial s_{1l'}} + \frac{\partial \phi_j}{\partial s_{1l'}}} \neq \frac{\frac{\partial m_{j'}}{\partial s_{1l}} + \frac{\partial \phi_{j'}}{\partial s_{1l}}}{\frac{\partial m_{j'}}{\partial s_{1l'}} + \frac{\partial \phi_{j'}}{\partial s_{1l'}}} = \frac{\frac{\partial q_{k'}}{\partial s_{1l}}}{\frac{\partial q_{k'}}{\partial s_{1l'}}} \qquad \text{for all } l' \neq l, \quad k' \neq k, \quad j' \neq j.$$

The inequality follows as $\frac{\partial m_j}{\partial s_{1l}} \neq \frac{\partial m_{j'}}{\partial s_{1l}}$ or $\frac{\partial m_j}{\partial s_{1l}} + \frac{\partial \phi_j}{\partial s_{1l}} \neq \frac{\partial m_j}{\partial s_{1l'}} + \frac{\partial \phi_j}{\partial s_{1l'}}$, generally.

This analogous way of testing the unitary model of household uses cross-sectional data, and it does not require information on individual income. This method has an advantage over the widely-used income pooling tests. The latter incurs substantial cost in collecting income information. Even if such information is collected, it is difficult to obtain consistent estimates of exogenous variation of individual income without correct profit measures and price data (Rosenzweig and Wolpin, 2000).[*5]

[*5] There is another possible advantage in using this test. If s_{11}, s_{12}, s_{13} are imprecisely measured as in classical errors-in-variable, so $s_{1j} = s^*_{1j} + e_j$ for $j = 1, 2, 3$, hence $\text{cov}[s_{1j}, e_j] = \sigma^2_{e_j}$, and assuming $\text{cov}[e_j, e_j] = 0$ for all $j \neq h$, then in regressing $q_k = \boldsymbol{\beta}'\mathbf{x} + \boldsymbol{\gamma}'\boldsymbol{s}_1$ with OLS, we have attenuation bias of:

$$\text{plim } \hat{\gamma}_1 = \kappa_1\gamma_1 < \gamma_1, \qquad \text{plim } \hat{\gamma}_2 = \kappa_2\gamma_2 < \gamma_2, \qquad \text{plim } \hat{\gamma}_3 = \kappa_3\gamma_2 < \gamma_3,$$

with $\kappa_j \in [0, 1]$ for all j:

$$\kappa_1 = \frac{\sigma^2_{r_1} + \delta^2_{12}\sigma^2_{e_2} + \delta^2_{13}\sigma^2_{e_3}}{\sigma^2_{r_1} + \delta^2_{12}\sigma^2_{e_2} + \delta^2_{13}\sigma^2_{e_3} + \sigma^2_{e_1}}, \quad \kappa_2 = \frac{\sigma^2_{r_2} + \delta^2_{21}\sigma^2_{e_1} + \delta^2_{23}\sigma^2_{e_3}}{\sigma^2_{r_2} + \delta^2_{21}\sigma^2_{e_1} + \delta^2_{23}\sigma^2_{e_3} + \sigma^2_{e_2}}, \quad \kappa_3 = \frac{\sigma^2_{r_3} + \delta^2_{31}\sigma^2_{e_1} + \delta^2_{32}\sigma^2_{e_2}}{\sigma^2_{r_3} + \delta^2_{31}\sigma^2_{e_1} + \delta^2_{32}\sigma^2_{e_2} + \sigma^2_{e_3}},$$

and r_j is prediction error of linear projection without a mismeasured variable:

$$s_{1j} = \boldsymbol{\eta}'_j\mathbf{x} + \delta_{jh}s^*_{1h} + \delta_{jh'}s^*_{1h'} + r_j = \boldsymbol{\eta}'_j\mathbf{x} + \delta_{jh}s_{1h} + \delta_{jh'}s_{1h'} + (r_j - \delta_{jh}e_h - \delta_{jh'}e_{h'}),$$

We have found that the amount of good consumption is censored information. We must employ censored regressions which are notoriously difficult to implement under the system-of-equations context with many goods (and zero's, see Yen et al., 2003). In addition, heteroskedasticity is almost always impossible to rule out in survey data. Given these difficulties, we use the expenditure data of Hicksian composite goods:[*6] if the relative prices of a group of goods faced by households are the same and fixed, then the entire group of goods can be considered as one single good in the demand system (Deaton and Muellbauer 1980, pp. 120-122). Denoting the k^{th} composite good by q_k, we have:

$$\frac{\frac{\partial p_k q_k}{\partial s_{1l}}}{\frac{\partial p_k q_k}{\partial s_{1l'}}} = \frac{p_k \frac{\partial q_k}{\partial m} \sum_i \frac{\partial m_i}{\partial s_{1l}}}{p_k \frac{\partial q_k}{\partial m} \sum_i \frac{\partial m_i}{\partial s_{1l'}}} = \frac{\sum_i \frac{\partial m_i}{\partial s_{1l}}}{\sum_i \frac{\partial m_i}{\partial s_{1l'}}} = \frac{p_{k'} \frac{\partial q_{k'}}{\partial m} \sum_i \frac{\partial m_i}{\partial s_{1l}}}{p_{k'} \frac{\partial q_{k'}}{\partial m} \sum_i \frac{\partial m_i}{\partial s_{1l'}}} = \frac{\frac{\partial p_{k'} q_{k'}}{\partial s_{1l}}}{\frac{\partial p_{k'} q_{k'}}{\partial s_{1l'}}} \qquad \text{for all } l' \neq l, \quad k' \neq k, \tag{2}$$

The assumption of having the same and fixed relative prices between villages holds if the good markets are integrated in the study area. This is likely under the frequent operation of busses, trucks, rickshaws, and other motorized and non-motorized vehicles.

We will use Village and caste (backward caste, scheduled caste, other caste, scheduled tribe, Muslim) dummy variables to control for the cluster fixed-effects. The other regressors include three groups of variables: (1) household demographic variables $\mathbf{z}$, (2) grandparental demographic variables $\boldsymbol{g}$, and (3) grandparental land holding variables $\boldsymbol{h}$. The use of grandparental variables is rare and can be considered as one of the strengths of this paper. As shown above, these will affect individual demand through the sharing rule in the collective setting; they are irrelevant in the unitary setting. There are fewer observations of grandparental land holding variables because survey respondents were sometimes unable to recall such information. Although such a memory loss to may be a random event once we condition on demographic and household wealth variables, it can be argued that the landless have weaker memories concerning land than the landed, generating a selection problem. Unfortunately, other than ages of respondents and years parents have been deceased, no variables are available to control for the 'unable-to-recall' selection process. Thus estimated results for $\boldsymbol{h}$ should be considered as exploratory.

It is important to recognize that, in using cross-sectional data, one cannot reject a 'preference-based' interpretation of significant estimates on EEP's. They reflect parental preference inherited from grandparents, and are not an evidence of effects on bargaining power. To formally test the collective models, one needs exogenous productivity shocks on each members that are uncorrelated with grandparents' preferences. This, however, requires at least panel data.[*7] However, if the inherited portion of preferences from grandparents is fixed during a prolonged period (as is usually assumed in the fixed-effect models), if deaths or the remote residence of grandparents diminish their

for $j \neq h$, $j \neq h'$. So if

$$\kappa_1 \simeq \kappa_2 \simeq \kappa_3,$$

the severity of attenuation biases are similar for all $\hat{\gamma}_j$, and we will have more precise estimates of their ratios.

[*6] One can, in principle, use only the minimally censored data and estimate SURE. However, there is a selection problem arises if some goods, which are conditionally correlated with relative prices and income, are left out from the system.

[*7] Even with a panel, shock prone individuals may have a systematic tendency in their preferences and behaviors that cannot be controlled in estimation.

effects on bargaining power, and if the deaths of parents are not correlated with preference heterogeneity, then households with surviving grandparents residing in proximity and the households with deceased or remotely residing grandparents, should have different parameter estimates for EEP's. This test is valid since under the null of collective model, with residential proximity and parental survival that is uncorrelated with preference heterogeneity, there will be significant differences in estimated parameters, while under the alternative of fixed preference-inheritance or no bargaining, there should be no any significant differences. Thus we estimate:

$$y_k = \Lambda\left[\boldsymbol{\beta}_1'\mathbf{z} + \boldsymbol{\beta}_{20}'\boldsymbol{g} + \boldsymbol{\beta}_{21}'D\boldsymbol{g} + \boldsymbol{\beta}_{30}'\boldsymbol{h} + \boldsymbol{\beta}_{31}'D\boldsymbol{h}\right],$$

where D is an indicator variable for surviving and proximate residence of grandparents. We test $\boldsymbol{\beta}_{21} = \mathbf{0}$.[*8]

As our data employs variable probability sampling (VPS), one needs to weight the likelihood or observations. As for QML, denoting the sampling weight for observation k of stratum j as π_{jk}, the weighted log-likelihood is:

$$\sum_k \frac{l_k(\boldsymbol{\beta})}{\pi_{jk}}.$$

If all the regressors are considered as exogenous, one can consistently estimate the parameters with VPSSURE and VPSQML.

[*8] We could have tested $\boldsymbol{\beta}_{31} = \mathbf{0}$, however, singularity prohibits the use of interaction term on $\boldsymbol{h}$.

VI Estimated Results

Table 4: Spending on Nonfood Father Goods with Village, Caste Fixed Effects

	SURE	SURE	SURE	SURE	SURE	QML	QML	QML	QML	QML
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
hd_age	0.028	−0.510	−0.387	−0.444	−0.245	−0.013	−0.023***	−0.022***	−0.019**	−0.016*
	(0.409)	(0.357)	(0.400)	(0.412)	(0.557)	(0.009)	(0.008)	(0.008)	(0.008)	(0.009)
hd_yrs	0.454	0.336	0.720	0.837	1.352	−0.014	−0.013	−0.007	−0.008	−0.004
	(0.715)	(0.719)	(0.747)	(0.729)	(1.008)	(0.014)	(0.013)	(0.014)	(0.014)	(0.017)
sp_age	0.953**	0.702*	0.847*	0.924*	0.400	0.022**	0.022**	0.021**	0.020**	0.010
	(0.476)	(0.376)	(0.439)	(0.473)	(0.443)	(0.011)	(0.009)	(0.009)	(0.009)	(0.008)
sp_yrs	0.745	0.010	0.236	0.425	4.311**	0.014	0.000	0.000	0.002	0.075**
	(1.436)	(1.261)	(1.361)	(1.376)	(2.042)	(0.026)	(0.025)	(0.026)	(0.027)	(0.032)
hd_sex	−26.584**	−19.127*	−15.087	−19.130*	−15.104	−0.923*	−1.019**	−0.973**	−0.980**	−1.171*
	(11.398)	(10.459)	(9.587)	(10.594)	(11.500)	(0.472)	(0.448)	(0.438)	(0.437)	(0.689)
total	4.141*	1.973	2.371*	2.171*	0.350	−0.098***	−0.174***	−0.188***	−0.196***	−0.250***
	(2.490)	(1.593)	(1.336)	(1.255)	(1.016)	(0.030)	(0.037)	(0.040)	(0.039)	(0.043)
amales		12.399***	15.110***	13.799***	13.316***		0.233***	0.290***	0.268***	0.225***
		(3.472)	(4.421)	(4.358)	(3.272)		(0.059)	(0.070)	(0.071)	(0.059)
afemales		12.665***	11.685***	11.946***	2.408		0.140**	0.116**	0.119**	0.007
		(3.882)	(3.716)	(3.712)	(4.756)		(0.061)	(0.059)	(0.059)	(0.074)
b_lop		−2.574	−1.934	−1.421	−1.510		−0.032	−0.016	0.003	−0.008
		(2.762)	(3.004)	(2.867)	(3.166)		(0.044)	(0.044)	(0.042)	(0.047)
b_upp		1.192	2.630	3.119	5.518		−0.008	0.012	0.021	0.106
		(3.305)	(3.439)	(3.446)	(4.144)		(0.066)	(0.063)	(0.064)	(0.067)
b_sec		0.248	0.485	0.599	2.591		0.019	0.024	0.023	0.093
		(3.520)	(3.605)	(3.631)	(4.656)		(0.058)	(0.058)	(0.059)	(0.067)
g_lop		2.011	2.041	2.220	3.009		−0.003	0.006	0.002	0.052
		(2.500)	(2.828)	(2.855)	(3.249)		(0.051)	(0.051)	(0.052)	(0.060)
g_upp		1.325	2.571	3.135	10.469***		−0.083	−0.066	−0.051	0.081
		(3.092)	(3.156)	(3.099)	(3.752)		(0.065)	(0.064)	(0.064)	(0.072)
g_sec		−0.838	−1.956	−1.098	1.568		−0.052	−0.074	−0.072	−0.015
		(3.486)	(3.555)	(3.659)	(3.858)		(0.067)	(0.065)	(0.067)	(0.073)
imales		−1.685	−1.617	1.072	6.671		−0.147*	−0.119	−0.080	0.023
		(4.378)	(4.799)	(4.636)	(5.075)		(0.082)	(0.078)	(0.074)	(0.075)
ifemales		−5.221*	−6.742**	−7.302**	−4.622		−0.106**	−0.143**	−0.150***	−0.095
		(2.889)	(3.399)	(3.241)	(3.794)		(0.054)	(0.060)	(0.057)	(0.066)
emales		10.159	14.140	16.016	35.543**		0.295**	0.438**	0.422**	0.905***
		(9.649)	(11.795)	(11.554)	(13.890)		(0.145)	(0.179)	(0.181)	(0.201)
efemales		−0.557	−0.332	0.070	−1.717		−0.162*	−0.128	−0.100	−0.161
		(4.743)	(5.831)	(5.718)	(6.498)		(0.087)	(0.104)	(0.105)	(0.118)
hdf_alive			−9.459	−8.280	15.191			−0.220	−0.206	0.308
			(9.027)	(8.768)	(13.318)			(0.199)	(0.185)	(0.279)
hdm_alive			1.521	0.286	7.020			0.039	0.023	0.063
			(7.475)	(7.265)	(8.922)			(0.142)	(0.138)	(0.164)
spf_alive			7.400	8.735	13.370**			0.131	0.151	0.115
			(5.717)	(5.573)	(5.643)			(0.103)	(0.102)	(0.103)
spm_alive			4.882	6.492	−2.467			0.141	0.168	0.018
			(6.603)	(6.538)	(6.237)			(0.125)	(0.127)	(0.101)
hdf_vill			7.261	3.150	−11.453			0.221	0.186	−0.039
			(11.767)	(11.403)	(15.724)			(0.235)	(0.224)	(0.308)
hdm_vill			4.192	2.487	−1.208			−0.018	−0.037	−0.050
			(7.133)	(7.473)	(8.526)			(0.146)	(0.150)	(0.164)
spf_vill			−9.086	−9.636	−12.853			−0.337*	−0.336**	−0.388**
			(8.399)	(8.482)	(9.312)			(0.173)	(0.172)	(0.163)
spm_vill			2.072	0.792	−1.843			0.105	0.085	0.064
			(6.150)	(6.330)	(7.851)			(0.125)	(0.128)	(0.125)
hdf_cores			8.932	3.437	−35.226**			0.059	0.035	−0.890**
			(14.356)	(14.316)	(17.165)			(0.275)	(0.270)	(0.371)
hdm_cores			2.264	4.512	2.682			−0.060	−0.049	0.042
			(7.585)	(7.635)	(9.705)			(0.138)	(0.139)	(0.151)
spf_cores			−17.553	−17.721	−9.987			−0.106	−0.091	0.265
			(14.895)	(14.118)	(15.798)			(0.346)	(0.332)	(0.303)
spm_cores			19.840*	15.645	9.108			0.153	0.081	−0.144
			(10.564)	(9.854)	(11.578)			(0.201)	(0.191)	(0.183)
hdf_lit			0.989	0.697	−2.481			0.000	0.012	−0.047
			(4.745)	(4.765)	(5.557)			(0.098)	(0.100)	(0.101)
spf_lit			0.354	2.147	−1.668			0.034	0.091	0.085
			(5.134)	(5.152)	(6.545)			(0.099)	(0.103)	(0.129)
hd_bro				0.468	−1.199				−0.014	−0.079***
				(1.252)	(1.701)				(0.025)	(0.031)
hd_sis				−0.672	−2.219				−0.013	−0.063**
				(1.162)	(1.400)				(0.023)	(0.026)
sp_bro				1.586	2.351				0.025	0.054*
				(1.432)	(1.456)				(0.027)	(0.029)
sp_sis				−1.034	−1.661				−0.023	−0.011
				(1.187)	(1.521)				(0.023)	(0.029)
hdf_irr					−0.501					−0.002
					(0.402)					(0.006)
hdf_dry					0.363*					0.005
					(0.210)					(0.003)
spf_irr					1.512					0.026*
					(0.937)					(0.015)
spf_dry					0.210					0.001
					(0.247)					(0.004)
hdp_adiff					−1.265**					−0.023*
					(0.636)					(0.012)
spp_adiff					0.790					0.004
					(0.584)					(0.012)

Table 5: Spending on Father Goods with Village, Caste Fixed Effects

	SURE	SURE	SURE	SURE	SURE	QML	QML	QML	QML	QML
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
hd_age	1.720	0.822	2.164	2.886	4.061	0.020	0.019	0.026**	0.029***	0.036***
	(2.467)	(2.601)	(2.564)	(2.866)	(4.183)	(0.012)	(0.013)	(0.010)	(0.011)	(0.013)
hd_yrs	0.987	1.278	4.129	3.307	2.307	−0.018	−0.016	−0.003	−0.010	−0.009
	(3.896)	(4.191)	(4.329)	(4.574)	(6.737)	(0.022)	(0.023)	(0.022)	(0.024)	(0.029)
sp_age	−0.335	−0.526	−0.432	−0.914	−1.223	−0.016	−0.015	−0.017	−0.018*	−0.028**
	(2.028)	(2.175)	(2.018)	(2.084)	(2.989)	(0.011)	(0.012)	(0.010)	(0.010)	(0.013)
sp_yrs	−11.277*	−11.796*	−9.755*	−9.185	−9.795	−0.072*	−0.072*	−0.042	−0.037	−0.009
	(5.940)	(6.737)	(5.610)	(5.839)	(9.105)	(0.038)	(0.041)	(0.035)	(0.039)	(0.059)
hd_sex	27.599	26.690	44.903	50.898	84.708	0.742**	0.658*	0.666**	0.640*	0.603
	(40.071)	(48.568)	(48.171)	(63.287)	(92.609)	(0.341)	(0.344)	(0.306)	(0.348)	(0.476)
total	14.954	13.313	18.746*	17.343*	18.862*	−0.059	−0.034	−0.035	−0.051	−0.046
	(11.205)	(10.842)	(9.827)	(9.787)	(10.982)	(0.044)	(0.039)	(0.037)	(0.036)	(0.038)
amales		−8.332	−1.954	−2.414	−4.699		−0.116	−0.087	−0.086	−0.206*
		(14.852)	(15.870)	(16.395)	(24.798)		(0.084)	(0.086)	(0.086)	(0.118)
afemales		21.469	9.950	10.047	0.379		−0.034	−0.063	−0.096	−0.098
		(18.964)	(18.557)	(18.575)	(30.283)		(0.097)	(0.085)	(0.086)	(0.104)
b_lop		−1.881	10.841	14.859	44.136**		0.036	0.135	0.174**	0.304***
		(15.433)	(16.050)	(16.885)	(22.222)		(0.096)	(0.085)	(0.084)	(0.080)
b_upp		−3.394	14.752	10.763	−9.603		−0.045	0.108	0.056	−0.074
		(20.397)	(20.384)	(21.277)	(30.338)		(0.122)	(0.097)	(0.097)	(0.113)
b_sec		−6.712	−8.046	−9.356	−29.692		−0.042	−0.064	−0.075	−0.161
		(21.125)	(21.475)	(22.215)	(30.373)		(0.106)	(0.095)	(0.094)	(0.107)
g_lop		1.192	−8.918	−9.357	−12.481		−0.060	−0.085	−0.110	−0.108
		(13.367)	(16.606)	(17.464)	(24.695)		(0.087)	(0.085)	(0.087)	(0.122)
g_upp		−7.080	−8.541	−3.872	−12.858		−0.115	−0.124	−0.114	−0.140
		(18.839)	(18.899)	(18.243)	(24.864)		(0.104)	(0.086)	(0.084)	(0.103)
g_sec		−3.524	−15.785	−20.815	−47.192		−0.049	−0.087	−0.117	−0.223*
		(23.382)	(27.594)	(29.381)	(38.942)		(0.120)	(0.113)	(0.114)	(0.120)
imales		15.754	27.805	26.009	11.468		0.053	0.204	0.233	0.145
		(28.499)	(31.285)	(32.001)	(38.712)		(0.178)	(0.164)	(0.152)	(0.163)
ifemales		6.732	−1.655	2.984	8.452		0.036	−0.049	−0.008	0.007
		(15.394)	(17.488)	(18.232)	(27.912)		(0.087)	(0.086)	(0.095)	(0.106)
emales		58.239	8.390	2.440	43.281		0.218	−0.008	−0.031	0.052
		(51.297)	(84.731)	(87.485)	(121.713)		(0.221)	(0.262)	(0.252)	(0.281)
efemales		0.135	−5.437	−8.939	7.836		−0.098	0.061	0.020	0.334*
		(21.007)	(29.968)	(30.630)	(45.215)		(0.138)	(0.152)	(0.150)	(0.179)
hdf_alive			−51.456	−32.472	−184.049			−0.487	−0.334	−1.115*
			(44.175)	(49.858)	(114.771)			(0.309)	(0.367)	(0.627)
hdm_alive			−51.558	−49.881	−49.206			−0.457*	−0.511**	−0.690**
			(33.757)	(35.080)	(53.097)			(0.237)	(0.242)	(0.330)
spf_alive			53.610	47.720	80.366			0.282*	0.221	0.275*
			(37.661)	(36.189)	(50.378)			(0.157)	(0.148)	(0.161)
spm_alive			40.583	43.789	66.030*			0.334**	0.378***	0.393**
			(28.154)	(28.471)	(39.910)			(0.150)	(0.147)	(0.154)
hdf_vill			−24.859	−34.738	143.341			−0.131	−0.267	0.815
			(56.802)	(61.213)	(127.376)			(0.388)	(0.454)	(0.717)
hdm_vill			48.522	30.677	23.876			0.194	0.033	0.001
			(41.373)	(43.576)	(55.741)			(0.267)	(0.272)	(0.314)
spf_vill			−42.947	−33.060	−16.094			−0.217	−0.133	0.164
			(45.797)	(46.623)	(59.080)			(0.285)	(0.296)	(0.308)
spm_vill			−33.119	−39.580	−80.027			−0.416	−0.492*	−0.738**
			(39.677)	(42.327)	(54.911)			(0.262)	(0.264)	(0.304)
hdf_cores			197.506	191.031	451.384**			0.942**	0.906**	2.057***
			(136.130)	(141.769)	(224.622)			(0.418)	(0.451)	(0.677)
hdm_cores			65.433*	61.879	68.275			0.205	0.226	0.208
			(39.625)	(40.416)	(54.716)			(0.249)	(0.242)	(0.270)
spf_cores			−198.632**	−199.258**	−183.041			−0.375	−0.430	0.070
			(83.879)	(79.588)	(117.148)			(0.490)	(0.436)	(0.498)
spm_cores			145.939**	135.927*	126.432			0.402	0.253	0.206
			(73.632)	(73.119)	(79.982)			(0.310)	(0.319)	(0.337)
hdf_lit			59.391	58.248	101.768**			0.568***	0.544***	0.791***
			(36.705)	(36.327)	(51.775)			(0.143)	(0.142)	(0.157)
spf_lit			−89.236***	−92.922***	−124.326***			−0.608***	−0.647***	−0.864***
			(29.640)	(30.534)	(38.728)			(0.156)	(0.155)	(0.199)
hd_bro				−8.779	−17.466				−0.014	−0.062
				(8.520)	(12.056)				(0.036)	(0.047)
hd_sis				10.367	14.318				0.087**	0.105**
				(8.187)	(11.025)				(0.040)	(0.048)
sp_bro				8.313	13.924				0.100***	0.147***
				(6.104)	(8.993)				(0.035)	(0.043)
sp_sis				−2.423	−7.811				−0.028	−0.050
				(7.559)	(10.155)				(0.043)	(0.060)
hdf_irr					−6.547**					−0.040***
					(2.810)					(0.013)
hdf_dry					0.278					0.004
					(1.148)					(0.004)
spf_irr					−9.674					−0.026
					(7.504)					(0.025)
spf_dry					0.097					0.000
					(1.297)					(0.006)
hdp_adiff					−6.653					−0.036*
					(4.174)					(0.019)
spp_adiff					1.599					−0.013
					(4.614)					(0.021)

Table 6: Spending on Mother Goods with Village, Caste Fixed Effects

	SURE (1)	SURE (2)	SURE (3)	SURE (4)	SURE (5)	QML (6)	QML (7)	QML (8)	QML (9)	QML (10)
hd_age	0.068 (0.538)	−0.470 (0.503)	−0.394 (0.525)	−0.274 (0.507)	0.032 (0.670)	−0.010 (0.008)	−0.014 (0.008)	−0.013 (0.009)	−0.008 (0.008)	−0.011 (0.010)
hd_yrs	1.770* (0.956)	1.685* (0.953)	1.563* (0.879)	1.718* (0.893)	2.120* (1.118)	0.035** (0.016)	0.033** (0.016)	0.025* (0.014)	0.029** (0.014)	0.022 (0.016)
sp_age	0.672 (0.528)	0.542 (0.554)	0.746 (0.588)	0.679 (0.569)	0.766 (0.677)	0.009 (0.008)	0.007 (0.009)	0.009 (0.010)	0.007 (0.009)	0.017 (0.010)
sp_yrs	3.443* (1.814)	2.118 (1.713)	1.761 (1.586)	1.816 (1.603)	4.045** (1.986)	0.029 (0.024)	0.014 (0.023)	0.003 (0.022)	0.000 (0.021)	0.038 (0.024)
hd_sex	−30.637* (17.479)	−28.711* (15.944)	−21.547 (14.616)	−18.659 (13.606)	−13.500 (17.757)	0.053 (0.563)	0.036 (0.518)	0.087 (0.502)	0.116 (0.458)	0.441 (0.425)
total	4.053 (2.605)	1.865 (1.563)	1.862 (1.322)	1.447 (1.290)	0.313 (1.394)	−0.176*** (0.039)	−0.267*** (0.049)	−0.298*** (0.049)	−0.314*** (0.050)	−0.325*** (0.050)
amales		2.767 (2.927)	5.594* (3.312)	6.190* (3.424)	11.794*** (3.776)		0.033 (0.050)	0.068 (0.052)	0.078 (0.052)	0.178*** (0.064)
afemales		21.599*** (4.012)	20.464*** (4.014)	20.813*** (3.984)	13.884** (5.649)		0.274*** (0.058)	0.267*** (0.059)	0.285*** (0.055)	0.168*** (0.064)
b_lop		0.728 (2.385)	1.097 (2.411)	1.379 (2.472)	−2.068 (3.521)		0.008 (0.045)	0.017 (0.047)	0.036 (0.044)	−0.038 (0.048)
b_upp		0.508 (3.401)	2.532 (3.568)	3.101 (3.518)	7.261* (4.412)		−0.010 (0.062)	0.022 (0.063)	0.039 (0.062)	0.163** (0.065)
b_sec		−0.434 (3.222)	1.139 (3.160)	0.967 (3.202)	0.273 (4.268)		−0.019 (0.059)	0.009 (0.056)	0.001 (0.053)	0.024 (0.063)
g_lop		0.730 (2.800)	1.044 (2.991)	2.011 (3.048)	0.361 (3.276)		−0.061 (0.052)	−0.053 (0.050)	−0.043 (0.049)	−0.077 (0.056)
g_upp		7.268** (3.467)	9.374*** (3.376)	10.261*** (3.371)	14.912*** (4.261)		0.092 (0.058)	0.130** (0.059)	0.155*** (0.057)	0.253*** (0.071)
g_sec		−2.358 (3.712)	−2.379 (3.783)	−3.266 (3.889)	−4.385 (4.036)		−0.144** (0.072)	−0.153** (0.070)	−0.178** (0.070)	−0.166** (0.074)
imales		−4.154 (4.144)	−1.724 (4.577)	−3.025 (4.735)	1.037 (5.546)		−0.127* (0.065)	−0.059 (0.069)	−0.101 (0.069)	−0.071 (0.078)
ifemales		−5.081* (3.036)	−6.761** (3.329)	−6.812** (3.372)	−2.174 (4.340)		−0.097* (0.055)	−0.106** (0.052)	−0.106** (0.051)	−0.015 (0.064)
emales		−3.941 (7.902)	3.834 (9.563)	5.309 (9.679)	5.232 (14.242)		−0.006 (0.127)	0.108 (0.157)	0.076 (0.158)	0.274 (0.198)
efemales		9.956* (5.232)	12.275* (7.096)	10.290 (7.319)	4.760 (7.442)		0.117 (0.083)	0.199* (0.108)	0.167 (0.109)	−0.007 (0.123)
hdf_alive			−15.935 (12.027)	−14.453 (12.270)	2.625 (23.990)			−0.292 (0.201)	−0.264 (0.200)	0.027 (0.261)
hdm_alive			9.181 (11.600)	11.310 (11.423)	23.694* (13.262)			0.140 (0.169)	0.182 (0.161)	0.380** (0.165)
spf_alive			8.233 (5.904)	7.955 (5.863)	19.070** (7.566)			0.154* (0.088)	0.147* (0.084)	0.267** (0.110)
spm_alive			11.415** (5.509)	12.926** (5.553)	7.731 (8.266)			0.157* (0.092)	0.193** (0.091)	0.186* (0.112)
hdf_vill			14.226 (16.122)	13.013 (16.314)	−3.224 (28.515)			0.304 (0.245)	0.337 (0.247)	0.060 (0.325)
hdm_vill			−3.070 (13.681)	−4.479 (13.325)	−9.692 (14.616)			−0.131 (0.193)	−0.144 (0.182)	−0.308 (0.198)
spf_vill			0.613 (10.393)	2.311 (10.500)	−13.329 (11.481)			0.011 (0.212)	0.067 (0.198)	−0.275 (0.227)
spm_vill			−4.799 (9.413)	−6.686 (9.717)	1.111 (9.355)			−0.147 (0.172)	−0.176 (0.159)	0.045 (0.151)
hdf_cores			6.075 (14.968)	0.770 (15.198)	−25.148 (27.041)			0.137 (0.276)	0.081 (0.273)	−0.472 (0.344)
hdm_cores			−5.675 (11.061)	−5.224 (11.074)	−6.032 (11.622)			−0.192 (0.155)	−0.190 (0.150)	−0.156 (0.154)
spf_cores			−11.628 (13.624)	−10.184 (14.651)	−2.614 (14.438)			−0.012 (0.226)	0.037 (0.247)	0.341 (0.243)
spm_cores			13.181 (8.747)	13.076 (8.820)	20.363* (11.858)			0.059 (0.142)	0.084 (0.136)	0.104 (0.173)
hdf_lit			2.901 (5.149)	3.492 (4.882)	−3.141 (6.615)			0.022 (0.089)	0.049 (0.085)	−0.058 (0.107)
spf_lit			11.863* (7.087)	8.954 (7.370)	7.391 (9.303)			0.232** (0.105)	0.187* (0.106)	0.204 (0.127)
hd_bro				−2.041 (1.348)	−1.456 (1.886)				−0.072*** (0.022)	−0.074** (0.034)
hd_sis				1.831 (1.511)	−1.369 (1.546)				0.034 (0.021)	−0.019 (0.024)
sp_bro				0.017 (1.449)	0.180 (1.546)				−0.022 (0.024)	−0.013 (0.023)
sp_sis				0.490 (1.654)	1.467 (1.976)				0.007 (0.025)	0.045 (0.028)
hdf_irr					−0.838** (0.406)					−0.013* (0.007)
hdf_dry					0.165 (0.192)					0.001 (0.003)
spf_irr					0.431 (1.048)					0.008 (0.015)
spf_dry					0.061 (0.326)					−0.003 (0.004)
hdp_adiff					−0.537 (0.776)					−0.012 (0.012)
spp_adiff					1.549* (0.867)					0.022 (0.013)

Table 7: Spending on Child Goods with Village, Caste Fixed Effects

	SURE	SURE	SURE	SURE	SURE	QML	QML	QML	QML	QML
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
hd_age	−0.519	−0.872	−0.630	−0.667	0.544	−0.029*	−0.037**	−0.032*	−0.030	−0.033
	(0.664)	(0.657)	(0.671)	(0.759)	(1.007)	(0.017)	(0.016)	(0.018)	(0.019)	(0.033)
hd_yrs	3.390**	2.864**	2.017	1.966	−1.312	0.092***	0.072***	0.049*	0.042	−0.054
	(1.536)	(1.445)	(1.580)	(1.572)	(2.919)	(0.028)	(0.026)	(0.028)	(0.028)	(0.043)
sp_age	1.085	0.756	0.984	1.018	−0.338	0.021	0.008	0.013	0.012	0.040
	(0.702)	(0.678)	(0.728)	(0.815)	(1.244)	(0.020)	(0.017)	(0.019)	(0.021)	(0.040)
sp_yrs	4.077	3.815	3.898	3.989	7.859*	−0.008	−0.001	0.026	0.028	0.089
	(3.475)	(3.783)	(3.769)	(3.766)	(4.400)	(0.041)	(0.046)	(0.046)	(0.045)	(0.068)
hd_sex	−13.914	−20.667	−17.132	−7.350	41.137	0.026	−0.025	0.087	0.305	0.987
	(23.944)	(26.207)	(27.084)	(29.080)	(34.912)	(0.896)	(0.962)	(0.936)	(0.930)	(0.790)
total	6.779	4.736	4.744	4.951	0.321	0.029	−0.026	−0.033	−0.027	−0.198**
	(4.149)	(3.576)	(3.376)	(3.510)	(2.676)	(0.043)	(0.056)	(0.080)	(0.079)	(0.085)
amales		0.659	−1.469	−2.038	7.437		0.152	0.113	0.092	0.440***
		(5.219)	(5.767)	(5.940)	(8.047)		(0.104)	(0.113)	(0.116)	(0.152)
afemales		13.433	13.632	14.464	0.471		0.237	0.234	0.257*	0.052
		(9.112)	(10.118)	(10.128)	(11.313)		(0.147)	(0.154)	(0.149)	(0.196)
b_lop		−8.980*	−8.860*	−10.924*	−17.875**		−0.236	−0.214	−0.243*	−0.091
		(5.114)	(5.375)	(6.056)	(7.556)		(0.144)	(0.135)	(0.145)	(0.159)
b_upp		8.274	8.403	7.457	14.561		0.171	0.180	0.131	0.467***
		(6.439)	(6.674)	(6.835)	(9.676)		(0.129)	(0.136)	(0.138)	(0.172)
b_sec		10.763	12.348	10.884	6.797		0.271**	0.270**	0.252**	−0.142
		(9.380)	(9.907)	(9.860)	(10.592)		(0.125)	(0.125)	(0.127)	(0.143)
g_lop		−7.334*	−7.143	−7.265	−3.795		−0.282**	−0.288**	−0.292**	−0.204
		(3.969)	(4.487)	(4.754)	(6.818)		(0.118)	(0.121)	(0.125)	(0.190)
g_upp		19.965***	21.886***	21.752**	37.069***		0.484***	0.490***	0.469***	0.785***
		(6.857)	(8.001)	(8.552)	(11.792)		(0.136)	(0.146)	(0.148)	(0.154)
g_sec		7.576	9.676	11.360	16.092*		0.166	0.202	0.224*	0.252*
		(6.866)	(7.243)	(7.509)	(9.076)		(0.146)	(0.138)	(0.136)	(0.147)
imales		1.674	3.025	3.813	1.178		−0.154	−0.185	−0.196	−0.521**
		(5.198)	(6.292)	(6.996)	(8.850)		(0.190)	(0.191)	(0.197)	(0.256)
ifemales		−3.645	−2.376	−3.484	−0.492		−0.084	−0.013	−0.024	−0.160
		(4.429)	(5.135)	(5.067)	(7.419)		(0.153)	(0.168)	(0.168)	(0.208)
emales		−5.985	−10.359	−6.921	2.884		0.242	0.088	0.067	0.132
		(12.769)	(14.853)	(14.618)	(17.868)		(0.353)	(0.352)	(0.359)	(0.510)
efemales		9.283	4.018	3.714	7.540		−0.061	−0.043	−0.027	−0.130
		(9.041)	(10.243)	(10.422)	(12.338)		(0.206)	(0.225)	(0.244)	(0.362)
hdf_alive			−3.652	−10.065	17.594			0.555	0.489	1.066
			(23.486)	(26.543)	(51.687)			(0.413)	(0.425)	(0.672)
hdm_alive			11.312	8.915	42.406**			0.026	−0.019	0.830*
			(14.060)	(14.136)	(20.667)			(0.355)	(0.350)	(0.475)
spf_alive			−11.869	−9.582	13.811			−0.383*	−0.359*	0.361
			(11.991)	(11.421)	(14.510)			(0.205)	(0.196)	(0.328)
spm_alive			2.730	0.428	−15.641			−0.109	−0.162	−0.613**
			(12.321)	(12.179)	(13.484)			(0.218)	(0.223)	(0.289)
hdf_vill			3.156	9.299	−17.519			−0.219	−0.121	−0.976
			(24.962)	(25.727)	(55.071)			(0.503)	(0.490)	(0.723)
hdm_vill			−8.237	−4.768	−33.514			−0.089	−0.042	−0.557
			(14.422)	(14.728)	(21.165)			(0.438)	(0.439)	(0.544)
spf_vill			40.758**	36.151**	13.557			1.435***	1.348***	1.065*
			(18.998)	(17.081)	(24.295)			(0.482)	(0.463)	(0.587)
spm_vill			−7.451	−3.466	7.354			−0.729*	−0.634	−0.053
			(15.477)	(14.280)	(21.622)			(0.434)	(0.441)	(0.497)
hdf_cores			9.099	13.022	−40.002			−0.038	0.019	−0.896
			(27.648)	(31.347)	(54.058)			(0.525)	(0.548)	(0.730)
hdm_cores			4.980	10.913	−11.299			0.071	0.163	−0.217
			(17.097)	(17.363)	(21.640)			(0.389)	(0.370)	(0.415)
spf_cores			10.113	10.573	20.048			−0.591	−0.749	−2.107**
			(37.980)	(36.664)	(41.279)			(0.657)	(0.655)	(0.892)
spm_cores			−5.001	1.026	19.583			−0.745	−0.752	−0.665
			(17.838)	(19.465)	(24.021)			(0.610)	(0.698)	(1.234)
hdf_lit			12.020	12.313	−4.205			0.062	0.075	−0.216
			(9.011)	(9.314)	(16.339)			(0.183)	(0.186)	(0.255)
spf_lit			11.395	10.462	−21.823			0.211	0.250	−0.147
			(12.018)	(13.883)	(19.293)			(0.242)	(0.273)	(0.261)
hd_bro				1.963	−5.269				0.031	−0.075
				(2.866)	(3.817)				(0.061)	(0.083)
hd_sis				−5.078**	−5.000				−0.087	−0.127*
				(2.548)	(3.810)				(0.069)	(0.076)
sp_bro				0.550	1.808				0.008	−0.006
				(2.741)	(2.949)				(0.056)	(0.073)
sp_sis				4.540	7.250				0.050	0.097
				(4.683)	(4.955)				(0.065)	(0.081)
hdf_irr					−1.217					0.005
					(0.855)					(0.021)
hdf_dry					2.366**					0.031***
					(1.131)					(0.006)
spf_irr					1.189					−0.009
					(2.149)					(0.050)
spf_dry					0.715					0.007
					(0.906)					(0.008)
hdp_adiff					1.741					−0.005
					(2.173)					(0.030)
spp_adiff					−1.324					0.042
					(1.677)					(0.027)

Table 8: Father Goods with Fixed Effects and Survival Interactions

	share of nonfood father goods				share of father goods			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
hd_age	−0.022***	−0.020**	−0.016*	−0.022***	0.025**	0.027**	0.035***	0.022**
	(0.008)	(0.008)	(0.010)	(0.008)	(0.010)	(0.011)	(0.013)	(0.010)
hd_yrs	−0.009	−0.009	0.000	−0.005	−0.004	−0.010	−0.005	0.000
	(0.013)	(0.014)	(0.017)	(0.014)	(0.021)	(0.023)	(0.029)	(0.022)
sp_age	0.022**	0.021**	0.010	0.014*	−0.017	−0.018*	−0.026*	−0.016
	(0.009)	(0.009)	(0.008)	(0.007)	(0.010)	(0.010)	(0.013)	(0.010)
sp_yrs	−0.005	−0.002	0.068**	0.006	−0.042	−0.036	0.004	−0.053
	(0.027)	(0.027)	(0.033)	(0.025)	(0.035)	(0.038)	(0.058)	(0.035)
hd_sex	−1.011**	−1.018**	−1.199*	−0.833**	0.711**	0.677*	0.606	0.645**
	(0.444)	(0.441)	(0.692)	(0.425)	(0.311)	(0.354)	(0.487)	(0.305)
total	−0.192***	−0.200***	−0.250***	−0.201***	−0.038	−0.054	−0.057	−0.027
	(0.041)	(0.042)	(0.045)	(0.039)	(0.037)	(0.036)	(0.039)	(0.038)
amales	0.290***	0.270***	0.223***	0.498***	−0.083	−0.082	−0.210*	0.055
	(0.069)	(0.071)	(0.058)	(0.119)	(0.086)	(0.086)	(0.120)	(0.116)
afemales	0.120**	0.121**	0.013	0.269***	−0.072	−0.110	−0.111	0.063
	(0.061)	(0.060)	(0.070)	(0.095)	(0.084)	(0.085)	(0.107)	(0.120)
b_lop	−0.022	−0.002	−0.006	0.234**	0.140	0.185**	0.331***	0.292**
	(0.044)	(0.042)	(0.047)	(0.104)	(0.086)	(0.085)	(0.081)	(0.146)
b_upp	0.018	0.027	0.099	0.257**	0.102	0.046	−0.065	0.298**
	(0.062)	(0.064)	(0.067)	(0.114)	(0.097)	(0.096)	(0.108)	(0.144)
b_sec	0.007	0.010	0.075	0.269**	−0.058	−0.066	−0.169	0.112
	(0.059)	(0.060)	(0.067)	(0.116)	(0.094)	(0.093)	(0.111)	(0.161)
g_lop	0.011	0.010	0.063	0.237**	−0.071	−0.099	−0.100	0.070
	(0.049)	(0.050)	(0.058)	(0.102)	(0.086)	(0.087)	(0.118)	(0.136)
g_upp	−0.066	−0.050	0.058	0.195*	−0.124	−0.121	−0.164	0.061
	(0.063)	(0.064)	(0.070)	(0.114)	(0.085)	(0.084)	(0.109)	(0.147)
g_sec	−0.053	−0.054	−0.002	0.154	−0.081	−0.115	−0.220*	0.116
	(0.065)	(0.067)	(0.074)	(0.122)	(0.113)	(0.113)	(0.122)	(0.168)
imales	−0.121	−0.088	0.050	0.061	0.201	0.239	0.205	0.442**
	(0.077)	(0.075)	(0.076)	(0.108)	(0.166)	(0.154)	(0.173)	(0.189)
ifemales	−0.143**	−0.151***	−0.111	0.049	−0.055	−0.013	0.004	0.094
	(0.056)	(0.054)	(0.069)	(0.097)	(0.088)	(0.097)	(0.107)	(0.122)
emales	0.442**	0.424**	0.900***	0.678***	0.029	0.009	0.055	0.331
	(0.183)	(0.183)	(0.200)	(0.204)	(0.261)	(0.250)	(0.263)	(0.297)
efemales	−0.142	−0.115	−0.188	0.071	0.063	0.032	0.351*	0.228
	(0.106)	(0.107)	(0.118)	(0.125)	(0.150)	(0.147)	(0.183)	(0.189)
hdf_alive	−0.382*	−0.353*	0.101	−0.208	−0.413	−0.199	−0.815	−0.473
	(0.202)	(0.190)	(0.278)	(0.207)	(0.337)	(0.388)	(0.600)	(0.311)
hdm_alive	0.038	0.027	0.133	0.106	−0.463**	−0.516**	−0.611*	−0.510**
	(0.138)	(0.137)	(0.162)	(0.140)	(0.232)	(0.235)	(0.319)	(0.241)
spf_alive	0.225**	0.236**	0.092	0.097	0.312*	0.228	0.119	0.253*
	(0.113)	(0.111)	(0.125)	(0.091)	(0.175)	(0.169)	(0.196)	(0.152)
spm_alive	0.105	0.134	−0.003	0.145	0.331**	0.382***	0.470***	0.372**
	(0.124)	(0.126)	(0.103)	(0.121)	(0.153)	(0.149)	(0.166)	(0.151)
hdf_vill	0.181	0.173	−0.014	0.202	−0.091	−0.237	0.782	−0.136
	(0.223)	(0.218)	(0.312)	(0.239)	(0.381)	(0.440)	(0.670)	(0.388)
hdm_vill	0.026	0.008	−0.157	−0.084	0.217	0.041	−0.141	0.209
	(0.143)	(0.148)	(0.156)	(0.148)	(0.264)	(0.269)	(0.332)	(0.266)
spf_vill	−0.332*	−0.328*	−0.519***	−0.297*	−0.182	−0.103	0.090	−0.218
	(0.172)	(0.172)	(0.173)	(0.167)	(0.287)	(0.297)	(0.319)	(0.274)
spm_vill	0.187	0.156	0.124	0.137	−0.421	−0.512*	−0.843**	−0.448*
	(0.133)	(0.136)	(0.149)	(0.124)	(0.269)	(0.269)	(0.342)	(0.262)
hdf_cores	0.083	0.065	−0.825**	0.072	0.900**	0.851*	1.919***	0.934**
	(0.263)	(0.261)	(0.360)	(0.280)	(0.423)	(0.453)	(0.635)	(0.415)
hdm_cores	−0.030	−0.024	0.015	−0.118	0.222	0.227	0.132	0.259
	(0.138)	(0.141)	(0.160)	(0.140)	(0.248)	(0.241)	(0.273)	(0.246)
spf_cores	−0.153	−0.124	0.122	−0.124	−0.380	−0.451	0.119	−0.314
	(0.348)	(0.341)	(0.314)	(0.325)	(0.501)	(0.439)	(0.480)	(0.475)
spm_cores	0.186	0.122	−0.103	0.080	0.437	0.284	0.174	0.347
	(0.204)	(0.194)	(0.184)	(0.203)	(0.309)	(0.318)	(0.322)	(0.342)
hdf_lit	−0.134	−0.100	−0.086	0.000	0.602***	0.613***	0.974***	0.547***
	(0.119)	(0.119)	(0.132)	(0.098)	(0.159)	(0.155)	(0.200)	(0.138)
spf_lit	0.173	0.220*	0.135	0.042	−0.491**	−0.555***	−0.937***	−0.547***
	(0.118)	(0.127)	(0.158)	(0.099)	(0.205)	(0.197)	(0.274)	(0.156)
hdf_alit	0.413**	0.349*	0.250		−0.215	−0.339	−0.536	
	(0.201)	(0.196)	(0.238)		(0.326)	(0.328)	(0.334)	
spf_alit	−0.348**	−0.321*	−0.208		−0.307	−0.205	0.147	
	(0.167)	(0.170)	(0.207)		(0.294)	(0.292)	(0.348)	
hd_bro		−0.020	−0.080***			−0.008	−0.056	
		(0.024)	(0.030)			(0.037)	(0.046)	
hd_sis		−0.012	−0.065**			0.087**	0.098*	
		(0.022)	(0.027)			(0.040)	(0.051)	
sp_bro		0.020	0.039			0.101***	0.139***	
		(0.027)	(0.028)			(0.035)	(0.044)	
sp_sis		−0.022	−0.012			−0.030	−0.048	
		(0.023)	(0.029)			(0.043)	(0.058)	
hdf_irr			−0.001				−0.041*	
			(0.016)				(0.023)	
hdf_dry			0.004				0.005	
			(0.003)				(0.005)	
spf_irr			0.035**				−0.025	
			(0.016)				(0.026)	
spf_dry			−0.003				−0.007	
			(0.004)				(0.006)	
hdp_adiff			−0.022**				−0.035*	
			(0.011)				(0.018)	
spp_adiff			0.004				−0.014	
			(0.011)				(0.021)	
hdf_airr			−0.022				−0.021	
			(0.019)				(0.028)	
hdf_adry			0.010				0.004	
			(0.007)				(0.012)	
spf_adry			0.017**				0.018	
			(0.008)				(0.011)	
blood1				−0.021				0.078
				(0.032)				(0.053)
blood2				0.174**				−0.267*
				(0.072)				(0.140)
blood3				−0.389***				0.014
				(0.128)				(0.185)

Table 9: Mother and Child Goods with Fixed Effects and Survival Interactions

	share of mother goods				share of child goods			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
hd_age	−0.012	−0.007	−0.014	−0.010	−0.033*	−0.031	−0.039	−0.028
	(0.009)	(0.008)	(0.010)	(0.009)	(0.017)	(0.019)	(0.033)	(0.019)
hd_yrs	0.025*	0.030**	0.027*	0.024*	0.048*	0.041	−0.055	0.045*
	(0.014)	(0.014)	(0.016)	(0.013)	(0.028)	(0.029)	(0.042)	(0.027)
sp_age	0.009	0.007	0.016	0.009	0.012	0.012	0.041	0.018
	(0.010)	(0.009)	(0.010)	(0.009)	(0.019)	(0.021)	(0.039)	(0.021)
sp_yrs	0.001	−0.004	0.045*	0.007	0.022	0.025	0.126*	0.021
	(0.022)	(0.021)	(0.026)	(0.022)	(0.048)	(0.047)	(0.069)	(0.051)
hd_sex	0.061	0.078	0.348	0.119	0.013	0.232	1.100	0.123
	(0.499)	(0.451)	(0.375)	(0.504)	(0.962)	(0.954)	(0.808)	(0.864)
total	−0.295***	−0.311***	−0.331***	−0.305***	−0.029	−0.023	−0.212***	−0.019
	(0.049)	(0.049)	(0.049)	(0.051)	(0.083)	(0.081)	(0.082)	(0.083)
amales	0.065	0.074	0.187***	0.067	0.113	0.095	0.438***	−0.211
	(0.052)	(0.051)	(0.061)	(0.081)	(0.113)	(0.115)	(0.152)	(0.292)
afemales	0.275***	0.301***	0.177***	0.232***	0.246	0.267*	0.067	0.095
	(0.060)	(0.056)	(0.064)	(0.073)	(0.164)	(0.158)	(0.195)	(0.229)
b_lop	0.013	0.028	−0.046	0.015	−0.229	−0.255	−0.104	−0.512
	(0.048)	(0.045)	(0.049)	(0.082)	(0.146)	(0.156)	(0.159)	(0.372)
b_upp	0.023	0.043	0.179***	0.039	0.194	0.147	0.455***	−0.208
	(0.062)	(0.061)	(0.063)	(0.100)	(0.138)	(0.138)	(0.173)	(0.326)
b_sec	0.007	−0.006	0.024	0.015	0.268**	0.252**	−0.098	−0.087
	(0.056)	(0.053)	(0.060)	(0.084)	(0.126)	(0.128)	(0.140)	(0.323)
g_lop	−0.061	−0.053	−0.075	−0.030	−0.297**	−0.295**	−0.250	−0.620*
	(0.051)	(0.050)	(0.059)	(0.083)	(0.127)	(0.128)	(0.188)	(0.345)
g_upp	0.131**	0.158***	0.216***	0.143	0.504***	0.483***	0.858***	0.132
	(0.060)	(0.058)	(0.065)	(0.097)	(0.138)	(0.140)	(0.155)	(0.366)
g_sec	−0.153**	−0.177**	−0.146**	−0.133	0.217	0.240*	0.273*	−0.185
	(0.070)	(0.069)	(0.070)	(0.099)	(0.139)	(0.136)	(0.145)	(0.297)
imales	−0.057	−0.104	−0.042	−0.062	−0.165	−0.183	−0.607**	−0.564*
	(0.069)	(0.069)	(0.077)	(0.108)	(0.189)	(0.194)	(0.256)	(0.308)
ifemales	−0.103**	−0.104**	−0.008	−0.087	−0.011	−0.025	−0.083	−0.312
	(0.051)	(0.051)	(0.060)	(0.081)	(0.164)	(0.165)	(0.225)	(0.284)
emales	0.096	0.052	0.336*	−0.018	0.057	0.044	0.178	−0.243
	(0.160)	(0.162)	(0.190)	(0.179)	(0.371)	(0.373)	(0.520)	(0.473)
efemales	0.200*	0.166	0.036	0.152	−0.030	−0.022	−0.109	−0.301
	(0.109)	(0.109)	(0.125)	(0.124)	(0.232)	(0.246)	(0.357)	(0.331)
hdf_alive	−0.318	−0.334	−0.019	−0.303	0.354	0.293	1.269*	0.594
	(0.209)	(0.210)	(0.245)	(0.195)	(0.520)	(0.510)	(0.720)	(0.398)
hdm_alive	0.140	0.186	0.431***	0.146	0.029	−0.007	0.769	0.039
	(0.169)	(0.159)	(0.161)	(0.173)	(0.355)	(0.348)	(0.480)	(0.365)
spf_alive	0.126	0.122	0.110	0.151*	−0.368	−0.327	0.450	−0.337*
	(0.096)	(0.090)	(0.127)	(0.089)	(0.247)	(0.235)	(0.422)	(0.195)
spm_alive	0.158*	0.193**	0.207*	0.149	−0.120	−0.173	−0.676**	−0.117
	(0.095)	(0.092)	(0.118)	(0.093)	(0.224)	(0.229)	(0.290)	(0.225)
hdf_vill	0.300	0.335	0.144	0.321	−0.216	−0.116	−0.906	−0.197
	(0.247)	(0.251)	(0.307)	(0.240)	(0.509)	(0.493)	(0.726)	(0.487)
hdm_vill	−0.149	−0.158	−0.388**	−0.105	−0.074	−0.021	−0.350	−0.077
	(0.188)	(0.178)	(0.183)	(0.202)	(0.439)	(0.443)	(0.518)	(0.440)
spf_vill	−0.006	0.053	−0.415	0.012	1.457***	1.374***	1.030*	1.477***
	(0.219)	(0.205)	(0.257)	(0.211)	(0.503)	(0.482)	(0.611)	(0.443)
spm_vill	−0.146	−0.167	0.028	−0.127	−0.720	−0.623	0.116	−0.726*
	(0.175)	(0.159)	(0.180)	(0.173)	(0.451)	(0.459)	(0.511)	(0.420)
hdf_cores	0.148	0.104	−0.388	0.171	0.024	0.067	−0.917	−0.057
	(0.279)	(0.277)	(0.323)	(0.268)	(0.547)	(0.557)	(0.730)	(0.497)
hdm_cores	−0.197	−0.195	−0.240	−0.194	0.068	0.161	−0.243	0.114
	(0.156)	(0.150)	(0.162)	(0.158)	(0.391)	(0.372)	(0.429)	(0.392)
spf_cores	−0.018	0.032	0.657**	−0.023	−0.701	−0.829	−1.117	−0.582
	(0.230)	(0.249)	(0.266)	(0.235)	(0.636)	(0.646)	(1.174)	(0.678)
spm_cores	0.044	0.071	0.065	0.071	−0.769	−0.754	−0.603	−0.657
	(0.145)	(0.139)	(0.173)	(0.139)	(0.635)	(0.709)	(1.228)	(0.612)
hdf_lit	0.008	0.008	−0.018	0.056	−0.046	−0.026	−0.193	0.088
	(0.099)	(0.096)	(0.125)	(0.090)	(0.205)	(0.209)	(0.269)	(0.176)
spf_lit	0.182	0.128	0.289**	0.215**	0.233	0.284	−0.195	0.205
	(0.117)	(0.122)	(0.126)	(0.106)	(0.281)	(0.317)	(0.374)	(0.230)
hdf_alit	0.076	0.184	−0.042		0.368	0.365	0.082	
	(0.170)	(0.178)	(0.217)		(0.471)	(0.466)	(0.512)	
spf_alit	0.125	0.134	−0.266		−0.010	−0.075	0.189	
	(0.201)	(0.182)	(0.207)		(0.412)	(0.415)	(0.475)	
hd_bro		−0.076***	−0.069**			0.025	−0.083	
		(0.023)	(0.033)			(0.058)	(0.086)	
hd_sis		0.032*	−0.030			−0.086	−0.120	
		(0.020)	(0.026)			(0.069)	(0.078)	
sp_bro		−0.026	−0.027			−0.001	0.044	
		(0.024)	(0.023)			(0.058)	(0.090)	
sp_sis		0.008	0.055**			0.049	0.100	
		(0.026)	(0.025)			(0.065)	(0.079)	
hdf_irr			−0.036***				0.001	
			(0.011)				(0.044)	
hdf_dry			0.002				0.030***	
			(0.003)				(0.006)	
spf_irr			0.011				−0.011	
			(0.017)				(0.048)	
spf_dry			−0.011***				0.014	
			(0.004)				(0.010)	
hdp_adiff			−0.008				−0.001	
			(0.011)				(0.029)	
spp_adiff			0.016				0.031	
			(0.012)				(0.029)	
hdf_airr			0.024				0.044	
			(0.016)				(0.050)	
hdf_adry			−0.004				−0.024	
			(0.007)				(0.015)	
spf_adry			0.030***				−0.023	
			(0.007)				(0.018)	
blood1				−0.078**				0.101
				(0.033)				(0.099)
blood2				0.028				0.209
				(0.066)				(0.182)
blood3				0.022				0.098
				(0.092)				(0.383)

Table 4, **5**, **6**, and **7** show the results of system regressions. Same column numbers in these tables indicate that they are estimated under the same system of equations. The estimated results in **Table 4** show SURE estimation with Huber-White standard errors of levels and QML fractional logit estimation with Huber-White standard errors of shares. The two estimation methods give qualitatively similar results. In the level estimation, parameter estimates on total expenditure is weakly positive, while they are significantly negative in the share estimation. This indicates that, with household characteristics controlled, nonfood father goods increase to some extent with total expenditure, thus they are weakly normal goods, but not at the rate total expenditure grows. Besides from total expenditure and number of adult and elderly males in households, smaller number of adult females and residence of spouse's father in the same village reduce nonfood father good spending share. The presence of grandfather is considered to bolster female bargaining power, so the finding indicates that collective models may be true in the study area. However, if adult female members act collectively, this smaller number of adult females should increase the father good spending, thus there is a mixed evidence for collective models.

Table 5 provides estimated results for expenditure on father goods including alcohol and cigarettes. Level estimates show that they are weakly normal goods, and share estimates show they increase at a rate smaller than that of total expenditure, although the latter is mostly insignificant. Spousal age and schooling years significantly reduce the shares in two specifications of (6) and (7), and so do in the levels insignificantly, although the sizes of these effects are not large. Literacy of the spouse's father significantly reduces spending on father goods, both in levels and in shares. The size of these effects are large, and they more than cancel the positive impact of the surviving spouse's mother. This is an interesting result because, whether or not the spouse's father is surviving, the effects of his education outlast and affect spending for the son-in-law. It is also notable that effects of total expenditure in the levels estimation are much weaker than when vices are not included. Together with the significant impact of father-in-law's literacy, this indicates that vices can be cut back, probably through negotiations between members. A natural interpretation of the positive correlation with coresiding head's father is joint consumption of vices. Such effects are even stronger if the head's father is literate. The positive impacts of the surviving spousal mother may be puzzling. If an elder mother-in-law requires assistance from her son-in-law, that may adversely affect the bargaining position of the spouses. Thus the findings in **Table 5** are generally consistent with collective models.

The estimated results in **Table 6** give the level estimates on total expenditure are positive (although insignificant), and share estimates are negative. This pattern is similar to nonfood father goods. However, the significance of level estimates is greater for nonfood father goods. The magnitude of the effect in share estimation is also greater than nonfood father goods. This indicates that mothers are more likely to give up their own growth dividends. Holding household characteristics fixed, both fathers and mothers abstain from increasing their own nonfood expenditure and maintain a certain fixed level, however, mothers do this more aggressively. The other parameter estimates show the positive impact of the surviving and literate spousal father. This is also true for the surviving spousal mother, and again, this is consistent with the collective models. An interpretation of these effects needs some caution, however. Given that mother goods are non-inferior or weakly normal, these results are not inconsistent with surviving and literate spousal father serveing as a source of wealth. Positive parameter estimates simply pick up his wealth effects. While this is possible, the unitary model is silent with regard to why such wealth effects are observed only in mother goods, as well as why the head's father variables are not significant in mother goods. Therefore, it indicates weak support of collective model. The negative coefficients for girls of secondary school age and female infants may reflect the mother's altruistic decision to substitute their consumption with her own.

The estimated results in **Table 7** show that the residency of the spouse's father in the same village significantly increases both spending levels and share of child goods. The estimates on lower and upper primary girls are somewhat puzzling. Spending increases if there are more upper primary girls in the household. This does not conform with the intuition of gender discrimination against them. It suggests that sampled households choose to spend on girls' school-related costs up to the upper primary level but not beyond. If we compare the girls with the boys, it shows that spending share on child goods decreases for girls as their age increases, while the opposite occurs for boys. This reflects the fact that girls stop schooling before boys, and this is a well documented form of gender discrimination against girls. The positive signs on the head's schooling years show that more educated fathers choose to spend more on child goods. The positive impact of the literacy of spouse's father is again consistent with collective models.

In **Table 8** and in **9**, we include in the share regressions the interaction terms of the surviving grandparents indicator. As in previous results, same column numbers show the results from the same system of equations. EEP's are interacted with grandfather's literacy and grandfather's land holding. Except for nonfood father goods, most estimates are insignificant. The surviving and literate head's father is positively correlated with the nonfood father good expenditure share; the surviving and literate spouse's father has a negative correlation. The surviving spouse's father's rainfed land holding increases the nonfood father and mother goods share. These may capture a positive correlation between the spouse's parents' wealth and dowries paid. A spouse who brings more dowries may increase the expenditure shares of parents. However, the size of an increase of the mother good share is greater by a factor of three quarters. The overall impact of literacy of the surviving grandfathers are examined with χ^2 tests, and the p values are 0.2589, 0.2822, 0.5924 for each specification. Nonrejection of $\boldsymbol{\beta}_{21} = \mathbf{0}$ is probably due to imprecise estimates of regressions other than nonfood father goods, and the aforementioned measurement errors in grandparental land holding variables $\boldsymbol{h}$ which attenuate $\boldsymbol{\beta}_{21}$ estimates. Nevertheless, considering significant and different-by-gender estimates of rainfed land holdings by the spouse's father, one cannot confidently reject the null of collective models.

Parameters on head's blood relatives show that nonfood father goods increase if the head's parents and siblings are coresiding (blood2) but decreases if other extended family (blood3) live with them. This is another evidence of bargaining may be taking place in a household where extended family members feel less altruistic toward the head. This explains the puzzling positive estimates on afemales and efemales in **Table 4** in the father goods share regressions. The positive impacts of female

Table 10: p Values of χ^2 Tests of Household Models

variables tested for proportionality	SURE					Fractional Logit				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
TEST OF UNITARY MODEL										
education years, age	0.84	0.86	0.80	0.79	0.82	0.41	0.98	0.96	0.96	0.71
TEST OF COLLECTIVE MODEL										
grandfather literacy			0.38	0.45	0.87			0.27	0.39	0.19
grandfather alive, grandmother alive			0.71	0.65	0.4			0.56	0.34	0.24
number of brothers and sisters				0.91	0.75				0.71	0.57
grandfather's rainfed and irrigated land holdings					0.68					0.79

Note: The column numbers indicate the specification of estimated equations in Tables 2-4. The row entries are p values of null being examined, using the indicated EEP's.

members are canceled if they are in the extended portion of the household. The parameter on own children (blood1) in the mother goods regression shows a negative correlation. This is consistent with mothers who cut back on their consumption in order to secure consumption for their children. This further confirms the finding of mother goods consumption in **Table 6**. The overall significance test of blood relatives gives the p value of 0.0008, and the null of no blood relative effects is strongly rejected.

While parameter estimates seem to favor collective rather than unitary models, one must formally test each models. **Table 10** shows the p values of various tests run in **Table 4**, **5**, and **6**. The column numbers show corresponding specification in these tables. A small p value indicates the rejection of the null. The first row tests proportionality of $\boldsymbol{s}_1$, or the unitary model: age and schooling years of head and spouse. Results suggest that the unitary model cannot be rejected. However, some coefficients on EEP's were statistically significant, and this is contrart to the unitary model. Thus, results are mixed.

The second through fifth rows in each block are tests of collective models. Elements of **s** that are not considered to be included in $\boldsymbol{s}_1$ are: literacy of each grandfather, presence of surviving grandparents, number of brothers and sisters of the head and spouse, and land holdings of each grandfather. We do not test the collective model in child goods equation because children are assumed to make no decisions. The results indicate that the χ^2 tests of proportionality generally do not reject the collective models.[*9]

Empirical analysis shows the persistent effects of the spouse's father. Through his literacy or presence in the same village, father goods consumption is reduced while mother and child goods consumption is increased.

It is also found that mothers tend to have lower assignable good consumption if there are more daughters. This holds after we control the total expenditure. This is further confirmed in estimation using blood relative indicators. It is the presence of her own daughters that reduces the mother goods

[*9] Shall we consider these as an evidence for the last remaining category of the household model, i.e., noncooperative models? This is not necessarily so, given the size of standard errors of the estimates. Obviously, with large standard errors, any tests examining equality of parameters do not reject the null irrespective of the true parameter values. Given that we test a nonlinear relationship between parameters, the power of tests can be reduced even further. In addition, the power of unitary and collective model tests may not be large because we use a ratio of parameters. If the element in **s** in the denominator is irrelevant in spending, the parameter asymptotically approaches to the true value of zero and the test statistic does not have a well defined probability limit.

consumption, but not that of other female members of the extended household. This is in accord with Kurosaki et al. (2006) who find that mothers tend not to discriminate by gender while fathers do, using the same data set as ours.

The coefficient on the surviving spouse's father's rainfed land holdings shows a positive impact on both mother and father goods. This implies a wealth effect. However, the size of this effect is much larger for mother goods, which further supports collective models. The last piece of evidence is stronger than the mere significant estimates of other EEP's. It is difficult to teel if significant estimates of EEP's is capturing preference heterogeneity or the parameters in sharing rule function. On the other hand, it is not plausible that alive or deceased statuses of grandparents may affect the preference of a unitary household. A collective model has a more natural interpretation of changes in bargaining powers.

With the results generally supporting collective models and persistent effects of spousal fathers, it is tempting to consider that there are greater impacts on child and female welfare if intervention is targeted to both female spouses and their birth parents. However, caution should be exercised. The strong effects of the spouse's father, who is literate and lives close by, may be due to spurious correlations through a third factor, such as the ability of spousal fathers. If parents try to find grooms in remote area to diversify income risks (Rosenzweig and Stark, 1989), it is plausible that fathers may live afar from their daughters who are married-off. It is also plausible that fathers with higher abilities may rely less on marriage in risk diversification. This should lead them to live closer to married-off daughters, or a selection in residential proximity. Such a possibility may mean that providing supports to spouse's father may not result in anticipated effects, because it is not by getting more resources that fathers exert influences, but by their innate higher ability. Spousal fathers who live close by can be individuals with exceptionally high abilities.

A simple check of correlations between proximate residence and ability indicators such as literacy and land holding can give insights into the plausibility of spurious correlations. Such a check reveals near zero correlations: 0.06 for literacy and 0.02 for total land holding.[*10] This indicates that the ability of spousal fathers does not systematically change by distance. Another check can be done by computing the correlation between the riskiness in income and proximity. A proxy measure of riskiness is the ratio of dry land holdings. The correlation with proximity has a negative but very weak value of -0.02. This suggests that providing support to both spouses and their parents who live close by, can help mothers invest more on girls.

VII Summary and Conclusions

We have conducted analysis based on the household demand for 'adult goods' to see how the households discriminate allocation based on the gender of children. Results suggest a general bias favoring boys over girls in the intrahousehold allocation of consumption goods among infants. This bias is not as great for older children. Similar to those in existing literature, however, these findings are not statistically significant.

[*10] Irrigated acreage is multiplied by 2 to adjust for productivity differences.

To understand if such discrimination is unanimously supported by adult household members, we tested for alternative models of households. The novelty in our test are: (1) use of grandparent variables as EEP's in expenditure estimation, (2) derivation of a test of a unitary model without income data, and (3) semi-formal use of the survival status of grandparents in testing unitary models. Findings indicate that the spouse's father characteristics are importantly correlated with greater mother and child goods expenditure shares, and smaller father good shares. Their survival status makes a difference, which is a stronger evidence against unitary models.

Evidence in this study leads to the conclusion that collective models are not falsified in the surveyed area. Thus, those who implement policies must be careful about who they support. With a high incidence of child labor in poverty stricken area, a careful consideration of repercussions within the household is necessary.

Results generally support collective models and persistent effects of spousal fathers. It is thus tempting to consider that there may be greater impacts on child and female welfare if intervention is targeted to both female spouses and their birth parents. However, such effects can be a product of spurious correlations through a third factor, namely the ability of spousal fathers. If this is the case, providing support to spousal parents may not result in less discrimination in households. We run a simple check on the possibility of proximity selection of spousal fathers, and find no evidence of selection: very low correlation between proximity and ability as well as proximity and riskiness of income. Thus we conclude that providing support to both spouses and their parents who live close by can help spouses to provide a household environment with less gender discrimination.

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