PREFERENCES OVER LEISURE AND CONSUMPTION OF SIBLINGS AND INTRA-HOUSEHOLD ALLOCATION

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ABSTRACT

This paper considers heterogeneity in siblings' preferences over leisure and consumption and builds a theoretical and empirical model for children's time and consumption allocations in a household. I test the predictions of the model with unique data from Ethiopia, India, Peru and Vietnam, which contain detailed information on time use and allocations of assignable goods for sibling pairs. My results suggest that differences in siblings' relative time and consumption allocations are driven by their preferences rather than differences in parents' altruism. Children seem to trade off leisure and consumption, select their optimal bundle, and are rewarded by their parents accordingly.

Keywords: Intra-household allocation, children.
JEL Classification: D1, J1, J2.

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1 Introduction

Economists increasingly consider children as active members in the household who affect household expenditure allocations (Moehling 2005; Lundberg et al. 2009; Kapan 2009; Dauphin et al. 2011) and their own time allocations (Berry 2013; Bursztyn and Coffman 2012; Kremer et al. 2009).[1] Recent evidence from lab experiments highlights heterogeneity in children's risk taking, attitudes towards ambiguity, time preferences, and competitiveness (Castillo et al. 2011; Andersen et al. 2013; Sutter et al. 2013).[2] Most parents will also agree that children growing up in the same household can be very different in their personality traits and preferences (Daniels and Plomin 1985; Dunn and Plomin 1990).[3] Still, economic models traditionally do not take into account heterogeneity in children's preferences within families and how these shape consumption and leisure allocations. When considering children as economic agents with preferences over consumption and leisure, it becomes natural to employ standard models employed in the labor economics literature in which agents maximize utility from consumption and leisure subject to a budget constraint. The objective of this paper is to understand whether children's preferences over consumption and leisure determine allocations of consumption and leisure among siblings.

The central contribution of the paper is twofold. First, it develops a simple unitary model of the household focusing on the role of heterogeneity in preferences of children and intra-sibling allocation of consumption and leisure.[4] The model assumes parents to be social planners taking into account children's preferences over leisure and consumption when making allocation decisions. The paper focuses on how allocations are driven conditional on children being in school rather than the tradeoff between work and school, so I abstract from schooling decisions.[5] The model provides insights into how heterogeneity in

[1]The psychology literature has long recognized the role of children in household decision-making and studies on child development suggest a process of gradual increase of shared decision making towards decision autonomy from childhood into adolescence (Grotevant 1983; Dornbusch et al. 1985; Yee and Flanagan 1985). Harbaugh et al. (2003) play dictator and ultimatum games with children and find that they are good bargainers by the age of 7, in the sense that they are aware of their own and their partner's pay-offs in a specific situation. Evidence from an experiment conducted by Harbaugh et al. (2001) suggests that by the age of 11, children's choices are roughly as rational as choices by adults, so that their choices satisfy the Generalized Axiom of Revealed Preference. Choices made by about 60% of 11 year old children and undergraduates are consistent with utility maximization, compared to about 25% of 7 year old children. Lundberg et al. (2009) show that there is a sharp increase in children's reported involvement in the decision making process between age 10-14.

[2]Castillo et al. (2011) and Sutter et al. (2013) show how differences in preferences elicited in experiments significantly correlate with differences in observed behaviors in real life, such as school referrals, smoking, alcohol consumption and saving of pupils in Georgia (United States) and Tyrol (Austria). Orkin (2011) presents qualitative evidence from children in rural Ethiopia supporting the idea that even within one village children have different preferences with regard to work as well as make decisions regarding their time allocation.

[3]One of the earliest studies documenting the low correlation of personality inventories between siblings was Crook (1937) using the Bernreuter personality inventory.

[4]My approach is most closely related to Browning and Gørtz (2012) who model the allocation of consumption and leisure between husband and wife, although their model is a collective household model.

[5]My model therefore does not view child work and schooling as substitutes, which is in line with evidence found by Attanasio et al. (2010). They show that increases in schooling hours caused by the Familias en

children's preferences and parental altruism affect allocations and yields testable propositions. The intuition is straightforward. Assume there is a family with two children, child A and child B, who face equal pay. If relative parental altruism towards child A and B drives allocation decisions and children's relative preferences over leisure and consumption are independently distributed, I expect relative expenditure and relative leisure to be positively correlated, controlling for observable exogenous characteristics. The favorite child gets allocated a higher expenditure share and higher leisure share. On the other hand, if relative preferences over leisure and consumption drive allocations, relative preferences for leisure and consumption are negatively correlated, and there is no variation in parental altruism, controlling for observable exogenous characteristics, relative leisure and relative consumption should be negatively correlated. Children who work longer hours get rewarded accordingly.[6] I show that my model can be nested within a collective household model in which parents' pareto weights are allowed to depend on prices and incomes. Under the assumption that parents' relative weights for specific children are not a function of their own pareto weights, the predictions of my model remain unchanged.

Second, I use detailed data on time use and assignable goods of children in Ethiopia, India, Peru and Vietnam to test the theoretical implications of the model. Data on both time use of children in the household and assignable expenditures from household surveys is rare for adults (Browning and Gørtz 2012), and even more so for children. I use data on the amount of time children spend on leisure and work activities, and child-specific clothing expenditures. To my knowledge, this is the first paper that explicitly models within-sibling variation in preferences over leisure and consumption and tests the predictions of the theoretical model with a data set of children who are in full-time schooling and haven't yet entered the formal labor market yet in the context of four developing countries.

I find that conditioning on observable variables, relative leisure and relative consumption are significantly negatively correlated. This suggests that differences in siblings' relative time and consumption allocations are driven by their relative preferences over leisure and consumption rather than differences in the relative altruism of parents vis-à-vis their children. I show that this correlation persists when I only explore variation in the hours worked in the household, ruling out that the positive correlation between relative work and relative expenditure is due to children working outside the house and therefore needing more work-related clothing expenditures. I also present evidence that the correlation does not seem to be driven by differences in productivity, passing-on of clothing to younger siblings, differences in levels of education and schooling hours, or the wealth of a family. Children appear to trade off leisure and consumption and are rewarded accordingly. As a result, the data is consistent with a model in which families behave as if they were an internal market

Acción program in Colombia did not map one to one into reductions in work hours; rather, the results suggest that children's leisure time decreased.

[6]These are the extreme cases. In reality, both relative altruism and relative preferences might play a role in determining allocations. The empirical analysis allows me to examine which of the two dominates.

in which children select their optimal consumption-leisure bundle.

This is important for at least two reasons. First, the model shows that if siblings have different preferences over leisure and consumption, it is efficient for parents to take these into account when making allocations in the household. Parents might possess information on preference heterogeneity among their children not available to policy makers. An implication is that blanket policies which limit parents' ability to take into account children's preferences over leisure and consumption might be welfare reducing. Further, I abstract the focus from the schooling-child labor trade-off traditionally employed in the literature, as I only look at children who are in full time schooling. The fact that I find heterogeneity in children's leisure and work allocations despite their full time enrolment status suggests that there are other factors that affect their time allocation apart from schooling.[7]

The approach adopted in this paper is based on the assumption that household allocations are efficient, an assumption embodied in unitary as well as collective household models, which explicitly assume the existence of an efficient intra-household decision making process (Becker 1981; Chiappori 1988; Browning and Chiappori 1998). Among the first to explicitly consider parent-children interactions was Becker (1981) with his well-known Rotten Kid Theorem. Within the literature on intra-household allocations, the presence of children and their effect on household economic behavior has received increasing attention over the past 20 years (Browning 1992; Browning and Lechene 2003; Browning and Ejrnæs 2009; Bonke and Browning 2011; Blundell et al. 2005; Cherchye et al. 2012). A recent paper by Dunbar et al. (2013) uses semi-parametric restrictions to identify the resource shares in a household allocated to children with the goal of estimating children's poverty levels in Malawi. The data employed in this paper allows me to investigate how child-specific expenditures relate to children's time allocations.

My focus on within sibling allocation of resources by parents also relates to the literature on child quantity and quality trade-offs, parental investment, and parental preferences for equality among their children. Becker and Lewis (1973) highlight the interaction between the quantity and quality of children: a larger number of children increases the marginal cost of quality, and vice versa. Becker and Tomes (1976) show that when children have different endowments, and the return to human capital investment is higher for high-endowment children, parents exacerbate these differences by investing human capital more heavily in the child with the higher endowments.[8] Whether parents reinforce or compensate endowments is still an open question in the literature.[9] My paper differs from this literature in

[7]Empirically, I am not able to distinguish whether my findings are generated by children's primitive or derived preferences; in other words, whether the observed behavior is due to children's intrinsic preferences or a reaction to incentives offered by parents; what is important is that both implications remain valid in either case.

[8]Behrman et al. (1995) highlight that this finding requires equal concern of parents, sufficiently high levels of resources allocated to children, and higher marginal as well as average returns to education for the more-able child.

[9]There is evidence for compensatory behavior of parents (Behrman et al. 1982; Griliches 1979), as well as

that I focus on a consumption good (clothing) rather than investment goods (i.e. education, health) and abstract from differences in initial endowments of children.[10] In my model, inequality in leisure and consumption among siblings can be due to differences in parental preferences as well as differences in children's preferences over leisure and consumption.[11] Finally, I do not explore the effect of family size due to limitations in the data. As I am able to identify expenditure shares and leisure time only for children with one other sibling in the age range of 5-17, I limit my sample to families with two children in this age group without younger siblings.

A few studies have departed from modeling children via caring preferences or as a household public good to consider them as agents in the household. Moehling (2005) shows that adolescents' labor force participation is positively correlated with their clothing expenditures using data from the Cost of Living Survey of 1917-1919 in the United States. Dustmann et al. (2009) use data from sixteen-year-old adolescents from the British National Child Development Study and find that adolescents' labor force participation reduces parental transfers.[12] The focus of this paper differs from these studies in that I am interested in how relative preferences of siblings and relative altruism of parents affect relative expenditures between siblings.

Dauphin et al. (2011) examine the demand systems of families with one child aged sixteen and over living with his or her parents using data from the United Kingdom; they find that the data are consistent with three decision makers for the complete sample, the sample of children aged 16-21 and for daughters (irrespective of their age). Kapan (2009) uses data from Turkey and finds that while the unitary model is not rejected for families in which the wife does not earn an income, it is strongly rejected when a son aged 12 and above is present in the household (but not for daughters). Instead of examining properties of demand systems to test whether the data are consistent with more decision makers when older children are present, my approach is to develop a model which delivers testable propositions on relative preferences and relative expenditures of siblings. Finally, this paper also relates to the literature on child labor. Edmonds (2008)[p. 3668] points out that "future research understanding the child's own role in her time allocation is perhaps the most pressing need in the child labor literature". If children have agency over their decisions even

reinforcement (Behrman et al. 1994; Rosenzweig and Zhang 2009). Parents might also be both reinforcing and compensating differences in different dimensions. Conti et al. (2010) use data from Chinese twins and find that parents make compensating investments in health and reinforcing investments in education, and there is no effect on the time parents spend with children. Barcellos et al. (2014) find that parents treat boys favorably in almost every dimension of child investment in India.

[10] Ideally, I would like to test for the role of ability as well; unfortunately, the data only contains information on ability for one household child.

[11] I do not make assumptions over what determines heterogeneity in parental altruism towards their children.

[12] Moehling (2005) argues that during the time of their data the income of children entered the household budget so that it increased the bargaining power of children, while Dustmann et al. (2009) argue that for their sample earnings of adolescents remain directly in the hands of the adolescent, so that parents respond by reducing transfers.

in relatively poor settings, considering their preferences is instrumental to understanding households' behavior in low-income countries.

The paper is structured as follows: Section 2 presents the context and data. Section 3 develops a theoretical model. Section 4 focuses on identification and estimation of the model parameters. Section 5 discusses the results and Section 6 concludes.

2 Data

Detailed data on allocations of time and goods within families is very rare, making it difficult to study their interaction. In the majority of household surveys we observe total household expenditures for particular goods, where at most it is possible to assign only a few goods to household members after making assumptions about the characteristics of goods. Detailed data on time allocations across household members is even sparser. I use data from the Young Lives Survey, a study of childhood poverty tracking two cohorts of children in Ethiopia, India, Peru and Vietnam. The older cohort is 7-8 years old when first interviewed in 2002, and is then interviewed again in 2006/2007 and 2009/2010. I use data from the second and third rounds as they contain detailed information on expenditures as well as information on what activities all household members aged 5-17 spent time on during a usual workday.[13]

The survey contains one 'panel' or 'index' child per family (which determines the panel dimension of the survey), but also collects detailed information on other family members in the household. Focusing on a cohort over time has the advantage that I can inspect how a relatively homogenous sample of children at two points in time interacts with siblings. From the whole data set, I select my sample along four dimension: (i) as I can assign expenditures with certainty only to children with one other sibling, I use the sample of children with one other household child younger than 18; (ii) given time diaries are available only for children aged 5–17, I limit the sample to panel children with siblings between 5 and 17 years; (iii) given that I am interested in time allocations for children who are in school, I raise the age cutoff to 6 years; (iv) I then only keep children who are in full time schooling to abstract from the child labor-schooling tradeoff. Given that in both rounds, about 89% of the children in my sample are in full-time schooling, this restriction does not particularly reduce my sample. This leaves me with a total of 1,598 sibling pair observations for both rounds across four countries.[14]

[13] Sampling protocols were tailored to the specific contexts, but in general 20 sentinel sites were chosen in each survey country and then children were randomly selected; see Young Lives (2011) for a description of the sampling procedure and references to studies comparing Young Lives children to nationally representative surveys.

[14] Table A.1 in the Appendix shows that 90 percent or more children are the biological siblings of the panel child in India, Peru and Vietnam and this is true for 76 percent in Ethiopia. The second largest group are half-siblings, who are mainly maternal, uncles/aunts and cousins. In the rest of the paper, I refer to the cohabiting child as the sibling, recognizing that a small proportion of the children in the sample are half-siblings or other

Table 1 presents descriptive statistics for the households in the sample. Expenditures on children's clothes amount to 9 percent in Ethiopia and range between 4 and 6 percent in India, Peru and Vietnam, thereby representing a signifiant percentage of total non-food expenditures of households. In terms of the socio-economic status of the surveyed households, more than 95% of households have electricity in India, Peru and Vietnam compared to 58% in Ethiopia. The proportion of households with a flush toilet, septic tank or a pit latrine in the household varies from 44% in India and 94% in Peru. Access to piped water also varies significantly from 18% of households in Vietnam to 96% of households in India. The sample also ranges from predominantly urban (Ethiopia and Peru) to predominantly rural (India and Vietnam). At least 31% (42%) of households in my sample own animals (land). Appendix B highlights the main differences between the sample used in this paper and the whole older cohort of the Young Lives sample.

2.1 Time Allocation

The household questionnaire asks the main caretaker of the panel child how household members aged 5 to 17 years allocated their time across the following activities on a typical weekday in the last week:[15] sleeping, caring for others, household chores, non-paid activities outside the household, activities for pay/sale outside the household or for someone not in the household, at school, studying outside of school time and playtime/general leisure.[16] Recalling activities as they occur has the advantages of avoiding recall bias and aggregation bias (adding up time).[17]

Table A.2 in the Appendix shows the characteristics of the panel child in 2006 and 2009. The panel child is between 11 and 13 years old in 2006. The proportion of male panel children in 2006 is highest in Peru with 62 percent, compared to 54, 51 and 45 percent in Vietnam, India and Ethiopia, respectively. All children in my sample are in school, but there are differences in the number of hours children spend in school. Children in Vietnam

relatives. In the robustness section, I present the results only using sibling pairs who have the same mother and father.

[15] I do not have data on the caretaker's reported time allocation for the panel child in India for 2009, so I use the child's reported time allocation. I tested the correlation between the caretaker's and the panel child's reported time allocation when both are available. Excluding data for 2009 for India, the correlation is 0.78 (with a p-value of 0.000) for leisure and 0.8253 (with a p-value of 0.000) for work. The results are stronger if I use the child's reported time allocation for the panel child. Given that I only have these for the panel child but not the sibling, I prefer to use the caretaker's reported time allocation for the main results.

[16] Caring for others relates to younger siblings and ill household members; household chores include fetching water, firewood, cleaning, cooking, washing, shopping; non-paid activities outside the household include tasks on family farm, cattle herding, other family business, shepherding, piecework or handicrafts done at home; school includes traveling time; studying outside of school time includes studying at home and extra tuition; playtime/general leisure includes time taken to eating, drinking and bathing.

[17] It has two main disadvantages: (i) it does not convey information on a usual weekday when children are in school during the day if the survey took place during holidays. As I am interested in time allocations of children who are spending part of their day at school, I only kept children in the sample who have positive school hours recorded; (ii) I am not able to say anything about work hours of children on weekends when they are not in school.

spend the fewest number of hours at school with 4.59 hours, while kids in India spend 6.88 hours per day on average in 2006. When taking into account differences in studying hours, children in Ethiopia, Peru and Vietnam spend about 8 hours on school and study, compared to 10 hours in India. Play time in 2006 is highest in Vietnam with almost six hours, as opposed to 3.3 hours in Ethiopia, 3.9 hours in India and 2.4 hours in Peru. There is also substantial variation across children in the hours of leisure, with about 40% of panel children spending 3 or 4 hours playing per day.

About 80% of children spend at least one hour per day contributing to the household economy by performing household chores, child care, non paid work and paid work. Differentiating by gender, Table 2 shows that about 86% of girls and 67% of boys perform household chores, 14% of girls take care of children and engage in non paid work outside the household, with the figure for boys being slightly lower for child care (11%) and slightly higher for non paid work outside the household (18%). Less than two percent of girls and boys undertake paid work outside the household. Aggregated across these categories, Table A.2 in the Appendix illustrates that kids in Ethiopia work about 3.5 hours a day in 2006 and 4 hours a day in 2009, thereby working the longest number of hours. Children in Peru work for about 1.6 hours in 2006 and 2.2 hours in 2009, similar to children in Vietnam. Children in India work on average about one hour per day. In all countries, the time allocated to working is higher in 2006 than in 2009. Sleeping accounts for about 8 to 9 hours and children sleep less when they are older.

Table A.3 in the Appendix presents the characteristics of the siblings of the panel child in 2006 and 2009. Siblings are between 6 and 17 years old, with an average age between 12 and 13 years. The average age is not strictly increasing as I don't have a balanced data set: some children are part of my sample in 2006 but not in 2009, for example, because their sibling is older than 17 years in 2009 and I do not have the time allocation data for children above 17 years. In the empirical analysis, I include time fixed effects and treat the dataset as pooled cross sections. About half of the siblings are male. The sibling data reflect the same patterns observed in the panel children. Children in India spend the most hours on school and study, and work hours are highest in Ethiopia. Play time of siblings is between 4 and 6 hours in India and Vietnam, and 3 hours in Ethiopia and Peru.

2.2 Expenditure Allocation

The household questionnaire collects detailed data on expenditures within the last 12 months. The 12 month recall has the disadvantage of recall bias but this is likely to be outweighed by the advantage of more complete reporting compared to diary-based data collection that only records expenditures over a few weeks.[18] I focus on children's clothes in this analy-

[18]There is no obvious reason for the difference in the recall periods of expenditures (12 months) and time allocations (typical day last week) to systematically bias the results since I look at relative time allocations. Events that affect both siblings equally would not affect the ratio.

sis,[19] which account for a sizeable share of total nonfood expenditures of households (5.6% on average). I exclude expenditures on school uniforms from the analysis as they are less likely to be discretionary expenditures shaped by children's preferences but rather parental investment decisions. Parents are asked to state the total amount of expenditures on boy's and girl's clothes. If they are not able to recall the gender, they indicate the total amount spent on a good. Within these categories, they indicate the approximate fraction of expenditures on the index child (nothing, less than half, about a half, more than half but not all, and everything). To recover child specific expenditures, I assume the following conversion: 0 if the stated share is "nothing", 0.25 if the stated share is "less than half", 0.5 if the stated share is "about a half", 0.75 if the stated share is "more than half but not all", and 1 if the stated share is "everything".[20] Since I focus on families with two children, knowing the allocation share to the index child, I can assign the remainder to the sibling for same sex sibling pairs.[21]

2.3 Relative Leisure and Expenditure

Figures A.1 to A.4 in the Appendix show relative expenditures and relative leisure of siblings for each country. A large proportion of parents is egalitarian, with the lower and upper bound given by 32.9 percent in Ethiopia and 58.5 percent in Peru of sibling pairs who have equal allocations of clothes expenditures.[22] Leisure is less equally distributed than expenditures with children in Peru having equal hours of leisure in 42.3 percent of sibling pairs, compared to 23.4 percent of sibling pairs in Vietnam. Unequal allocations are distributed between a factor of 0.1 and 20 for clothes and 0.125 and 8 for leisure.

The pairwise correlation coefficient of relative expenditures and relative leisure is equal to -0.16 for Peru and Vietnam (with p-values of 0.007 and 0.000), -0.761 for India (with a p-value of 0.0771) and -0.7771 (with a p-value of 0.2856) for Ethiopia. I therefore do not reject that relative leisure and consumption are significantly and negatively correlated in the data in India, Peru and Vietnam, as illustrated by the graph in the South West corner which shows a significant and negative relationship between relative leisure and relative expenditures for these countries. When I exclude observations who have ratios of 5 or more (this reduces the sample by a maximum of 4 observations per country), the negative

[19] Other assignable expenditures include clothes, footwear, school uniform, school fees, private classes, books, transportation to school, doctors, medicine and entertainment. In addition to clothes, I have also included footwear, cinema and presents as further expenditure categories and my results are substantively the same. I prefer to use clothes expenditures as most parents report a positive amount of expenditures on clothes, while expenditures on jewellery or entertainment, are much more rare.

[20] I have tried alternative assumptions such as an allocation of one third if the stated share is "less than half" and two thirds if the stated share is "more than half but not all" and these do not affect my results.

[21] Ruling out corner solutions, I only use the sample of children with some positive clothes expenditures for both siblings. This implies that I exclude 156 observations for whom either one or both children have zero clothes expenditures.

[22] The fact that households might over-declare equal sharing likely biases the correlation between relative leisure and relative expenditure towards zero.

correlation is even stronger for Peru and Vietnam with correlation coefficients of -0.20 and remains substantially unchanged for Ethiopia and India. I do not exclude these observations in the estimation, but it is important to check that the result is not driven by them. If anything, my results are stronger without outliers. The next section presents the theoretical model.

3 Theoretical Model

This section develops a simple unitary household model in which parents are social planners and allocate time and consumption within the household. I allow for heterogeneity in preferences over leisure and consumption of household members as well as heterogeneity in parental altruism towards a particular child. The model yields testable predictions on optimal relative consumption and leisure allocations across siblings.

Assume that a family consists of parents P and children K where I assume that $K = A, B$.[23] Children are assumed to be egoistic. Parents have a joint welfare function Ω^P with caring preferences which aggregates the utilities of household members, taking into account individual's preferences. Ω^P is therefore a function of the parents' own utility, U^P, child A and B's utilities, U^A and U^B, and how much weight the parents attribute to their own utility, measured by α, as well as how much they care about their offspring through the caring parameter δ so that

$$\Omega^P = \alpha\, U^P + \delta\, U^A + (1-\delta)\, U^B \tag{1}$$

where I include δ and $(1-\delta)$ to allow for differences in child A and B's weight in the parents' utility function.[24] [25] Ω^P can therefore be seen as a social welfare function $\Omega^P = \omega(U^P, U^A, U^B)$ in the spirit of Samuelson (1956), where the weighting function ω depends on α and δ.[26] I assume that α and δ are independent of prices and incomes and that $0 < \delta < 1$ and $0 < \alpha < 1$. Further, I rule out that children can affect the level of altruism

[23] Behrman (1997) refers to this as *consensus parental preferences*.

[24] This differs from *child-neutral preferences* as employed by Becker and Tomes (1976) or *equal concern* of parents as employed by Behrman et al. (1982) where parents attribute equal weights to children.

[25] From the literature on intrahousehold allocation it has become clear that classical properties of demand systems (Slutksy symmetry and income pooling) are generally violated when households are composed of a husband and wife (Browning et al. 2011), suggesting that they rarely act as a unit. Appendix C shows that a generalization of my model to allow for two parents and two children and with different bargaining weights among parents (which depend on prices and incomes) leaves the predictions of my model unchanged. What I still require is that the *relative* weights of child A and B are independent of the parents' pareto weights but this is significantly less restrictive than assuming that both parents have the same weights for children. To maintain a focus on the core mechanism, which is within-sibling allocation, I keep the model as parsimonious as possible.

[26] I can not distinguish whether the differences in the weight are due to differences in parental altruism because parents have a higher level of love for one child, or whether this is because one child is better at terrorizing the parents, thereby increasing her or his bargaining weight. For the purpose of the theoretical and empirical model I interpret δ as the parents' level of altruism for child A.

of the parents.[27] The parents' welfare function is thus strictly increasing in the utility of household members $m = P, A, B$ which is defined as

$$U^m = U^m(x_m, l_m) \tag{2}$$

where x is a private good and l is leisure.[28]

I assume that $U^m_{x_m} > 0$, $U^m_{l_m} > 0$, U^m is continuous, and strictly quasi concave for $m = P, A, B$. I assume that individual utility functions are additive over consumption and leisure

$$U^m = \theta^m \ln x_m + \tau^m \ln l_m \quad \text{for } m = P, A, B \tag{3}$$

so that θ measures household member m's preferences for consumption and τ measures his or her preferences for leisure; without loss of generality I set $\tau^P = 1$. The use of a log linear utility function for parents P and children A and B has two desirable properties. First, it builds a concern for equity into the utilitarian welfare function Ω^P, without explicitly modeling it through an additional parameter. Second, it allows me to obtain closed form solutions which I can take directly to the data, establishing a clear link between the theoretical model and the estimated parameters.

The household faces the budget constraint

$$x_P + x_A + x_B = I + h_P\, w_P + h_A\, w_A + h_B\, w_B \tag{4}$$

where the price of the consumption good is normalized to one, w denotes wage income and I is non wage income; household members face the time constraints

$$l_m = T - h_m \quad \text{for } m = P, A, B \tag{5}$$

where T is the time endowment and h are hours worked.[29] The utility function and budget and time constraints make a number of assumptions. First, any activity apart from work is considered as leisure. If children do not consider schooling as leisure, the total time endowment of children could therefore be defined as $T = 24 - s_m$ for $m = A, B$, where s represents time at school.[30] Alternatively, I could have an additional term for schooling s

[27] This is relaxed in the literature on strategic behavior of adult children competing for transfers from parents (Chang 2009; Chang and Luo 2011). In Chang (2009), adult children are modeled as homogenous, while in Chang and Luo (2011) adult children differ in their wages; children's preferences over leisure and consumption are not modeled in these two papers.

[28] Preferences and utility functions are denoted with superscripts, choice variables with subscripts.

[29] Children's wages can be seen as either through working outside the household where income earned enters the household budget, or through doing housework which in turn allows the parents to participate in activities outside the household. In light of the descriptive statistics of the previous section, it is reasonable to assume that these children contribute to household income by carrying out work inside and outside the household.

[30] In the empirical section, I only look at children who are in school. However, I also test whether treating hours spent at school as an additional choice variable affects the results.

so that $l_m = T - s_m - h_m$ for $m = A, B$. Schooling valued at wages would appear as an additional term in the value of consumption, but leave the optimality conditions between leisure and consumption unchanged, and thus the main results of the model equivalent. Second, individuals do not derive any utility from working. Third, parents have deferential preferences, in that they care about children's utilities but allow them to decide on their optimal consumption bundle based on their preferences. An implication is that parents do not derive any direct utility from seeing their children consume goods or participate in work other than through an increase in the child's utility. To render the model more realistic, following Browning and Gørtz (2012), I could have included household production of a public good. This would leave the core predictions of my model unchanged. Because both modifications, schooling as a separate term and production, do not affect my result, I opted for keeping the model as parsimonious as possible.

Parents function as social planners and maximize overall household welfare by solving the following maximization problem

$$\max_{x_P, x_A, x_B, l_P, l_A, l_B} \alpha U^P + \delta U^A + (1-\delta) U^B \text{ subject to} \tag{6}$$

$$x_P + l_P w_P + x_A + l_A w_A + x_B + l_B w_B = I + T(w_P + w_A + w_B)$$

Deriving the utility function with respect to x_P, x_A, x_B, l_P, l_A and l_B, combined with the first order conditions, I get

$$\frac{x_A}{x_B} = \frac{\delta}{1-\delta} \frac{\theta^A}{\theta^B} \tag{7}$$

$$\frac{l_A}{l_B} = \frac{\delta}{1-\delta} \frac{w_B}{w_A} \frac{\tau^A}{\tau^B} \tag{8}$$

for siblings A and B, where $\delta/(1-\delta)$ measures parents' altruism towards child A compared to child B, θ_A/θ_B measures children's relative preferences for consumption, τ_A/τ_B measures children's relative preferences for leisure, and w_B/w_A measures children's relative wages. I can also see that individual members' optimal consumption labor choice, $U_x^m/U_l^m = 1/w_m$, can be achieved through a two stage budgeting process in which in the first stage income is distributed appropriately, and in the second stage household members maximize $U^m(x_m, l_m)$ subject to $x_m + l_m w_m = I_m + T w_m$ where I_m is determined by the sharing rule of non-labor income (Browning et al. 2011). Therefore, following the second welfare theorem, a competitive outcome can be reproduced given appropriate redistribution of initial incomes.[31]

[31]The theoretical model can be readily extended to n children, yielding $n(n-1)/2$ optimality conditions per family. However, the estimation becomes substantially less straightforward due to dyads at the family level as will be clear in the next section. Further, I can only identify resource allocation shares for a subset of families with three children. I therefore keep the model with 2 children and leave the application to larger families for future research.

Equations (7) and (8) illustrate that if $\delta > 0.5$, and $\theta^A = \theta^B$ as well as $\tau^A = \tau^B$, parents will find it efficient to allocate relatively more consumption as well as relatively more leisure to child A compared to child B. On the other hand, if $\delta = 0.5$ and $\theta^A > \theta^B$ (or $\tau^A > \tau^B$) parents find it efficient to allocate more consumption (leisure) to child A compared to child B.[32]

4 Identification and Estimation

I now discuss substantive and functional form assumptions required to translate my theoretical model into estimable equations. Before presenting the results, I also outline how I deal with measurement error, and discuss fixed effects and the non-linearity of the relative expenditures variable.

4.1 Substantive Assumptions

Equations (7) and (8) describe the relative expenditure and leisure allocations of siblings A and B which depend on relative preferences θ^A/θ^B and τ^A/τ^B, as well as on relative parental altruism $\delta/(1-\delta)$ and relative wages w_B/w_A at a particular point in time. Since I look at preferences of children, I want to relax the assumption that preferences are stable. I assume that relative parental altruism is fixed over time.[33] Let's therefore rewrite equations (7) and (8) with time subscripts on the child specific preference variables as well as the time and consumption allocations

$$\frac{x_{At}}{x_{Bt}} = \frac{\delta}{1-\delta}\,\frac{\theta_t^A}{\theta_t^B} \tag{9}$$

$$\frac{l_{At}}{l_{Bt}} = \frac{\delta}{1-\delta}\,\frac{w_{Bt}}{w_{At}}\,\frac{\tau_t^A}{\tau_t^B}. \tag{10}$$

I now denote sibling pair A and B in a family with subscript i and get

$$x_{it} = \delta_i\,\theta_{it} \tag{11}$$

$$l_{it} = \delta_i\,\kappa_t^{-1}\,\tau_{it} \tag{12}$$

where $x_{it} = x_{At}/x_{Bt}$ is sibling pair i's relative consumption of a particular good at time t; in other words, sibling A's consumption of a particular good divided by sibling B's consumption

[32] Note that, holding everything else constant, a proportional increase ϱ of θ^A and τ^A leads to an increase in x_A and l_A by ϱ, while an increase in δ by the same amount leads to an increase in x_A and l_A by $\varrho\,\delta/(1-\varrho\,\delta) > \varrho$ for $0 > \varrho\,\delta < 1$.

[33] There are reasons to believe that relative parental altruism might be time-varying, i.e. parents having at birth stronger relative altruism towards boys, but reverting to stronger relative altruism for girls when the boys are in puberty. For simplicity, I assume that relative altruism is stable across time.

of a particular good at time t. Similarly, I define $l_{it} = l_{At}/l_{Bt}$, $\theta_{it} = \theta_t^A/\theta_t^B$, $\tau_{it} = \tau_t^A/\tau_t^B$ and $\delta_i = \delta/(1-\delta)$ as parents' relative altruism towards child i. I have assumed that relative wages of sibling A and B are constant across children, so that $\kappa_t = w_{At}/w_{Bt}$.[34] Equations (11) and (12) illustrate that relative altruism δ_i affects both relative consumption and relative leisure of sibling pair i positively, so that parents with $\delta > 0.5$ will allocate a higher consumption as well as more leisure to child A, holding θ_{it} and τ_{it} constant. Further, as becomes clear from the theoretical model, the consumption and work decisions are simultaneous decisions; therefore, regressing relative leisure on relative consumption, or vice versa, would lead to biased estimates. I use an approach employed by Browning et al. (1994) and instead are interested in the correlation of the residuals of these two simultaneous equations, conditional on observable exogenous variables. In other words, conditioning on basic observable characteristics, I test whether unobservables from the time allocation decision are correlated with unobservables from the consumption decision.

4.2 Functional Form Assumptions

I model children's relative preferences for consumption and leisure at time t as a function of a vector of observable household and child characteristics $\boldsymbol{Z}_{it}$ which include age, gender, rural or urban location, and a time fixed effect; further, I assume the presence of unobservable time invariant individual fixed effects $\lambda_{\theta i}$ and $\lambda_{\tau i}$, as well as time-varying idiosyncratic error terms $\varepsilon_{\theta it}$ and $\varepsilon_{\tau it}$ unobserved by the econometrician, yielding

$$\theta_{it} = \exp\{\beta_{\theta_0} + \beta_\theta' \boldsymbol{Z}_{it} + \lambda_{\theta i} + \varepsilon_{\theta it}\} \tag{13}$$

$$\tau_{it} = \exp\{\beta_{\tau_0} + \beta_\tau' \boldsymbol{Z}_{it} + \lambda_{\tau i} + \varepsilon_{\tau it}\}. \tag{14}$$

Birth order or relative birth order have proven to be important determinants of within household allocation (Black et al. 2005; Chesnokova and Vaithianathan 2008; Ejrnæs and Pörtner 2004; Patrinos and Psacharopoulos 1997). It would therefore be a natural candidate to model relative altruism. However, it is highly correlated with the age difference. Second, it does not satisfy the exclusion restriction that the effect of birth order R_{it} is equal to zero in a regression of the difference between relative expenditure and relative leisure on birth order.[35][36] I therefore assume that parents' relative altruism for child A versus child

[34] I relax this assumption in the empirical section, where I proxy wages with years of education.

[35] The exclusion restriction emerges from taking the ratio of equations (11) and (12), and taking logs. This removes δ_i so that I require $\beta_{\delta 1} = 0$ in

$$\ln x_{it} - \ln l_{it} = \beta_{\delta 0} + \beta_{\delta 1} R_i + \boldsymbol{\beta}_{\delta 2}' \boldsymbol{Z}_{it} + \varepsilon_{\delta it}.$$

In other words, conditional on $\boldsymbol{Z}_{it}$, a variable R_i proxying for altruism should not affect $\ln x_{it} - \ln l_{it}$.

[36] I have also tested including a dummy variable which is equal to one if the oldest sibling is a boy (unconditional on whether he has a younger brother or a sister) and if the oldest sibling is a boy with a sister, but the variables do not pass the exclusion restriction or only marginally pass it, so I do not include them.

B is a function of an unobservable time invariant individual fixed effect $\lambda_{\delta i}$

$$\delta_i = \exp\{\beta_{\delta_0} + \lambda_{\delta i}\}. \tag{15}$$

4.3 Measurement Error

Until now I assumed that I know the true level of expenditures and leisure. However, in addition to recall bias, due to the nature of the data there is a second source of likely measurement error, illustrated in detail in Appendix D. I know the allocation to the panel child as a fraction of the expenditure category (boys or girls clothes). I therefore always denote the panel child as child A. However, expenditures allocated to the sibling of the panel child are vulnerable to measurement error, since I assume that parents list clothes for household members 18 and over in the adult clothes category. Therefore, I assume that expenditures on child A are correctly measured so that $x_A = x_A^*$ where x_A denotes the data and x_A^* the true expenditure. For child B, I have $x_B = e^{\rho} x_B^*$ where x_B indicates the data, x_B^* the true expenditure and ρ is the difference between the recorded and the true log expenditure. Plugging my definition of x_B into equation (7) and taking logs I can see that ρ will be contained in the error term, biasing the constant. When the dependent variable is measured with error, consistency requires that the measurement error ρ is not correlated with the explanatory variables (Wooldridge 2002). This seems plausible in my case, so that the age of children, gender, and location is not correlated with the presence of adolescents aged 18-25 in the household who parents consider as children. Further, I know when measurement error is going to be more likely. The cases particularly prone to measurement error are (i) when both children are of the same sex, and there are further siblings aged 18 and over of the same sex in the household who parents consider a child (denoted as case 1); (ii) when children are of the opposite sex, but there is a further member of the same sex as child B in the household aged 18 and over who the parents consider a child (denoted as case 2).[37] Relative expenditures x_A/x_B are therefore a lower bound estimate of true relative expenditures, since $x_B = \max\{0, x_B\}$ for those with older siblings. I can use this information to model measurement error ρ as

$$\rho = \beta_{\rho 0} + \beta_{\rho} O_{it} + \varepsilon_{\rho it} \tag{16}$$

where O_{it} is equal to one in case (i) or (ii) occur, and zero otherwise; $\varepsilon_{\rho it}$ is an idiosyncratic error.

Plugging (13), (14), (15) and (16) into (11) and (12) while taking measurement error

[37] On the other hand, measurement error is going to be less likely for same sex siblings whenever the over 18 year old sibling is of the opposite sex, and for mixed sex siblings whenever the over 18 year old sibling is of the opposite sex of sibling B.

into account, and taking logs I get the following structural equations

$$\ln x_{it} = (\beta_{\theta 0} + \beta_{\delta_0} + \beta_{\rho_0}) + \boldsymbol{\beta}'_{\theta} \boldsymbol{Z}_{it} + \beta'_{\rho} O_{it} + (\lambda_{\theta i} + \lambda_{\delta i}) + \varepsilon_{\theta it} + \varepsilon_{\rho it} \tag{17}$$

$$\ln l_{it} = (\beta_{\tau_0} + \beta_{\delta_0}) + \beta'_{\tau} \boldsymbol{Z}_{it} + (\lambda_{\tau i} + \lambda_{\delta i}) + \varepsilon_{\tau it}. \tag{18}$$

I can not separately identify the effect of $\ln \kappa_t$ and the coefficient on the time trend contained in $\boldsymbol{Z_{it}}$, due to my assumptions on the constant ratio across sibling pairs, so that it is part of $\boldsymbol{Z_{it}}$. The two linear reduced forms are

$$\ln x_{it} = \Pi_{x0} + \boldsymbol{\Pi}'_{x\theta} \boldsymbol{Z}_{it} + \Pi'_{x\rho} O_{it} + \epsilon_{xit} \tag{19}$$

$$\ln l_{it} = \Pi_{l0} + \boldsymbol{\Pi}'_{l\tau} \boldsymbol{Z}_{it} + \epsilon_{lit}. \tag{20}$$

Identification of $\Pi_{x\theta}$, $\Pi_{l\tau}$, and $\Pi_{x\rho}$ requires that $\boldsymbol{Z}_{it}$, and O_{it} are uncorrelated with the composite error terms ϵ_{xit} and ϵ_{lit}. This is not an implausible assumption given that age, gender and location are out of the control of the child. I test the two following propositions adopted from Browning and Gørtz (2012):

Proposition 1 (Differences in children's preferences) *If θ_{it} and τ_{it} are negatively correlated, there is no variation in δ_i and $w_{Bt} = w_{At}$, then x_{it} and l_{it} will be negatively correlated.*

Proposition 2 (Differences in parental altruism) *If there is variation in δ_i while θ_{it} and τ_{it} are independent of each other and $w_{Bt} = w_{At}$, x_{it} and l_{it} will be positively correlated.*

The empirical model shows that if *differences in parental altruism* drive allocations and preferences for leisure and consumption are independent, I expect the residuals to be positively correlated due to the fact that they both contain $\lambda_{\delta i}$ and altruism affects consumption and leisure positively. If heterogeneity is due to *differences in children's tastes*, so that if relative preferences for leisure and consumption are negatively correlated and there is no variation in relative altruism, then I expect the residuals to be negatively correlated as they contain $(\lambda_{\theta i} + \varepsilon_{\theta i})$ and $(\lambda_{\tau i} + \varepsilon_{\tau i})$. Propositions 1 and 2 present the extreme cases. It is reasonable to assume, and I can not rule out, that both relative altruism and relative preferences play a role in determining outcomes. For example, if I find a strong negative correlation of the residuals in the empirical application this does not imply that parents do not have different weights for their children. It only indicates that results are consistent with a model in which differences in preferences are the dominant driver of allocations rather than differences in parental altruism. Further, is important to note that evidence

against proposition 2 is evidence against the joint assumptions of proposition 2. In the robustness section, I allow wages to differ between siblings. As discussed in Section 3, the same predictions would come out of a two-stage budgeting process in which the parents first allocate resources among their children, and children are then allowed to spend them in their preferred manner. An alternative model creating the same predictions would be one in which children increase their bargaining power by working and thereby raising their expenditure allocations. My model highlights, that even without work allocations of children affecting their bargaining power, differences in relative preferences are sufficient to generate a negative correlation in relative leisure and relative consumption. Finally, the relationship could be due to the fact that children who work require clothes to perform the work, in particular for work outside the household. In the empirical section, I argue that one way to test whether this is the driving force is to limit the sample to children who work only inside the household. I discuss various tests of alternative explanations in the empirical section.

4.4 Estimation: Fixed Effects and Non-Linearity of the Expenditure Variable

Despite having a panel, a consistent estimation of the fixed effects $(\lambda_{\theta i}+\lambda_{\delta i})$ and $(\lambda_{\tau i}+\lambda_{\delta i})$ is not feasible. First, with two time periods, it is not possible to obtain a consistent estimate of the fixed effect (Wooldridge 2002). Second, several of the preference parameters are time invariant; even for more time periods, I would only be able to identify a combination of the fixed effect and the coefficient on the time invariant variables. Instead of using the natural logarithm, I follow Browning et al. (1994) and transform x_{it} and l_{it} using the inverse hyperbolic sine.[38] Inspection of the distribution of x_{it} and l_{it} in figures A.1 to A.4 also showed that these variables are clumped at specific values, which is particularly true for x_{it}. The nature of the questionnaire is the reason for this clumping at various points. As discussed in the previous section, parents were asked to indicate the approximate fraction of expenditures that went to the index child, measured by a variable ranging from 1 to 5. In order to take into account the non-continuous nature of the variable, I also model relative expenditures and relative leisure as ordered variables, taking on three values

$$v_{it}^{*}=\begin{cases}0 & \text{if } v_{it}<1\\ 1 & \text{if } v_{it}=1\\ 2 & \text{if } v_{it}>1\end{cases} \tag{21}$$

[38]The main advantage of this transformation is that the inverse hyperbolic sine is always positive and linear for low values, but very similar to the natural logarithm for high values. This avoids having highly negative values when relative expenditure and relative leisure are very low. Even though it is defined for the whole real line, so including zero, I do not include relative expenditure or leisure that is equal to zero. My results are substantively unchanged when using the natural logarithm instead of the inverse hyperbolic sine; the choice between the inverse hyperbolic sine and the natural logarithm is therefore not fundamental for the results.

for $v = l, x$. I present estimates for treating both variables as continuous, x_{it} as an ordered variable and l_{it} as continuous, and both variables as ordered. For all models, I jointly estimate equations (19) and (20) with full information maximum likelihood, assuming that the errors have a bivariate normal distribution, and then test the correlation of the error terms of the two equations. The estimation is performed employing the command `cmp` as developed by Roodman (2009), using the Davidon-Fletcher-Powell algorithm, and clustering standard errors at the panel child level.

5 Empirical Results and Discussion

5.1 Baseline Results

I start by looking at the unconditional distribution of leisure and consumption. Figure 1 shows relative expenditure using the inverse hyperbolic sine transformation on the y-axis; the x-axis shows relative leisure using the inverse hyperbolic sine transformation. Circles represent individual data points; in a lightly shaded hexagon each line from the centre represents one observation; in a dark hexagon, each line from the centre represents four observations; overlaid are a linear regression and a local polynomial regression with 95% confidence intervals. The figures show that there is a significant, negative, and fairly linear relationship between siblings' relative consumption and leisure for India, Peru and Vietnam. I have also dropped outliers (defined as observations with the log of relative consumption or leisure above 2) and the graphs are very similar. For the empirical model, I present results for the different specifications of the dependent variables. Column (1) presents the results for both variables modeled as continuous, column (2) models x_{it} as ordered and l_{it} as continuous, and column (3) models both variables as ordered. I present the correlations of the residuals as this allows me later to purge relative leisure and relative consumption from the effects of age and gender. The correlation of the residuals is shown following the estimated coefficients.

The correlations of the residuals of a model including an intercept only are shown in Table 3 for each of the countries, supporting what figure 1 already suggested. To take into account correlation across errors for panel children which are in the sample in two rounds (about 50% of the sibling pairs), all standard errors are clustered at the panel child level. There is a significant negative correlation between the residuals of the leisure and the consumption equations for India, Peru and Vietnam, and this negative correlation is robust across the three estimation methods.[39] The last row of Table 3 shows that the correlation is significant for all three models when the data is pooled across countries. The results are

[39]The fact that the correlation in Ethiopia is less significant could be due to the smaller sample size, or due heterogeneity, which would be consistent with the fact that children in Ethiopia state that they feel substantially less agency over their choices compared to the other three countries when asked about activities they have done in the last few days and whether it was their choice.

virtually identical when including a time trend, but there is no a priori reason to expect that the ratios change significantly over time. These findings lend support to proposition 1 which states that if θ_{it} and τ_{it} are negatively correlated, there is no variation in δ_i and $w_{Bt} = w_{At}$, then x_{it} and l_{it} will be negatively correlated. In other words, differences in children's preferences drive allocations. If differences in parental altruism δ_i were driving allocations while θ_{it} and τ_{it} are independently distributed and $w_{Bt} = w_{At}$ as outlined in proposition 2, I would expect x_{it} and l_{it} to be positively correlated.

For the main empirical model I pool the data across the four countries, while staying fully flexible by including a range of interaction effects to allow for differences in the slope of the parameters by country and time. The main advantage of pooling the data is that I have more power when testing the correlation of the residuals.

Table A.4 in the Appendix shows the basic results for equations (19) and (20) where I include separate intercepts for each of the countries and a time dummy variable. The upper panel shows the relative expenditure equation, and the lower panel shows the relative leisure equation. Before interpreting the coefficients, I test for a number of restrictions to arrive at a more parsimonious specification. The theoretical model does not prescribe the functional form through which gender affects preferences. Additionally, the gender of the denominator and nominator child switches according to the sibling pair, where child A always denotes the index child. To impose as few restrictions as possible on sibling-interactions, I first entered dummy variables for all gender combinations, leaving a female-female sibling pair as the base category. I then jointly test for both, the leisure and expenditure equation, whether the coefficient on the male-female dummy variable is equal to the negative of the coefficient on the female-male sibling dummy variable. This restriction is not rejected by the data when modeling both dependent variables as linear, but it is rejected when I model both dependent variables as ordered. For ease of exposition, I therefore do not impose it in the three models, but this does not affect my results. With regard to age, I tested jointly for both equations whether the coefficient on the age of child A is equal to the negative of the coefficient on the age of child B which is not rejected in any of the models. I can therefore impose the restriction that age affects relative expenditure and leisure through the difference in age of child A and B.[40]

I now discuss the parsimonious specification presented in Table 4. The main reason to include these variables is to control for observable characteristics, rather than their independent interest. I therefore only discuss them briefly here, and then focus on the correlation of the residuals. The results show that the coefficients on relative age are statistically significantly different from zero in both the leisure and the expenditure equation, and this holds for any specification of the dependent variables. I find that the larger the age difference

[40]When testing these restrictions with a set of likelihood ratio tests, I am not able to cluster standard errors at the child level. I have also estimated the models without imposing any restrictions and the results remain robust.

between child A and B, the higher is relative expenditure and the lower is relative leisure. For mixed sibling pairs, an interesting pattern arises. When the index child is female and has a brother, she enjoys significantly higher expenditure and significantly lower leisure compared to a female index child with a sister. The effect is significant also for male index children who have a sister, who enjoy significantly higher leisure compared to female index children with a sister. The control for whether the child lives in an urban area is insignificant which suggests that there are no systematic differences across urban and rural settings that would lead to more or less equal relative expenditure or relative leisure patterns. The coefficient on the variable capturing measurement error is negative, in line with my conjecture, indicating that my measure of relative expenditure is systematically lower when one of the two outlined cases of measurement error takes place.

The negative correlation in the relative leisure-consumption relationship I observed in the unconditional distribution graphs could have been driven simply by the fact that older children have less leisure if they get a younger sibling due to longer hours of caretaking, but they get higher expenditures since they are the oldest and parents need to build up a stock of children's clothes and other child-related items. In the same logic, younger children could get more leisure (playing time) as they are younger and less clothes expenditures due to the fact that their older sibling passes them on clothes. However, this does not appear to be the case as even after controlling for the age difference and gender composition, the negative correlation of the residuals persists. The last row in Table 4 shows that the correlation of the residuals is substantially lower with a correlation of about -0.06 in columns (2) and (3) compared to -0.2 in Table 3 but it remains negative, and is statistically significantly different from zero when estimating the model as a an ordered probit with a linear model in column (2), or as two ordered probit equations in column (3). The correlation in the residuals is negative as well in column (1) when both variables are modeled as continuous variables, although statistically not significantly different from zero. Given the discontinuous distribution of in particular the expenditure variable, it is not surprising that the model performs better when taking the structure of the data into account. Thus, my preferred specification is column (2). The results, modeling both variables as ordered variables, are very similar.

5.2 Alternative explanations

My theoretical model is an abstract version of one possible way in which allocations are made. An alternative model generating the same residual correlation would be one of child specialization: parents send one child to school and give that child more leisure; the other child goes to work and gets paid accordingly. I can rule this out as the main story by my restriction on only using children who are in school. In what follows, I discuss further alternative explanations that might lead to the same empirical regularity I observe in the data.

Each row in Table 5 shows the correlations of residuals from a different specification. I start by the main concern, namely that the negative correlation between relative consumption and relative leisure is driven by the fact that children who work require clothes to perform the work, rather than by differences in relative preferences. To do this, I first run the same specification as presented in Table 4 using relative work hours instead of leisure hours as the dependent variable by aggregating the number of hours a child is engaged in household chores, child care, non-paid work and paid work of children into a work variable. I would now expect the opposite effects. According to my model, if differences in children's preferences are the dominant driver, then the residuals would be positively correlated. Whoever works longer hours receives higher consumption. On the other hand, if differences in parental altruism determine allocations and there is no correlation in preferences, then the residuals would be negatively correlated. The preferred child would work less but enjoy higher consumption. Table 5 shows that the correlation of the residuals are consistent with the previous findings of differences in children's tastes being the dominant force. The residuals of the work and expenditure equations are positively correlated and are very similar in magnitude, so that children who work relatively more hours are rewarded with higher relative expenditures.

Returning to my main concern, namely that clothes are required to work and this introduces the correlation; I would expect the need to have specific clothes to work to be higher for children performing work outside the household. To test whether this is the case, I redefine work only as household chores and child care (excluding non-paid work and paid work outside the household), both tasks which I would not expect to significantly raise clothes requirements. I estimate two specifications: first, I keep all children in the sample, simply replacing the work variable with zero unless children performed work in the household. Thereby, I only compare the workload of siblings in the household. The correlation of the residuals is not driven by this mechanical relationship. Second, I drop from the sample children who work outside the household, and estimate the model again, only examining variation in the hours worked by children in the household. This specification is most costly in that I lose about half of the sample. Despite the substantially smaller sample size and use of a completely different subsample, the magnitude of the correlation and significance level are almost unchanged.

I next test whether differences in wages, non-linear age effects or productivity differences could be driving the results. As I lose more than a third of my sample when using work hours, I return to using relative leisure as the dependent variable. Table 5 first repeats the results from Table 4 and then shows the correlation of the residuals resulting from each of the alternative models. In the theoretical model, I assumed that the relative wage of child A and child B is constant across children, so that the term $\ln \kappa_t$ is captured by the time dummy variable. I now relax the assumption of equal wages and rewrite κ_t as κ_{it}. Ideally, I would include past wages earned by siblings, but this is a variable available for

very few children. I therefore assume that the relative wage of child B to child A is proxied by the relative number of years of schooling of child A and B at time t. I then re-estimate the model including the level of schooling of child A and B as additional variables in the analysis; this does not affect the negative correlation in the residuals. The test also allows me to examine whether the actual grade a child is enrolled in matters rather than the age difference. If younger adolescents are still enrolled in primary school this might be an important factor determining household allocations.[41] Differences in the amount of hours spent on schooling might be correlated with unobservables determining relative leisure and relative consumption. These differences are rather small in me selected sub-sample;[42] as a robustness check, I nevertheless include a third simultaneous equation for schooling. This does not affect the estimated correlation of the residuals between relative expenditure and relative leisure.

The model so far imposed linearity in the age difference effect which embeds two assumptions: first, the effect of an age gap of two years is half the effect of an age gap of four years; and second, the effect of age differences is independent of when the age gap occurs, so that the age gap between an 11 and 13 year old child is the same as the age gap between a 15 and 17 year old child. Given the importance of the age variable, I test whether the results are sensitive to inclusion of up to a third order polynomial, a model in which I include the age of child A and B separately, as well as interaction terms between the age difference and the age of child A and B. I find that both robustness checks do not affect the correlation of the residuals. As a further robustness check not reported here, I have included dummy variables for age gap and the results are substantively the same.

my findings could be due to a more mechanical relationship in which children are more or less productive at different ages and therefore perform different activities, rather than to do with the model's assumptions of differences in preferences.[43] I control for the age difference between siblings, but unobserved heterogeneity due to interactions between the age difference, gender and location could be substantial.[44] I therefore now include interaction terms between location (whether the household lives in an urban or rural area), the age difference between siblings and gender combinations of siblings, as well as the cross interaction terms of all these variables in the relative leisure equation, to test whether the correlation of the residuals is driven by gender-age-location or a combination of these, thereby driving the allocation of relative leisure. The correlation in the residuals remains so that I can reject that unobserved heterogeneity due to interactions between gender, age

[41] Given that schooling choice is likely to be correlated with unobservables affecting allocations, I prefer to include the schooling variable only in the robustness check. The base model only includes variables exogenous to the sibling pair such as age, age order, gender composition and location of the household.

[42] About 67 percent of sibling pairs spending equal amounts of hours in school. Eighty-five percent of sibling pairs have not more than a 20% difference, and 93 % of children have a maximum of a 30 percent difference.

[43] Edmonds (2006) finds that child labor in Nepal is consistent with comparative advantage of children.

[44] For example, older girls might be perceived as more productive caretakers than older boys, which would point towards an interaction effect between gender and age difference.

and location is leading to differences in productivity drive the results.

There are many characteristics of a child that affect her/his productivity that the parent can observe apart from gender, age and location. Unfortunately I do not have any other measures for both siblings. However, for the panel child I can include his/her body mass index and Peabody Picture Vocabulary Test (PPVT) score as a measure of the child's physical fitness and cognitive ability. When I include both my results are stronger. Next, one could argue that for children below age 10 the type of activities they can undertake is likely to be more limited as their productivity is very low, and I would expect differences in preferences to be less developed at an earlier stage. I thus limit the age range of siblings by excluding children below the age of 10 years. The results suggest that my findings were not driven by sibling pairs with large age gaps which are now excluded, as they are stable even when I drop a large number of children from the sample.

Given that I am pooling countries with a range of political, economic and ideological beliefs, I also test whether the results are robust to a fully flexible specification in which I interact all explanatory variables with the country fixed effects. The correlation of the residuals drops slightly in size but remains significantly different from zero in column (2). Family dynamics might be systematically different when non-biological siblings are part of the family. I test whether it is these cases that are driving the results by limiting the sample to siblings with same mother and same father, excluding 87 observations. I find that my findings remain substantively the same for the three columns. Finally, the theoretical model abstracts from constraints to household choices resulting from market imperfections. To test whether this is empirically important, I include the wealth index of a household as a further control. Overall, the correlation of the residuals is remarkably robust to different samples, and testing for different alternative explanations which could generate the results.

6 Conclusion

This paper considered children as agents with their own preferences over leisure and consumption and built a theoretical and empirical model for children's time and consumption allocations. To my knowledge, this is the first paper that theoretically and empirically models within sibling distribution of preferences over leisure and consumption. The simple theoretical model allowed for heterogeneity in parental altruism as well as children's preferences over leisure and consumption and develops testable propositions. I kept the model as parsimonious as possible to highlight predictions generated simply by differences in relative preferences of children and relative altruism by parents. This comes at the cost of imposing sometimes fairly strict assumptions. For example, I imposed that parents' relative bargaining weights in the family do not affect the weight of specific children (i.e., girls versus boys) in the household's problem. I also assumed that children's work hours do not affect their parents' altruism.

I tested these propositions with a panel data set of children from Ethiopia, India, Peru and Vietnam which contains detailed information on time use and allocations of assignable goods for sibling pairs. I found that after conditioning on observable variables, the residuals of these simultaneous decisions are significantly negatively correlated. I showed that this correlation persists when I only explore variation in the hours worked in the household, ruling out that the positive correlation between relative work and relative expenditure is due to children working outside the house and therefore needing more work-related clothes expenditures. I also presented evidence that the correlation does not seem to be driven by differences in productivity, passing-on of clothes to younger siblings and differences in levels of education and schooling hours. This suggests that differences in siblings' relative time and consumption allocations are driven by their relative preferences over leisure and consumption rather than differences in parents' relative altruism. Children seem to trade off leisure and consumption and are rewarded accordingly. As a result, the data are consistent with a model in which families behave as if they were an internal market in which children select their optimal consumption-leisure bundle.

One implication of this finding is that in order to understand households' behavior in low-income countries, it is important to consider heterogeneity in children's preferences. Given the stringent data requirements, I was able to undertake this analysis for families with two children between the ages of 6-17 years in four developing countries. To investigate the generalizability of the results, future research should focus on extending the analysis to families with more than two children and application to further countries.

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7 Tables

Table 1: Descriptives statistics

	Ethiopia		India		Peru		Vietnam	
	mean	s.d.	mean	s.d.	mean	s.d.	mean	s.d.
Food Exp	86.93	49.16	451.37	211.53	127.84	67.31	285.43	154.23
Non-Food Exp	64.01	82.97	577.00	505.75	134.63	285.61	191.27	176.22
Total Exp	149.64	113.22	1028.37	599.16	262.48	317.97	476.71	295.62
Share children clothes	0.09	0.07	0.06	0.04	0.06	0.04	0.04	0.04
Wealth Index	0.37	0.18	0.55	0.19	0.63	0.18	0.61	0.16
Electricity	0.58	0.49	0.95	0.23	0.95	0.21	0.98	0.13
Toilet Quality	0.46	0.50	0.44	0.50	0.94	0.24	0.73	0.44
Water Quality	0.57	0.50	0.96	0.20	0.83	0.38	0.18	0.38
Household Size	5.02	1.48	4.56	1.01	4.44	1.03	4.36	0.77
Urban	0.52	0.50	0.33	0.47	0.84	0.36	0.23	0.42
Any Animals	0.57	0.50	0.31	0.46	0.54	0.50	0.45	0.50
Total land owned	0.70	0.46	0.67	0.47	0.42	0.49	0.93	0.25

Notes: Real Expenditures in real 2006 Birr (Ethiopia), Rupees (India), Soles (Peru) and Vietnamese Dong (Vietnam).

Table 2: Allocation of time spent on various tasks

	male	female
Child Care	0.105	0.139
Household Chores	0.665	0.855
Non Paid Work	0.175	0.137
Paid Work	0.017	0.016
	n=830	n=768

Table 3: Correlation ρ of Residuals of an Intercept-only Model

	$\ln x_{it}$ continuous $\ln l_{it}$ continuous	x_{it} ordered $\ln l_{it}$ continuous	x_{it} ordered l_{it} ordered
	(1)	(2)	(3)
Ethiopia (n=194)	-.0766	-.0887	-.1193
	(0.0814)	(0.0862)	(0.0939)
India (n=540)	-.0811**	-.1311***	-.1205**
	(0.0374)	(0.0466)	(0.0543)
Peru (n=258)	-.2193***	-.2710***	-.2655***
	(0.0616)	(0.0705)	(0.0824)
Vietnam (n=606)	-.2243***	-.2955***	-.3798***
	(0.0346)	(0.0416)	(0.0486)
Pooled (n=1598)	-.1430***	-.1964***	-.2272***
	(0.0253)	(0.0284)	(0.0313)

Notes: Robust standard errors in parenthesis, clustered at child level; *, **, *** denote significance at 10%, 5% and 1% levels.

Table 4: Parsimonious Model

	$\ln x_{it}$ continuous $\ln l_{it}$ continuous	x_{it} ordered $\ln l_{it}$ continuous	x_{it} ordered l_{it} ordered
	(1)	(2)	(3)
Relative Expenditure			
Relative Age	0.033***	0.117***	0.117***
	(0.003)	(0.01)	(0.01)
A=male, B=male	-.017	0.0008	0.0008
	(0.03)	(0.069)	(0.069)
A=male, B=female	-.010	0.055	0.055
	(0.03)	(0.087)	(0.086)
A=female, B=male	0.032	0.28***	0.28***
	(0.028)	(0.082)	(0.082)
Urban	0.033	0.101	0.101
	(0.022)	(0.067)	(0.067)
Measurement Error	-.148***	-.454***	-.454***
	(0.031)	(0.093)	(0.093)
Obs.	1598	1598	1598
$R^{2\dagger}$	0.1402	0.0841	0.0841
Relative Leisure			
Relative Age	-.035***	-.035***	-.151***
	(0.002)	(0.002)	(0.01)
A=male, B=male	0.003	0.003	0.105
	(0.02)	(0.02)	(0.086)
A=male, B=female	0.073***	0.073***	0.362***
	(0.022)	(0.022)	(0.09)
A=female, B=male	-.067***	-.067***	-.250***
	(0.021)	(0.021)	(0.084)
Urban	-.002	-.002	0.004
	(0.018)	(0.018)	(0.07)
Obs.	1598	1598	1598
$R^{2\dagger}$	0.1885	0.1885	0.1136
Correlation ρ	-.0411	-.0630**	-.0686**
	(.02746)	(.0298)	(.0342)

Notes: All models include country and time intercepts. †Pseudo R^2 for ordered probit. Robust standard errors in parenthesis, clustered at child level; *, **, *** denote significance at 10%, 5% and 1% levels.

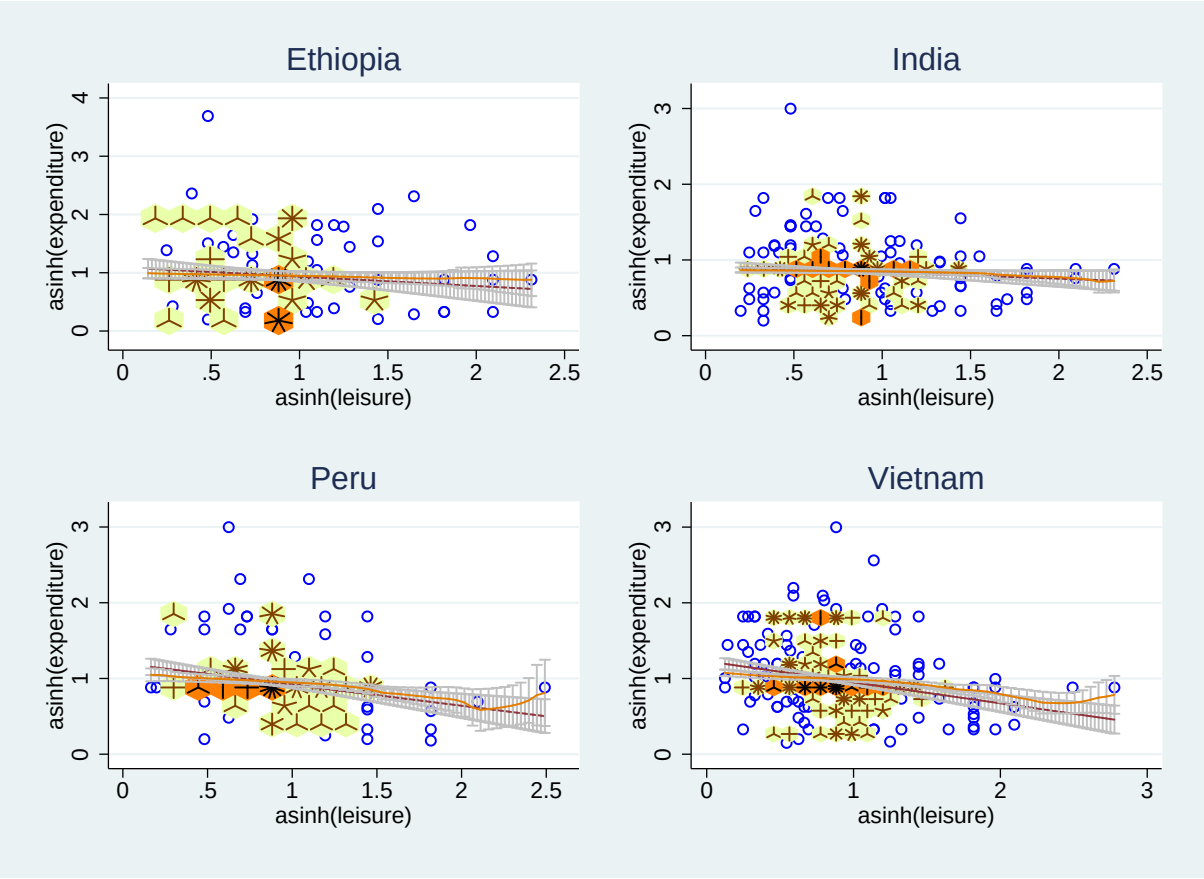
Table 5: Alternative Explanations

	$\ln x$ con $\ln l$ con	x ord $\ln l$ con	x ord l ord
	(1)	(2)	(3)
Work as dependent variable			
Correlation parsimonious model (n=1054)	.0405	.0666*	.0846*
	(.0327)	(.0346)	(.0424)
Excl. work outside the house (n=992)	.0647*	.0728*	.0865*
	(.0361)	(.0366)	(.0449)
Excl. children working outside (n=746)	.0673*	.0720*	.0912*
	(.0403)	(.0406)	(.0494)
Leisure as dependent variable			
Correlation parsimonious model (n=1598)	-.0411	-.0630**	-.0686**
	(.02746)	(.0298)	(.0342)
Education included (n=1597)	-.0346	-.0561*	-.0615*
	(.0269)	(.0296)	(.0338)
Schooling as simultaneous choice (n=1598)	-.0414	-.0616**	-.0671*
	(.0274)	(.0299)	(.0341)
Non-linear age effect (n=1598)	-.0438	-.0637**	-.0690**
	(.0277)	(.0299)	(.0343)
Heterogeneity in age effect (n=1598)	-.0335	-.0553*	-.0583*
	(.0270)	(.0298)	(.0342)
Productivity differences (n=1598)	-.0417	-.0610**	-.0640*
	(.0276)	(.0303)	(.0344)
BMI and PPVT included (n=1505)	-.0468*	-.0637**	-.0699**
	(.0266)	(.0302)	(.0352)
11-17 year olds only (n=1031)	-.0624*	-.0794**	-.0752*
	(.0360)	(.0369)	(.0409)
Full set of interaction effects (n=1652)	-.0344	-.0589**	-.0568
	(.0271)	(.0295)	(.0344)
Biological siblings only (n=1518)	-.0431	-.0726**	-.0664*
	(.0262)	(.0298)	(.0348)
Wealth index included (n=1586)	-.0402	-.0620**	-.0634*
	(.027)	(.0300)	(..0342)

Notes: All models include country and time intercepts. Robust standard errors in parenthesis, clustered at child level; *, **, *** denote significance at 10%, 5% and 1% levels.

8 Figures

Figure 1: Unconditional Joint Distribution of $\ln x_{it}$ and $\ln l_{it}$



Notes: Y-axis shows relative expenditure using the inverse hyperbolic sine transformation; x-axis shows relative leisure using the inverse hyperbolic sine transformation. The figure contains circles and hexagons. Circles represent individual data points; in a light hexagon each line from the centre represents one observation; in a dark hexagon, each line from the centre represents four observations; overlaid are a linear regression and a local polynomial regression with 95% confidence intervals.

APPENDIX - FOR ONLINE PUBLICATION

A Additional Tables and Figures

Table A.1: Relationship of Sibling to Panel Child

	Ethiopia	India	Peru	Vietnam
Brother/sister (both parents the same)	0.763	0.991	0.915	0.988
Half-sibling (same father)	0.005		0.004	0.005
Half-sibling (same mother)	0.088		0.062	0.002
Adoptive brother/sister	0.005			
Uncle/aunt	0.036		0.008	
Cousin (including cousin-brother & cous	0.072	0.007	0.012	0.005
Nephew/niece	0.010	0.002		
Brother/sister-in-law (spouse of siblin	0.010			
Other relative	0.010			
Servant (farm-worker, maid, etc.)	0.005			

Notes: Relationship of sibling to panel child from household roster.

Table A.2: Panel Child Characteristics

	2006				2009			
	mean	sd	min	max	age	sd	min	max
Ethiopia								
Age	11.49	0.50	11	12	14.49	0.50	14	15
Male	0.45	0.50	0	1	0.51	0.50	0	1
School	5.99	1.24	4	10	6.22	1.35	3	10
Study	1.91	0.91	0	5	2.26	1.24	0	7
Play	3.27	1.46	1	8	2.68	1.55	1	8
Child Care	0.09	0.35	0	2	0.39	0.76	0	4
Household chores	2.46	1.59	0	8	2.62	1.46	0	6
Non Paid	0.80	1.46	0	5	0.95	1.67	0	8
Paid	0.07	0.51	0	4	0.22	0.91	0	6
Any Work†	3.41	1.89	0	8	4.18	1.78	1	9
Sleep	9.16	1.03	6	12	8.66	1.18	5	11
	n=94				n=100			
India								
Age	11.72	0.45	11	12	14.69	0.46	14	15
Male	0.51	0.50	0	1	0.53	0.50	0	1
School	6.88	1.06	4	10	8.24	1.25	1	12
Study	2.32	1.44	0	8	2.69	1.28	0	7
Play	3.86	1.81	1	9	3.58	1.44	1	8
Child Care	0.08	0.30	0	2	0.18	0.42	0	3
Household chores	0.70	0.80	0	4	1.10	0.94	0	4
Non Paid	0.06	0.29	0	3	0.10	0.45	0	3
Paid	0.00	0.00	0	0	0.04	0.37	0	5
Any Work†	0.85	0.94	0	4	1.42	1.33	0	8
Sleep	8.93	0.89	6	11	8.07	0.91	5	10
	n=281				n=259			
Peru								
Age	11.88	0.44	11	13	14.41	0.57	13	17
Male	0.62	0.49	0	1	0.58	0.50	0	1
School	5.56	0.70	5	9	6.53	0.94	5	10
Study	2.14	0.94	0	6	2.40	0.89	0	6
Play	2.41	1.09	1	7	3.29	1.31	1	7
Child Care	0.34	0.68	0	4	0.47	1.04	0	6
Household chores	0.95	0.62	0	3	1.35	0.85	0	4
Non Paid	0.24	0.71	0	4	0.31	0.79	0	4
Paid	0.06	0.44	0	3	0.05	0.26	0	2
Any Work†	1.60	1.29	0	7	2.18	1.72	0	8
Sleep	9.25	1.01	6	12	8.95	1.03	6	12
	n=140				n=118			
Vietnam								
Age	11.70	0.47	11	13	14.71	0.46	14	16
Male	0.54	0.50	0	1	0.45	0.50	0	1
School	4.59	0.62	4	8	5.51	0.87	4	10
Study	3.01	1.57	0	8	4.01	1.56	1	8
Play	5.90	1.81	1	10	4.00	1.47	1	8
Child Care	0.07	0.31	0	2	0.07	0.35	0	2
Household chores	1.12	0.82	0	5	1.43	0.78	0	4
Non Paid	0.45	1.02	0	4	0.41	0.91	0	4
Paid	0.02	0.25	0	3	0.03	0.38	0	6
Any Work†	1.66	1.33	0	6	1.94	1.20	0	8
Sleep	8.80	0.79	7	11	8.54	1.06	5	12
	n=349				n=257			

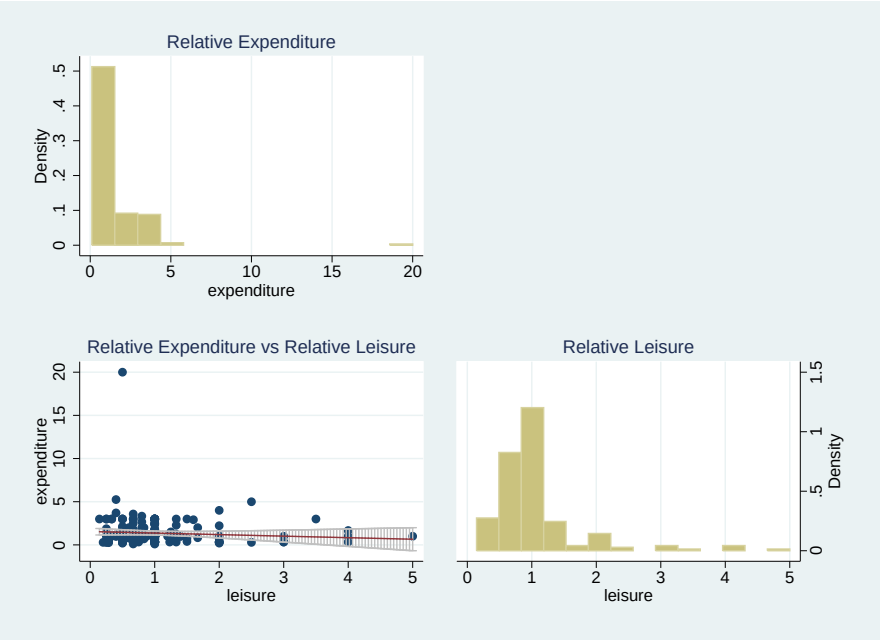
Notes: Activities are measured in hours; †Any work is the sum of child care, household chores, non paid and paid work.

Table A.3: Sibling Characteristics

	2006				2009			
	mean	sd	min	max	age	sd	min	max
Ethiopia								
Age	12.35	3.70	6	17	11.88	2.38	6	17
Male	0.55	0.50	0	1	0.62	0.49	0	1
School	6.07	1.45	4	11	6.16	1.24	4	10
Study	1.76	1.12	0	5	1.79	1.03	0	6
Play	3.35	1.76	1	8	3.39	1.62	1	8
Child Care	0.05	0.23	0	1	0.11	0.42	0	2
Household chores	2.07	1.77	0	8	2.07	1.46	0	6
Non Paid	1.10	1.83	0	6	1.35	1.98	0	7
Paid	0.16	0.77	0	4	0.06	0.45	0	4
Any Work†	3.38	2.14	0	8	3.59	1.93	0	10
Sleep	9.12	1.13	7	12	9.07	1.32	6	12
	n=94				n=100			
India								
Age	11.59	2.99	6	17	13.17	2.48	6	17
Male	0.56	0.50	0	1	0.62	0.49	0	1
School	6.82	1.08	3	10	8.13	1.01	6	12
Study	2.35	1.50	0	9	2.17	1.06	0	5
Play	4.06	1.93	1	10	4.20	1.49	1	9
Child Care	0.04	0.24	0	2	0.11	0.37	0	2
Household chores	0.53	0.74	0	3	0.72	0.80	0	4
Non Paid	0.04	0.24	0	2	0.05	0.26	0	2
Paid	0.01	0.12	0	2	0.01	0.12	0	2
Any Work†	0.62	0.90	0	5	0.90	0.99	0	5
Sleep	9.01	1.00	6	12	8.61	0.85	6	11
	n=281				n=259			
Peru								
Age	11.71	3.47	6	17	12.31	3.00	6	17
Male	0.54	0.50	0	1	0.49	0.50	0	1
School	5.52	0.78	4	10	6.28	0.95	4	10
Study	2.20	1.01	0	6	2.38	0.93	0	6
Play	2.44	1.20	1	6	3.58	1.19	1	7
Child Care	0.18	0.47	0	3	0.07	0.39	0	3
Household chores	0.89	0.74	0	4	1.28	0.83	0	4
Non Paid	0.19	0.59	0	3	0.27	0.82	0	4
Paid	0.11	0.57	0	4	0.08	0.49	0	5
Any Work†	1.37	1.41	0	7	1.69	1.28	0	6
Sleep	9.26	1.10	7	12	9.14	1.11	6	13
	n=140				n=118			
Vietnam								
Age	12.14	3.58	6	17	11.93	3.48	6	17
Male	0.56	0.50	0	1	0.56	0.50	0	1
School	4.73	1.09	3	10	5.26	0.99	3	10
Study	2.98	1.76	0	8	3.51	1.60	1	9
Play	6.08	2.08	1	11	4.91	1.73	1	11
Child Care	0.04	0.24	0	2	0.02	0.19	0	2
Household chores	0.93	0.92	0	4	0.89	0.84	0	5
Non Paid	0.37	0.92	0	4	0.26	0.81	0	5
Paid	0.01	0.16	0	3	0.03	0.39	0	6
Any Work†	1.35	1.35	0	6	1.20	1.36	0	10
Sleep	8.83	0.99	6	11	9.14	1.15	5	12
	n=349				n=257			

Notes: Activities are measured in hours; †Any work is the sum of child care, household chores, non paid and paid work.

Figure A.1: Relative Leisure and Consumption in Ethiopia

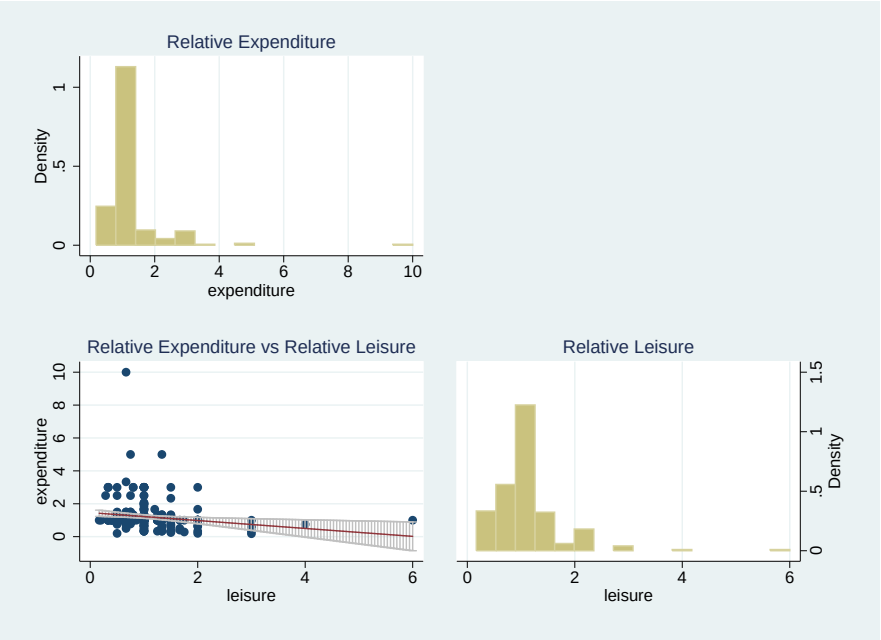


Notes: Linear regression of relative leisure on relative consumption with 95% confidence interval in the South-West panel.

Figure A.2: Relative Leisure and Consumption in India

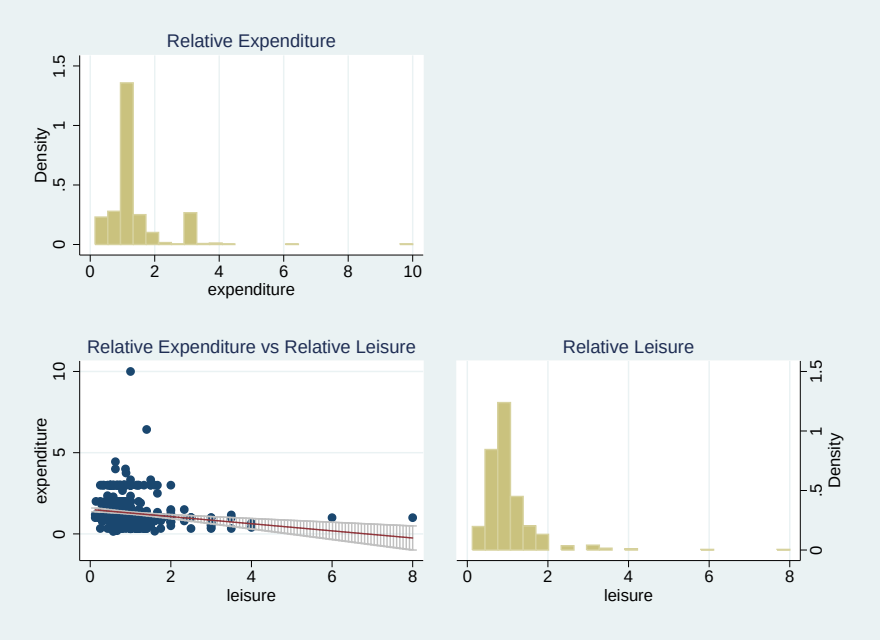
Notes: Linear regression of relative leisure on relative consumption with 95% confidence interval in the South-West panel.

Figure A.3: Relative Leisure and Consumption in Peru



Notes: Linear regression of relative leisure on relative consumption with 95% confidence interval in the South-West panel.

Figure A.4: Relative Leisure and Consumption in Vietnam



Notes: Linear regression of relative leisure on relative consumption with 95% confidence interval in the South-West panel.

Table A.4: Base Model

	$\ln x_{it}$ continuous $\ln l_{it}$ continuous	x_{it} ordered $\ln l_{it}$ continuous	x_{it} ordered l_{it} ordered
	(1)	(2)	(3)
Relative Expenditure			
A's age	0.026	0.099*	0.1*
	(0.02)	(0.06)	(0.06)
B's age	-.035***	-.123***	-.123***
	(0.003)	(0.009)	(0.009)
A=male, B=male	-.017	0.0004	0.0004
	(0.03)	(0.069)	(0.069)
A=male, B=female	-.009	0.057	0.057
	(0.03)	(0.087)	(0.087)
A=female, B=male	0.033	0.284***	0.284***
	(0.028)	(0.082)	(0.082)
Urban	0.033	0.102	0.102
	(0.022)	(0.067)	(0.067)
Measurement Error	-.146***	-.457***	-.457***
	(0.03)	(0.092)	(0.092)
Obs.	1598	1598	1598
$R^{2\dagger}$	0.1499	0.0880	0.0880
Relative Leisure			
A's age	-.015	-.015	-.042
	(0.015)	(0.015)	(0.06)
B's age	0.036***	0.036***	0.158***
	(0.002)	(0.002)	(0.01)
A=male, B=male	0.003	0.003	0.11
	(0.02)	(0.02)	(0.086)
A=male, B=female	0.073***	0.073***	0.366***
	(0.022)	(0.022)	(0.089)
A=female, B=male	-.068***	-.068***	-.254***
	(0.021)	(0.021)	(0.084)
Urban	-.004	-.004	-.003
	(0.018)	(0.018)	(0.071)
Obs.	1598	1598	1598
$R^{2\dagger}$	0.1941	0.1941	0.1176
Correlation ρ	-.0308	-.0545*	-.0580*
	(.0268)	(.0298)	(.0341)

Notes: All models include country and time intercepts. †Pseudo R^2 for ordered probit. Robust standard errors in parenthesis, clustered at child level; *, **, *** denote significance at 10%, 5% and 1% levels.

B Comparison with whole Young Lives sample

Given my focus on families with two children aged 5–17 who are both in school is a specific sub-sample of the Young Lives (YL) older cohort, this section discusses some of the main differences in observable household and child characteristics. The child characteristics refer to the panel child. Tables A.5-A.8 show that my sample in consistently richer, measured both in terms of food (except India) and non-food expenditures and real outcomes as measured by the wealth index, a composite index of housing quality, access to services and ownership of durables. Within these categories, however, patterns differ across countries. For instance in Ethiopia, my sample is not significantly better off in terms of toilet facilities (the difference is actually negative) and access to safe water; the same holds for water in the case of India, while in Peru my sample is better off along all measured dimensions of basic living standards. By construction, households in my sample are significantly smaller, between 1.6 to 0.5 persons on average. my sample is also significantly more urban, and ownership of animals is lower. Land ownership is significantly lower in my sample compared to the whole Young Lives sample in Ethiopia and India, while it is significantly higher in Vietnam. Children who are in my sub-sample are all enrolled, spend significantly more time in school compared to the whole Young Lives sample (except India where the difference is not statistically different from zero) and score higher on the PPVT test. Their BMI is not significantly different from the whole sample, and even lower for Indian and Vietnamese children.

Table A.5: Ethiopia

	Sample	YL whole sample	Difference	p-value
Food Exp	86.928	73.203	13.724	0.000
Non-food Exp	64.005	47.783	16.222	0.001
Total Exp	149.638	119.817	29.820	0.000
Share children clothes	0.092	0.094	-0.001	0.837
Wealth Index	0.365	0.320	0.046	0.000
Electricity	0.582	0.489	0.093	0.014
Toilet Quality	0.464	0.496	-0.032	0.396
Water Quality	0.572	0.541	0.032	0.403
Household Size	5.021	6.584	-1.563	0.000
Urban	0.515	0.393	0.123	0.001
Any Animals	0.567	0.702	-0.135	0.000
Total land owned	0.696	0.774	-0.078	0.015
Hours in school	6.106	5.503	0.603	0.000
Enrolled	1.000	0.913	0.087	0.000
PPVT score	110.237	100.292	9.944	0.015
BMI	16.179	15.973	0.206	0.248

Table A.6: India

	Sample	YL whole sample	Difference	p-value
Food Exp	451.373	437.433	13.940	0.419
Non-food Exp	577.000	508.634	68.365	0.020
Total Exp	1028.373	946.068	82.305	0.023
Share children clothes	0.058	0.065	-0.007	0.004
Wealth Index	0.552	0.475	0.078	0.000
Electricity	0.946	0.927	0.020	0.120
Toilet Quality	0.441	0.314	0.127	0.000
Water Quality	0.959	0.963	-0.004	0.706
Household Size	4.557	5.339	-0.782	0.000
Urban	0.331	0.213	0.119	0.000
Any Animals	0.313	0.453	-0.140	0.000
Total land owned	0.670	0.734	-0.063	0.005
Hours in school	7.528	7.471	0.057	0.421
Enrolled	1.000	0.691	0.309	0.000
PPVT score	119.281	106.811	12.470	0.000
BMI	21.773	23.184	-1.411	0.815

Table A.7: Peru

	Sample	YL whole sample	Difference	p-value
Food Exp	127.841	110.997	16.845	0.001
Non-food Exp	134.634	93.954	40.680	0.008
Total Exp	262.476	204.951	57.525	0.001
Share children clothes	0.055	0.063	-0.008	0.037
Wealth Index	0.627	0.523	0.104	0.000
Electricity	0.953	0.842	0.111	0.000
Toilet Quality	0.938	0.881	0.057	0.008
Water Quality	0.829	0.739	0.091	0.002
Household Size	4.442	5.721	-1.279	0.000
Urban	0.845	0.739	0.106	0.000
Any Animals	0.543	0.661	-0.118	0.000
Total land owned	0.419	0.409	0.010	0.779
Hours in school	6.004	5.646	0.357	0.001
Enrolled	1.000	0.950	0.050	0.000
PPVT score	88.899	83.481	5.418	0.000
BMI	20.314	20.049	0.265	0.227

Table A.8: Vietnam

	Sample	YL whole sample	Difference	p-value
Food Exp	285.434	251.068	34.366	0.000
Non-food Exp	191.275	162.341	28.934	0.004
Total Exp	476.709	413.409	63.299	0.000
Share children clothes	0.043	0.050	-0.007	0.003
Wealth Index	0.609	0.548	0.061	0.000
Electricity	0.983	0.950	0.034	0.000
Toilet Quality	0.734	0.563	0.172	0.000
Water Quality	0.180	0.149	0.031	0.086
Household Size	4.360	4.886	-0.526	0.000
Urban	0.228	0.188	0.040	0.039
Any Animals	0.454	0.459	-0.005	0.836
Total land owned	0.931	0.899	0.031	0.025
Hours in school	4.979	4.045	0.934	0.000
Enrolled	1.000	0.810	0.190	0.000
PPVT score	157.210	149.575	7.636	0.000
BMI	17.227	17.383	-0.156	0.195

C Extension: Collective Household Model

This section shows that the model in this paper is nested in a collective model with two parents who have different bargaining weights μ which can depend on prices and incomes. To see this, as discussed in Browning et al. (2011), assume a household welfare function Ω'^P of the form

$$\Omega'^P = \mu\,(U^M + \kappa^M U^C) + (1-\mu)\,(U^F + \kappa^F U^C) \tag{22}$$

where U^M is the mother's utility, U^F is the father's utility, μ is the pareto weight, κ^M is the mother's weight for children, and κ^F is the father's weight for children. This allows for the bargaining power of mother and father to affect the weight of children in the household's problem, as often modeled theoretically and found empirically in studies investigating intra-household allocation outcomes as a function of the identity of the income earner (Attanasio and Lechene 2002; Basu 2006; Bobonis 2009; Duflo 2000; Duflo 2003; Lundberg et al. 1997; Reggio 2011; Thomas 1990; Ward-Batts 2008). Equation (22) can be rewritten as

$$\Omega'^P = \mu\, U^M + (1-\mu)\, U^F + (\mu\,\kappa^M + (1-\mu)\,\kappa^F)\, U^C.$$

Denoting $\phi = \mu\,\kappa^M + (1-\mu)\,\kappa^F$ and assuming $U^C = \delta\, U^A + (1-\delta)\, U^B$ in line with equation (1) I have

$$\Omega'^P = \mu\, U^M + (1-\mu)\, U^F + \phi\{\delta\, U^A + (1-\delta)\, U^B\}.$$

The maximization problem is

$$\max_{x_M,x_F,x_A,x_B,l_M,l_F,l_A,l_B} \mu\, U^M + (1-\mu)\, U^F + \phi\,\delta\, U^A + \phi\,(1-\delta)\, U^B \text{ subject to}$$

$$x_M + l_M\, w_M + x_F + l_F\, w_F + x_A + l_A\, w_A + x_B + l_B\, w_B = I + T(w_M + w_F + w_A + w_B)$$

and the first order conditions for x_A and x_B are

$$\mathscr{L}_{x_A} = \phi\,\delta\,\frac{\partial U^A}{\partial x_A} - \lambda = 0$$

$$\mathscr{L}_{x_B} = \phi\,(1-\delta)\,\frac{\partial U^B}{\partial x_B} - \lambda = 0.$$

Assuming that preferences of all household members are as given in (3) this collapses into equation (7) when taking ratios and equivalently for the relative leisure equation (8)

$$\frac{x_A}{x_B} = \frac{\phi}{\phi}\,\frac{\delta}{1-\delta}\,\frac{\theta^A}{\theta^B} = \frac{\delta}{1-\delta}\,\frac{\theta^A}{\theta^B}.$$

D Measurement Error

Measurement error in the expenditure data is due to the fact that I only know the allocation to child A with certainty, while I assign the remainder of children's expenditures to child B. In the presence of older siblings aged 18 and over who parents nevertheless regard as children, this will lead to an upward biased estimation of expenditures to child B, so that x_A/x_B is the lower bound. Below I discuss hypothetical cases for three children, A, B and C to illustrate when I can and can not identify expenditure shares.

Table A.9: Identified Cases

	A	B	C	boy's x	girl's x	share A
Case 1						
Gender	male	male	female	100	50	0.5
Age	12	14	20			
Assignment	50	50	0			
Case 2						
Gender	male	female	male	100	50	0.5
Age	12	14	20			
Assignment	50	50	50			

Table A.9 gives examples of cases when I can identify the share of expenditures with certainty. Case 1 is when the index child (A) is male, with a brother (B) and an older sister (C). Since I know the allocation to boy's clothes, and the share to the index child, I can assign the residual expenditures to child B. Clothes expenditures for the older sister would then be recorded either under adult expenditures of girl's expenditures, not affecting the allocations to child A and B. Case 2 is when the index child is male and child B is female, but there is an older brother in the family. I then know the allocation to child A from the questionnaire, and can assign girls expenditures to child B. The same cases hold for the opposite gender combinations.

Table A.10 gives examples of cases when I am likely to measure the share of expenditures with measurement error if the parents consider males and females aged 18-25 as children when recording expenditures. Case 1 presents the scenario when the index child is male, with a brother aged 14 and an older brother aged 20. In this case, I assume that the residual expenditures (total expenditures minus the allocation share to the index child) is for child B, while alternative assignments for child B could be lower as illustrated if the parent record clothes expenditures for the 20 year old brother under boy's expenditures and not male adult expenditures. Case 2 presents the scenario when the index child is male, with a sister aged 14 and an older sister aged 20; again, the table shows that my assumed assignment is lower if the parents consider the 20 year old sister C as a child. The same logic applies to the opposite sex combinations.

I use these cases to model when measurement error is going to be more likely as illustrated in the examples. The cases particularly prone to measurement error are (i) when

Table A.10: Under-identified Cases

	A	B	C	boy's x	girl's x	share A
Case 1						
Gender	male	male	male	100	0	0.5
Age	12	14	20			
Assumed assignment B	50	50	0			
Alternative assignment B (i)*	50	0	50			
Alternative assignment B (ii)*	50	25	25			
Case 2						
Gender	male	female	female	100	150	1
Age	12	14	20			
Assumed assignment B	100	150	0			
Alternative assignment B (i)*	100	0	150			
Alternative assignment B (ii)*	100	100	50			

Note: * illustrates hypothetical alternative assignments.

both children are of the same sex, and there are further siblings aged 18-25 of the same sex in the household who parents consider a child (denoted as case 1); (ii) when children are of the opposite sex, but there is a further member of the same sex as child B in the household aged 18-25 who the parents consider a child (denoted as case 2). I include a dummy variable that is equal to one if I observe either case (i) or case (ii) in the data which is case in 12% of the sample.