Preferences over Leisure and Consumption of Siblings and Intra-Household Allocation

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ABSTRACT

Children are often treated as passive members in the household and their preferences over consumption and leisure are rarely modelled. This paper considers children as agents with their own preferences over leisure and consumption and builds a theoretical and empirical model for children's time and consumption allocations in a household. We test the predictions of the model with data from Ethiopia, India, Peru and Vietnam which contain detailed information on time use and allocations of assignable goods for sibling pairs. We find that conditioning on observable variables, the residuals of these simultaneous decisions 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 parents' relative altruism. Children, even in relatively poor settings, appear to have a sense of agency and families seem to function as market economies in which children trade off leisure and consumption and are rewarded by their parents accordingly.

Keywords: Intra-household allocation, children

JEL Classification: D1, J1, J2

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1 Introduction

Children are often treated as passive members in the household and their preferences over consumption and leisure are rarely modelled. With few exceptions, household models in economics treat children as public goods or passive agents of the household, let alone allowing for preference heterogeneity among siblings[1]. In many developing country contexts, children are expected to perform unpaid or paid work inside or outside the house, but there is also a significant level of heterogeneity across children with regard to their attitudes and preferences towards work[2]. While parents certainly play a central role in deciding over a child's time allocation, Edmonds (2008, p. 3668) points out:

> *"Future research understanding the child's own role in her time allocation is perhaps the most pressing need in the child labor literature."*

Several economists have argued that trade sanctions and consumer boycotts as policies to fight child labor might backfire and raise child labor at least in the short run, and even contribute to its persistence in the long run (Edmonds and Pavcnik, 2005; Basu and Zarghamee, 2009; Doepke and Zilibotti, 2010). If children have agency over their decisions even in relatively poor settings, outcomes for children might be best improved by offering more choices rather than stricter labor regulation.

When considering children as economic agents with preferences over consumption and leisure, it becomes natural to apply standard models employed in the labor economics literature in which agents maximize utility from consumption and leisure subject to a budget constraint. If parents have equal levels of altruism towards their children, differences in within-household allocations among siblings would then be due to differences in preferences.

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, Carlsmith, Bushwall, Ritter, Leiderman, Hastorf, and Gross, 1985; Yee and Flanagan, 1985). Harbaugh, Krause, and Liday (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. Experimental evidence from Harbaugh, Krause, and Berry (2001) suggests that by the age of 11, children's choices are roughly as rational as choices by adults, in the sense that their choices follow generalized axioms of revealed preference. Lundberg, Romich, and Tsang (2009) show that there is a sharp increase children's reported involvement in the decision making process between age 10-14. 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

[1] Studies who treat children as decision makers include Moehling (2005); Lundberg, Romich, and Tsang (2009); Kapan (2009) and Dauphin, El Lahga, Fortin, and Lacroix (2010).

[2] Orkin (2011) presents qualitative evidence from children in rural Ethiopia supporting the idea that children have different preferences with regard to work as well as make decisions regarding their time.

Plomin, 1985; Dunn and Plomin, 1990)[3].

The objective of this paper is to view children as agents and to understand whether children's preferences over consumption and leisure determine allocations of assignable goods among siblings. The central contribution of the paper is twofold. First, it develops a theoretical model of intra-sibling allocation of consumption and leisure. We assume parents to be social planners taking into account children's preferences over leisure and consumption when making allocation decisions. The focus of this paper is how allocations are driven conditional on children being in school rather than the tradeoff between work and school, so we abstract from schooling decisions. The model provides insights into how heterogeneity in 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. If relative parental altruism towards child A and B drives allocation decisions and children's relative preferences over leisure and consumption are independently distributed, we expect the residuals of the expenditure and leisure equation to be positively correlated, controlling for age and gender composition effects. The favorite child gets allocated a higher expenditure share and lower work share. On the other hand, if child A's relative preferences of leisure and consumption are negatively correlated with child B's relative preferences of leisure and consumption and there is no variation in parental altruism in the unobservables, conditional on age and gender composition effects, the residuals should be negatively correlated. Children who work longer hours get rewarded accordingly. Second, we use detailed data on time use and assignable goods of a panel data set of children in Ethiopia, India, Peru and Vietnam to test the theoretical implication 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, 2006), and even more so for children. To our 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 entered the formal labor market yet in the context of four developing countries.

We find that conditioning on observable variables, the residuals of these simultaneous decisions 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. Children seem to trade off leisure and consumption and are rewarded accordingly. As a result, families appear to behave as if they were an internal market in which children select their optimal consumption-leisure bundle.

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, 1991; Chiappori, 1988; Browning and Chiappori, 1998). Among the first to explicitly consider parent-children interaction was Becker (1981) with his well known Rotten Kid Theorem. Within the literature on

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

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; Dunbar, Lewbel, and Pendakur, 2010; Bonke and Browning, 2011). A few studies have departed from modeling children via caring preferences or as a household public good to consider them as further decision makers in the household (Moehling, 2005; Kapan, 2009; Dauphin, El Lahga, Fortin, and Lacroix, 2010). This paper differs from these studies in that we are interested in how preferences of children affect outcomes between siblings, instead of between parents and children. Intra-household allocation outcomes as a function of the identity of the income earner have been the subject of several studies (Attanasio and Lechene, 2002; Bobonis, 2009; Braido, Olinto, and Perrone, 2012; Duflo, 2000, 2003; Thomas, 1990). We focus on a children's clothes as assignable good and show that even after controlling for structural variables such as age and gender composition in the household, there is substantial variation in the unobservable preferences driving allocations.

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. In the majority of household surveys we observe total household expenditures for particular goods, where at most it is possible to assign a few goods to husband, wife and children after making assumptions about the characteristics of goods. Detailed data on time allocations across household members is even sparser. Having both pieces of information in the same survey is crucial for studying their interaction. We use data from the Young Lives Survey, a study of childhood poverty tracking two cohorts of children in Ethiopia, India, Peru and Vietnam. For the purpose of this paper, we use data from the older cohort which is 7-8 years old when first interviewed in 2002. The second and third rounds took place in 2006/2007 and 2009/2010 and collected detailed information on expenditures as well as information on what activities all household members aged 5-17 spent time on a usual workday.

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 we can inspect how a relatively homogenous sample of children at two points of time interacts with siblings. From the whole data set we select our sample along three dimension: (i) as we can assign expenditures with certainty only to children with one other sibling, we use the sample of children with one other child below 18 years old in the household; (ii) since the time diary is available only for children between 5 and 17, we limit the sample to panel children with siblings between 5 and 17 years; (iii) given that we are interested in time allocations for children who are in school, we raise the age cutoff to 6 years. This leaves us with a total of 1,652 sibling pair observations for both rounds across four countries.

A first look at the data confirms that there is significant heterogeneity with regard to children's preferences and decision making. As part of the child questionnaire, the index child was asked to

name activities he or she did the day before the survey, and whether it was the child's choice to do that activity. Table 2 shows the number of children who mentioned the activity and the percentage of children who say that it was their choice to do this activity for the four countries. Children across the four countries named on average between 3 and four activities. Children in Peru, India and Vietnam appear to have a significant degree of agency, with an average of 78, 77 and 74 percent of children doing an activity they listed by choice. Ethiopian children lag behind with the average percentage of children doing a listed activity by choice being less than half. More than 89% of children across the four countries named school as an activity they did the day before the survey, but while 64 percent of children go there by choice in Peru, only 35 or 33 percent do so in Vietnam and Ethiopia. Similar heterogeneity is there for chores. Domestic chores in the household are performed by choice by at least 80 percent of children in Vietnam and India, compared to 63 and 41 percent for children in Peru and Ethiopia. Collecting firewood is done by choice by 75 percent of Indian children, compared to 26 percent of Ethiopia children. Leisure time with friends is an activity undertaken by at least 90 percent of children because they want to; this is similar for watching TV, with the exception of Ethiopia where only 65 percent of children state that they watch TV by choice.

Table 3 shows the relationship of the second child in the household to the panel child. Ninety 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 we refer to the co-habitating child as the sibling, recognizing that a small proportion of the children in the sample are half-siblings or other relatives.

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[4]: sleeping, caring for others (younger siblings, ill household members), household chores (fetching water, firewood, cleaning, cooking, washing, shopping, etc), non-paid activities outside the household (tasks on family farm, cattle herding, other family business, shepherding, piecework or handicrafts done at home), activities for pay/sale outside the household or for someone not in the household, at school (including traveling time), studying outside of school time (at home, extra tuition) and playtime/general leisure (including time taken to eating, drinking and bathing). Asking allocations on a typical weekday has the advantage that it provides a better picture of everyday activities of a child and is less vulnerable to particularities of the survey day than referring to activities the day before the survey.

Table 4 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 53, 51 and 45 percent in Vietnam, India and Ethiopia. All children in our sample are in school, but there are differences in the number of hours children spend in school. Children in Vietnam spend the fewest number of hours at school with 4.59 hours, while kids in India spend 6.89 hours per day on average in 2006. When taking into account differences

[4]We do not have data on the caretaker's reported time allocation for the panel child in India for 2009, so we use the child's reported time allocation.

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 is highest in Vietnam with an average across the two years of almost 5 hours, as opposed to 2.97 hours in Ethiopia, 3.72 hours in India and 2.86 hours in Peru. There is also substantial variation across children in the hours of leisure.

Children spend a significant amount of time contributing to the household economy. Kids in Ethiopia work almost 4 hours a day, thereby working the longest number of hours on providing child care and carrying out household chores, as well as unpaid and paid work outside the household. Vietnamese children and Peruvian children work about 2 hours per day, and Indian children about 1 hour per day. Sleeping accounts for about 8.5 to 9 hours and children sleep less with higher age.

Table 5 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 between 12 and 13 years. The average age is not strictly increasing as we don't have a balanced data set: some children exit the data set when their parents have a third child, and some children enter the data set through as their siblings when their siblings are above 18 years. About half of the siblings are male. The sibling data reflect the same patterns emerging from 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 about 4 hours in India and Vietnam, and 3 hours in Ethiopia and Peru.

2.2 Expenditure allocation

The household questionnaire collects 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. Assignable expenditures include clothes, footwear, school uniform, school fees, private classes, books, transportation to school, doctors, medicine and entertainment. We focus on children's clothes in this analysis, which account with an average of 6.2% for a sizeable share of total nonfood expenditures of households[5]. Parents are asked to state the total amount of expenditure 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 expenditure on the index child (nothing, less than half, about a half, more than half but not all, and everything). To recover child specific expenditures we 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". Since we focus on families with two children, knowing the allocation share to the index child, we can assign the remainder to the sibling for same sex sibling pairs. Ruling out corner solutions, we only use the sample of children with some positive clothes expenditures for both siblings.

Table 6 shows that there is large variation children's clothes expenditures. Given that the interview is centered around the panel child, one might worry that parents report significantly higher amounts for the panel child compared to their siblings. We do not find evidence in support of systematically higher reporting for the panel child. Rather, we find that expenditures are on average significantly higher for the sibling for Ethiopia in 2006 and for India in both rounds. We come back to this issue when discussing sources of measurement error in the identification section 4.

[5]The median is slightly lower with 4.6%.

2.3 Relative leisure and expenditure

Figures 1 to 4 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 32.7 percent in Ethiopia and 58.7 percent in Peru of sibling pairs who have equal allocations of clothes expenditures. Leisure is less equally distributed than expenditures with the children in Peru having equal hours of leisure in 41.3 percent of sibling pairs, compared to 23.3 percent of sibling pairs in Vietnam. Unequal allocations are distributed between 0.1 and 20 for clothes and 0.125 and 8 for leisure.

The pairwise correlation coefficient of relative expenditures and relative leisure is significantly equal to -0.16 for Peru and Vietnam (with p-values of 0.007 and 0.0001), -0.81 for India (with p-value of 0.0560) and -0.755 (with p-value of 0.2890) for Ethiopia. We therefore do not reject that relative leisure and consumption are 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 we exclude 4 observations who have ratios of 5 or more (this reduces the sample by a maximum of 4 observations per country), the negative correlation is even stronger for Peru and Vietnam with correlation coefficients of -0.22 and -0.21 and remains substantially unchanged for Ethiopia and India. We do not exclude these observations in the estimation, but it is important to check that the result is not driven by just a few observations. If anything, our results are stronger without outliers. The next section presents the theoretical model.

3 Theoretical Model

This section develops a simple cooperative household model in which parents are social planners and allocate time and consumption within the household. We 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.

3.1 Household's problem

Assume that a family consists of parents P and children K where we assume that $K = A, B$. 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[6]. 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 the parents care about any of their offspring through the caring parameters α^K and δ^K so that

$$\Omega^P = U^P + \alpha^K \left\{ \delta^A U^A + \delta^B U^B \right\} \tag{1}$$

[6]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, Chiappori, and Weiss, 2011), suggesting that they rarely act as a unit. However, the focus in this model is on the interaction between parents and siblings, for which the unitary assumption is more plausible. The model can be generalized to allow for two parents and two children and with different bargaining weights among parents (which depend on prices and incomes). As long as both parents share the same caring parameters for their children which is independent of the within parent bargaining weight, extending the model adds additional complexity and leaves the results unchanged.

where we include δ^A and δ^B to allow for differences in the children's weight in the parents' utility function. 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^K and δ^K. We assume that α^K and δ^K are independent of prices and incomes and that $0 < \delta^K < 1$ and $0 < \alpha^K < 1$. 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[7]. We assume that $U^m_{x_m} > 0$, $U^m_{l_m} > 0$, U^m is continuous, and

Table 1: Notation for m=P,A,B

U	utility
x	private goods consumption
T	total time endowment
h	work
l	leisure
w	parents' wage
I	non-wage income

strictly quasi concave for m=P,A,B. The household faces the budget constraint

$$x_P + x_A + x_B = I + h_P\, w_P + h_A\, w_A + h_B\, w_B \tag{3}$$

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

$$l_m = T - h_m \quad \text{for m=P,A,B} \tag{4}$$

where T is the time endowment and h are hours worked. Substituting the time constraints into the budget constraint yields the full budget constraint

$$\underbrace{x_P + l_P\, w_P + x_A + l_A\, w_A + x_B + l_B\, w_B}_{\text{Value of Consumption}} = \underbrace{I + T(w_P + w_A + w_B)}_{\text{Value of Endowment}}. \tag{5}$$

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. The utility function and 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[8]. Alternatively, we could have an additional term for schooling s 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

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

[8] In the empirical section we only look at children who are in school.

care about children's utility 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, 2006) we could have included household production of a public good. In the absence of externalities, the result of the model will be the identical. Since both modifications, schooling as a separate term and production, do not affect our result, we 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

$$\max_{x_P,x_A,x_B,l_P,l_A,l_B} U^P + \alpha^K \left\{\delta^A U^A + \delta^B U^B\right\} \text{ subject to} \tag{6}$$

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

The Lagrangean is

$$\begin{aligned}\mathscr{L} &= U^P + \alpha^K \left\{\delta^A U^A + \delta^B U^B\right\} \\ &- \lambda \left\{x_P + l_P\, w_P + x_A + l_A\, w_A + x_B + l_B\, w_B - I - T(w_P + w_A + w_B)\right\}\end{aligned} \tag{7}$$

and the first order conditions are

$$\mathscr{L}_{x_P} = \frac{\partial U^P}{\partial x_P} - \lambda = 0 \tag{8}$$

$$\mathscr{L}_{x_A} = \alpha^K \delta^A \frac{\partial U^A}{\partial x_A} - \lambda = 0 \tag{9}$$

$$\mathscr{L}_{x_B} = \alpha^K \delta^B \frac{\partial U^B}{\partial x_B} - \lambda = 0 \tag{10}$$

$$\mathscr{L}_{l_P} = \frac{\partial U^P}{\partial l_P} - \lambda\, w_P = 0 \tag{11}$$

$$\mathscr{L}_{l_A} = \alpha^K \delta^A \frac{\partial U^A}{\partial l_A} - \lambda\, w_A = 0 \tag{12}$$

$$\mathscr{L}_{l_B} = \alpha^K \delta^B \frac{\partial U^B}{\partial l_B} - \lambda\, w_B = 0 \tag{13}$$

$$\mathscr{L}_{\lambda} = x_P + l_P\, w_P + x_A + l_A\, w_A + x_B + l_B\, w_B \tag{14}$$

$$- I - T(w_P + w_A + w_B) = 0. \tag{15}$$

We assume that individual utility functions are additive over consumption and leisure

$$U^m = \theta^m \ln x_m + \tau^m \ln l_m \quad \text{for m=P,A,B} \tag{16}$$

so that θ measures household member m's preferences for consumption and τ measures his or

her preferences for leisure[9]. 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, we get

$$\frac{x_A}{x_B} = \frac{\delta^A}{\delta^B}\frac{\theta^A}{\theta^B} = \delta\,\theta \tag{17}$$

$$\frac{l_A}{l_B} = \frac{\delta^A}{\delta^B}\frac{w_B}{w_A}\frac{\tau^A}{\tau^B} = \delta\,\kappa^{-1}\,\tau \tag{18}$$

where $\delta = \delta_A/\delta_B$ measures parents' altruism versus child A compared to child B, $\theta = \theta_A/\theta_B$ measures children's relative preferences for consumption, $\tau = \tau_A/\tau_B$ measures children's relative preferences for leisure, and $\kappa = w_A/w_B$ measures children's relative wages. We 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 distribution 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, Chiappori, and Weiss, 2011). Therefore, following the second welfare theorem a competitive outcome can be reproduced given appropriate redistribution of initial incomes.

The simple comparative statics follow from (17) and (18)

$$\frac{\partial(\frac{x_A}{x_B})}{\partial\theta} > 0 \qquad \frac{\partial(\frac{l_A}{l_B})}{\partial\theta} = 0 \tag{19}$$

$$\frac{\partial(\frac{x_A}{x_B})}{\partial\tau} = 0 \qquad \frac{\partial(\frac{l_A}{l_B})}{\partial\tau} > 0 \tag{20}$$

$$\frac{\partial(\frac{x_A}{x_B})}{\partial\delta} > 0 \qquad \frac{\partial(\frac{l_A}{l_B})}{\partial\delta} > 0 \tag{21}$$

$$\frac{\partial(\frac{l_A}{l_B})}{\partial\kappa} < 0. \tag{22}$$

The comparative statics imply that A's consumption increases relative to child B's, the stronger their relative preferences for consumption θ and the higher relative parental altruism δ. The higher τ, so the stronger A's preference for leisure relative to B's, the more leisure A will have compared to B. Finally, the higher B's wages are relative to A's, the more leisure A will take relative to B.

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 straight forward due to diads at the family level as will be clear in the next section. We therefore kept the model with 2 children.

[9]We could also normalize one preference parameter to one. To avoid a clumsier exposition we decided to keep them as two parameters.

4 Identification and Estimation

Equations (17) and (18) describe the relative expenditure and leisure allocations of sibling A and B which depend on relative preferences θ and τ, as well as on relative parental altruism δ and relative wages κ at a particular point in time. Since we look at preferences of children, we want to relax the assumption that preferences are stable. We assume that relative parental altruism is fixed over time[10]. Let's therefore rewrite equations (17) and (18) with time subscripts on the child specific preference variables as well as the time and consumption allocations

$$\frac{x_{At}}{x_{Bt}} = \frac{\delta^A}{\delta^B} \frac{\theta_t^A}{\theta_t^B} \tag{23}$$

$$\frac{l_{At}}{l_{Bt}} = \frac{\delta^A}{\delta^B} \frac{w_{Bt}}{w_{At}} \frac{\tau_t^A}{\tau_t^B}. \tag{24}$$

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

$$x_{it} = \delta_i \, \theta_{it} \tag{25}$$

$$l_{it} = \delta_i \, \kappa_t^{-1} \, \tau_{it} \tag{26}$$

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 of a particular good at time t. Similarly, we define $l_{it} = l_{At}/l_{Bt}$, $\theta_{it} = \theta_t^A/\theta_t^B$, $\tau_{it} = \tau_t^A/\tau_t^B$ and $\delta_i = \delta^A/\delta^B$ as parents' relative altruism towards child i. We have assumed that relative wages of sibling A and B are constant across children, so that $\kappa_t = w_{At}/w_{Bt}$[11]. Equations (25) and (26) illustrate that relative altruism δ_i affects both relative consumption and relative leisure of sibling pair i positively, so that parents with $\delta^A > \delta^B$ will allocate a higher consumption as well as more leisure to child A, holding θ and τ constant. Further, as becomes clear from the theoretical model, the consumption and work decisions are simultaneous decisions; therefore, regressing relative leisure on relative expenditure, or vice versa, would lead to biased estimates. We use an approach employed by Browning, Bourguignon, Chiappori, and Lechene (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 and accounting for time-invariant heterogeneity, we test whether unobservables from the time allocation decision are correlated with unobservables from the consumption decision.

We model children's relative preferences for consumption and leisure at time t as a function of a vector of observable household and child characteristics $\boldsymbol{X_{it}}$ which include age, gender, rural or urban location, and a time trend; further, we 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 $\varepsilon_{\tau it}$

[10] 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, we assume that relative altruism is stable across time.

[11] We relax this assumption in the empirical section where we proxy wages with years of education.

unobserved by the econometrician, yielding

$$\theta_{it} = \exp\{\beta_{\theta_0} + \beta'_\theta \boldsymbol{X_{it}} + \lambda_{\theta i} + \varepsilon_{\theta it}\} \tag{27}$$

$$\tau_{it} = \exp\{\beta_{\tau_0} + \beta'_\tau \boldsymbol{X_{it}} + \lambda_{\tau i} + \varepsilon_{\tau it}\}. \tag{28}$$

Birth order or relative birth order have proven to be important determinants of within household allocation (Ejrnæs and Pörtner, 2004). It would therefore be a natural candidate to model relative altruism. However, two issues arise with using birth order in our example. First, is is a transformation of the age variables which enter children's preferences, so that due to multicollinearity we are not able to identify the effect. 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[12]. We therefore assume that parents' relative altruism for child A versus child B is a function of an unobservable time invariant individual fixed effect $\lambda_{\delta i}$

$$\delta_i = \exp\{\beta_{\delta_0} + \lambda_{\delta i}\}. \tag{29}$$

Until now we assumed that we 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 the appendix in section 7.1. We know the allocation to the panel child as a fraction of the expenditure category (boys or girls clothes). However, expenditures allocated to the sibling of the panel child are vulnerable to measurement error, since we assume that parents count clothes for household members 18 and over in the adult clothes category. Therefore, we assume that expenditures on child A are correctly measured so that

$$x_A = x_A^* \tag{30}$$

where x_A indicates the data and x_A^* the true expenditure. For child B, however, we have

$$x_B = e^\rho x_B^* \tag{31}$$

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 this into equation (17) and taking logs we 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 independent of the explanatory variables (Wooldridge, 2002). This seems plausible in our 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, we 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

[12]The exclusion restriction requires $\beta_\delta = 0$ in

$$\ln x_{it} - \ln l_{it} = \beta_{\delta 0} + \beta_\delta \boldsymbol{R_i} + \varepsilon_{it}.$$

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). 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. 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. We can use this information to model measurement error ρ as

$$\rho = \beta_{\rho 0} + \beta_\rho \boldsymbol{O_{it}} \tag{32}$$

where $\boldsymbol{O_{it}}$ is equal to the number of older siblings according to case (i) or (ii) in either round.

Plugging (27), (28), (29) and (32) into (25) and (26) and taking logs we get the following structural equations

$$\begin{aligned} \ln x_{it} =& (\beta_{\theta 0} + \beta_{\delta_0} - \beta_{\rho_0}) + \beta'_\theta \boldsymbol{X_{it}} + \beta'_\rho \boldsymbol{O_{it}} \\ &+ (\lambda_{\theta i} + \lambda_{\delta i}) + \varepsilon_{\theta it} \end{aligned} \tag{33}$$

$$\begin{aligned} \ln l_{it} =& (\beta_{\tau_0} + \beta_{\delta_0}) + \beta'_\tau \boldsymbol{X_{it}} \\ &+ (\lambda_{\tau i} + \lambda_{\delta i}) + \varepsilon_{\tau it}. \end{aligned} \tag{34}$$

We can not separately identify the effect of $\ln \kappa_t$ and the coefficient on the time trend contained in $\boldsymbol{X_{it}}$, due to our assumptions on the constant ratio across sibling pairs, so that it is part of $\boldsymbol{X_{it}}$. We then get the two linear reduced forms if estimated by OLS

$$\ln x_{it} = \Pi_{x0} + \Pi'_{x\theta} \boldsymbol{X_{it}} + \Pi'_{x\rho} \boldsymbol{O_{it}} + \epsilon_{xit} \tag{35}$$

$$\ln l_{it} = \Pi_{l0} + \Pi'_{l\tau} \boldsymbol{X_{it}} + \epsilon_{lit}. \tag{36}$$

Identification of $\Pi_{x\theta}$, $\Pi_{l\tau}$ and $\Pi_{x\rho}$ requires that $\boldsymbol{X_{it}}$, R_{it} and $\boldsymbol{O_{it}}$ 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. We test the two following propositions adopted from Browning and Gørtz (2006):

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

Proposition 1 and 2 present the extreme cases and intermediate cases will be a weighted average of the two. The empirical model shows that if 'differences in parental altruism' drive allocations and preferences for leisure and consumption are independent, we 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. However, if heterogeneity is due to 'differences in children's tastes' where $corr((\lambda_{\theta i} + \varepsilon_{\theta i}), (\lambda_{\tau i} + \varepsilon_{\tau i})) < 0$ and $\lambda_{\delta i} = 0$, then we would expect that x_{it} and l_{it} to be negatively correlated.

We jointly estimate equations (35) and (36) for each round of the data using a SUR estimator. 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, the estimate of the fixed effect is inconsistent (Wooldridge, 2002). Second, several of the preference parameters are time invariant; even for more time periods we would only be able to identify a combination of the fixed effect and the coefficient on the time invariant variables.

Inspection of the distribution of x_{it} and l_{it} in figures 1 to 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, we also model relative expenditures and relative leisure as ordered variables, taking on three values

$$v_{it}^{*} = \begin{cases} 1 & \text{if } v_{it} < 1 \\ 2 & \text{if } v_{it} = 1 \\ 3 & \text{if } v_{it} > 1 \end{cases} \tag{37}$$

for $v = l, x$. We 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, we jointly estimate equations (35) and (36) with full information maximum likelihood, assuming that the errors have a bivariate normal distribution, and then test the covariance of the error terms of equations. The estimation is performed using the command `cmp` as developed by Roodman (2009).

5 Empirical Results and Discussion

We start by looking at the unconditional distribution of leisure and consumption. Instead of using the natural logarithm, we follow Browning, Bourguignon, Chiappori, and Lechene (1994) and transform x_{it} and l_{it} using the inverse hyperbolic sine which is defined for the whole real line, linear for low values and very similar to the logarithm for high values. This avoids having highly negative values when relative expenditure and leisure are very low. The results are robust to using the natural logarithm. Figure 5 shows the joint distribution of relative expenditure and leisure overlaid with a linear and a local polynomial regression and a 95 percent confidence interval. The figures that there is a significant negative, fairly linear, relationship between siblings relative consumption and leisure for India, Peru and Vietnam.

For the empirical model, we present results for the different specifications of the dependent variables. Column (1) presents the results for both variables modeled as continuous, column (2) models $\ln x_{it}$ as ordered and $\ln l_{it}$ as continuous, and column (3) models both variables as ordered. The correlation of the residuals are presented following the estimated coefficients.

The correlations of the residuals of a model including an intercept only are shown in table 7 for each of the countries, supporting what figure 5 already suggested. All standard errors are clustered at the 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. The last row of table 7 shows that the correlation is significant for all three models when the data is pooled across countries. The results are 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, and there is no variation in δ_i, 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 as outlined in proposition 2, we would expect x_{it} and l_{it} to be positively correlated.

For the main empirical model we 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 we have more power when testing the correlation of the residuals.

Table 8 shows the basic results for equations (35) and (36) where we include separate intercepts for each of the countries and a time dummy variable. We 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. To impose as few restrictions as possible on sibling-interactions, we first entered dummy variables for all gender combinations, leaving a female-female sibling pair as the base category. We 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, so that we maintain it for all models. With regard to age, we first estimated the model entering the age of child A and B separately and then 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. We can therefore impose the restriction that age affects relative expenditure and leisure through the difference in age of child A and B. When testing these restrictions with a set of likelihood ratio tests, we are not able to cluster standard errors at the child level. As a robustness check we have tested the restrictions estimating the model with OLS, clustering standard errors at the child level, and the results remain equivalent.

Table 9 shows the results of the more parsimonious specification. The results show that the the two variables highly statistically significantly different from zero in both the leisure and the expenditure equation are age and gender, and this hold for any specification of the dependent variables. For interpretational simplicity, taking column (1), we find that an additional year of age difference between A and B increases relative allocations of expenditure between child A and child B by about 3.4 percent and lowers relative leisure of child A and B by the same amount. Additionally, the coefficient on the variable capturing measurement error is negative and marginally insignificant, in line with our conjecture. For mixed sibling pairs, an interesting pattern arises. Boys with a sister appear to receive significantly lower expenditures, but they enjoy significantly higher leisure. 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 which would lead to more equal or less equal expenditure patterns.

The negative correlation in the relative leisure-consumption relationship we observed in the un-

conditional 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 9 shows that the correlation of the residuals remains negative, and is statistically significantly different from zero when estimating the model as a an ordered probit with a linear model, or as two ordered probit equations. 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 discontinous distribution of in particular the expenditure variable, it is quite intuitive that the loss of information when modelling the variable linearly is so substantial for the model not to be able to pick up the correlation. Thus, our preferred specification is column (2). The results, modelling both variables as ordered variables, are very similar.

We perform a battery of robustness checks testing specifications, assumptions and alternative explanations. The correlation of the residuals is presented in table 10.

First, given that we are pooling countries with a range of political, economic and ideological beliefs, we also test whether the results are robust to a fully flexible specification in which we interact all explanatory variables with the country shifters. We find that our findings remain substantively the same for models (1) and (2), with the correlation in column (3) persistent and negative but significant now only at the 11 percent level.

Second, in the theoretical model we 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. We now relax this assumption and rewrite κ_t as κ_{it} where we assume that the relative wage of child B to child A is determined by the relative number of years of schooling of child A and B at time t. We then re-estimate the model including the level of schooling of child A and B separately in the analysis, which does not affect the negative correlation in the residuals. Given that schooling choice is likely to be correlated with factors unobserved by the econometrician, we 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.

Third, 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, with 67 percent of sibling pairs spending equal amounts of hours in school. Eighty percent of sibling pairs have not more than a 20 percent difference, and 92 percent of children have a maximum of a 30 percent difference. As a robustness check, we nevertheless include a third simultaneous equation for schooling, which does not affect the estimated correlation between relative expenditure and relative schooling.

Fourth, the model so far imposed linearity in the age difference effect, implying 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, we test whether the results are sensitive to inclusion of up

to a third order polynomial, and find that it does not affect the residual correlation.

Fifth, family dynamics might be systematically different when non-biological siblings enter the family. We test whether it is these cases that are driving the results by limiting the sample to biological siblings with same mother and same father, excluding 87 observations. The residuals remain negatively correlated.

Sixth, our 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. We include an interaction term between location, age and gender as well as the cross interaction terms to test whether it is gender-age-location specific combinations that are determining time allocations. The residual correlation remains so that we can reject that heterogeneity along gender, age and location in productivity drive the results.

Seventh, we limit the age range of siblings by excluding children below the age of 10 years. We argue that for children below this age group the type of activities they can undertake is likely to be more limited as their productivity is very low, and we would expect differences in preferences to be less developed at an earlier stage. The results suggest that our findings were not driven by sibling pairs with large age gaps which are now excluded, as they are stable even when we drop a large number of children from the sample.

Finally, we aggregate the number of household chores, child care, non-paid work and paid work of children into a work variable. When then we undertake the whole analysis using relative work hours instead of leisure hours as the dependent variable. We would now expect the opposite effects. 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. The results 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. If we use work hours we lose 572 observations (about 20 percent of index children do not work, and about 34 percent of siblings do not work and we can not use a sibling pair if one of the two siblings does not work), which given our sample size is a loss of more than a third of the observations. We therefore prefer to use leisure in the analysis because of the higher number of non-zero observations.

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. We tested the predictions of the model with a panel data set of children from Peru which contains detailed information on time use and allocations of assignable goods for sibling pairs. We found that even after conditioning on observable variables, the residuals of these simultaneous decisions remain 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 parent's relative altruism. Families appear to function as market economies in which children trade off leisure and consumption and get rewarded accordingly. To our knowledge, this is the first paper that theoretically and empirically models within sibling distribution of preferences and consumption goods. The findings of this paper present evidence that children, even in relatively poor settings, have a sense of agency. Policies to improve outcomes of children who grow up in poor families should therefore focus on allowing for more choices for children, rather than restricting their choice set. Given the stringent data requirement, we were able to undertake this analysis for families with two children between the ages of 6-17 years in four developing countries. Future research should focus on extending the analysis to families with more than two children and application to further countries.

7 Appendix

Table 2: Children's time use and choice

	Ethiopia n=143		India n=394		Peru n=177		Vietnam n=430	
	named activity (1)	own choice (2)	named activity (3)	own choice (4)	named activity (5)	own choice (6)	named activity (7)	own choice (8)
school	0.89	0.33	0.91	0.58	0.98	0.64	0.95	0.35
homework/tuition	0.50	0.46	0.82	0.66	0.95	0.80	0.84	0.81
caring for younger children from hh	0.02	0.33	0.01	1.00	0.02	0.33	0.02	0.75
caring for elderly or sick family mem	0.01	0.00	0.02	0.83	0.01	1.00	0.00	1.00
domestic chores within the home	0.67	0.41	0.28	0.85	0.47	0.63	0.66	0.80
collecting firewood or water for hh	0.24	0.26	0.13	0.75	0.03	0.40	0.02	0.63
caring for animals belonging to hh	0.22	0.28	0.02	0.33	0.07	0.58	0.09	0.74
working on hh's farm	0.05	0.14	0.02	0.56	0.05	0.63	0.03	0.73
visiting place of worship	0.03	0.80	0.01	1.00			0.00	
leisure time with friends	0.36	0.90	0.70	0.94	0.03	1.00	0.51	0.95
playing computer games	0.01	1.00	0.03	1.00	0.01	1.00	0.03	0.92
watching tv	0.14	0.65	0.55	0.92	0.58	0.95	0.64	0.96
paid work outside household	0.01	0.00	0.04	0.71			0.01	1.00
taking younger children to creche	0.05	1.00	0.00	1.00	0.00		0.08	1.00
visiting relatives	0.02	1.00	0.06	0.96	0.02	1.00		
sick at home	0.01	0.00	0.01	0.67			0.00	
going to the market	0.02	0.33	0.03	0.60			0.02	0.71
playing with pets	0.01	0.00	0.00	0.00			0.00	1.00
other	0.06	0.56	0.06	0.73	0.06	0.91	0.08	0.72
playing with younger children			0.24	0.97	0.04	0.86	0.01	1.00
using the internet			0.00	1.00	0.06	0.91	0.00	1.00
making handicrafts (for sale)					0.02	1.00	0.01	0.25
household chores for another fam mem					0.01	1.00		
selling things					0.01	1.00		
playing at home					0.25	0.95		
playing in the street					0.32	0.93		
playing in the playground					0.07	0.75		
accompanying another pers to work					0.07	0.62		
					0.00			
Average own choice		0.45		0.77		0.78		0.74

Notes: Data from round 2 of Young Lives Data. Children were asked to name activities they undertook the day before the survey and whether it was the child's choice to do that activity. Odd numbered columns show the percentage of children naming a particular activity; even numbered columns show the fraction of children who stated it was their choice to do the particular activity they listed.

Table 3: Relationship of Sibling to Panel Child

	Ethiopia	India	Peru	Vietnam
brother/sister (both parents the same)	0.764	0.991	0.900	0.987
half-sibling (same father)	0.005		0.004	0.005
half-sibling (same mother)	0.085		0.059	0.002
adoptive brother/sister	0.005			0.002
uncle/aunt	0.035		0.015	
cousin (including cousin-brother & cousin	0.070	0.007	0.015	0.005
nephew/niece	0.010	0.002	0.007	
brother/sister-in-law (spouse of sibling)	0.010			
other relative	0.010			
servant (farm-worker, maid, etc.)	0.005			

Table 4: Panel Child Characteristics

	2006				2009			
	mean	sd	min	max	age	sd	min	max
Ethiopia								
Age	11.49	0.50	11	12	14.50	0.50	14	15
Male	0.45	0.50	0	1	0.53	0.50	0	1
School	5.99	1.24	4	10	6.23	1.35	3	10
Study	1.89	0.93	0	5	2.25	1.23	0	7
Play	3.25	1.48	1	8	2.69	1.53	1	8
Child Care	0.11	0.40	0	2	0.38	0.75	0	4
Household chores	2.44	1.59	0	8	2.58	1.47	0	6
Non Paid	0.80	1.46	0	5	0.98	1.68	0	8
Paid	0.11	0.59	0	4	0.21	0.89	0	6
Sleep	9.17	1.03	6	12	8.67	1.17	5	11
	n=95				n=104			
India								
Age	11.72	0.45	11	12	14.69	0.46	14	15
Male	0.51	0.50	0	1	0.52	0.50	0	1
School	6.89	1.06	4	10	8.26	1.29	1	13
Study	2.33	1.44	0	8	2.68	1.27	0	7
Play	3.86	1.81	1	9	3.58	1.45	1	8
Child Care	0.08	0.30	0	2	0.18	0.43	0	3
Household chores	0.69	0.80	0	4	1.11	0.96	0	4
Non Paid	0.06	0.28	0	3	0.10	0.45	0	3
Paid	0.00	0.00	0	0	0.04	0.36	0	5
Sleep	8.92	0.89	6	11	8.05	0.92	5	10
	n=285				n=269			
Peru								
Age	11.88	0.44	11	13	14.41	0.57	13	17
Male	0.62	0.49	0	1	0.59	0.49	0	1
School	5.57	0.70	5	9	6.52	0.94	5	10
Study	2.14	0.94	0	6	2.42	0.94	0	6
Play	2.41	1.09	1	7	3.30	1.32	1	7
Child Care	0.34	0.67	0	4	0.49	1.05	0	6
Household chores	0.95	0.61	0	3	1.32	0.84	0	4
Non Paid	0.24	0.71	0	4	0.32	0.81	0	4
Paid	0.06	0.43	0	3	0.05	0.24	0	2
Sleep	9.24	1.01	6	12	8.92	1.02	6	12
	n=141				n=130			
Vietnam								
Age	11.71	0.47	11	13	14.72	0.46	14	16
Male	0.53	0.50	0	1	0.46	0.50	0	1
School	4.59	0.63	2	8	5.48	0.86	4	10
Study	3.00	1.57	0	8	3.99	1.56	1	8
Play	5.92	1.83	1	10	4.03	1.47	1	8
Child Care	0.08	0.32	0	2	0.07	0.34	0	2
Household chores	1.11	0.82	0	5	1.42	0.78	0	4
Non Paid	0.47	1.07	0	6	0.46	1.08	0	9
Paid	0.02	0.25	0	3	0.03	0.37	0	6
Sleep	8.81	0.79	7	11	8.54	1.04	5	12
	n=256				n=272			

Notes: Activities are measured in hours.

Table 5: Sibling Characteristics

	2006				2009			
	mean	sd	min	max	age	sd	min	max
Ethiopia								
Age	12.31	3.71	6	17	11.76	2.47	6	17
Male	0.55	0.50	0	1	0.63	0.49	0	1
School	6.07	1.44	4	11	6.16	1.26	4	10
Study	1.75	1.12	0	5	1.76	1.03	0	6
Play	3.34	1.76	1	8	3.40	1.61	1	8
Child Care	0.06	0.24	0	1	0.11	0.42	0	2
Household chores	2.09	1.77	0	8	2.02	1.46	0	6
Non Paid	1.11	1.82	0	6	1.38	2.00	0	7
Paid	0.16	0.76	0	4	0.06	0.44	0	4
Sleep	9.11	1.12	7	12	9.11	1.34	6	12
		n=95			n=104			
India								
Age	11.58	3.03	6	17	13.18	2.48	6	17
Male	0.56	0.50	0	1	0.61	0.49	0	1
School	6.84	1.07	3	10	8.11	1.02	5	12
Study	2.34	1.51	0	9	2.16	1.06	0	5
Play	4.08	1.97	1	12	4.20	1.50	1	9
Child Care	0.05	0.24	0	2	0.12	0.38	0	2
Household chores	0.53	0.74	0	3	0.74	0.82	0	4
Non Paid	0.04	0.23	0	2	0.05	0.25	0	2
Paid	0.01	0.12	0	2	0.01	0.12	0	2
Sleep	9.01	1.00	6	12	8.62	0.86	6	11
	n=285				n=269			
Peru								
Age	11.73	3.46	6	17	12.17	3.13	6	17
Male	0.55	0.50	0	1	0.51	0.50	0	1
School	5.52	0.78	4	10	6.28	0.97	4	10
Study	2.21	1.01	0	6	2.37	0.97	0	6
Play	2.44	1.20	1	6	3.52	1.21	1	7
Child Care	0.18	0.47	0	3	0.06	0.37	0	3
Household chores	0.89	0.73	0	4	1.27	0.89	0	5
Non Paid	0.19	0.58	0	3	0.25	0.79	0	4
Paid	0.11	0.57	0	4	0.07	0.47	0	5
Sleep	9.26	1.10	7	12	9.16	1.11	6	13
	n=141				n=130			
Vietnam								
Age	12.12	3.60	6	17	11.97	3.54	6	17
Male	0.56	0.50	0	1	0.56	0.50	0	1
School	4.73	1.08	3	10	5.24	1.04	3	10
Study	2.96	1.77	0	8	3.47	1.63	0	9
Play	0.04	0.24	0	2	4.97	1.81	1	11
Child Care					0.02	0.18	0	2
Household chores	0.93	0.92	0	4	0.92	0.86	0	5
Non Paid	0.39	0.97	0	6	0.31	0.90	0	6
Paid	0.01	0.16	0	3	0.03	0.38	0	6
Sleep	8.84	1.00	6	12	9.11	1.16	5	12
	n=356				n=272			

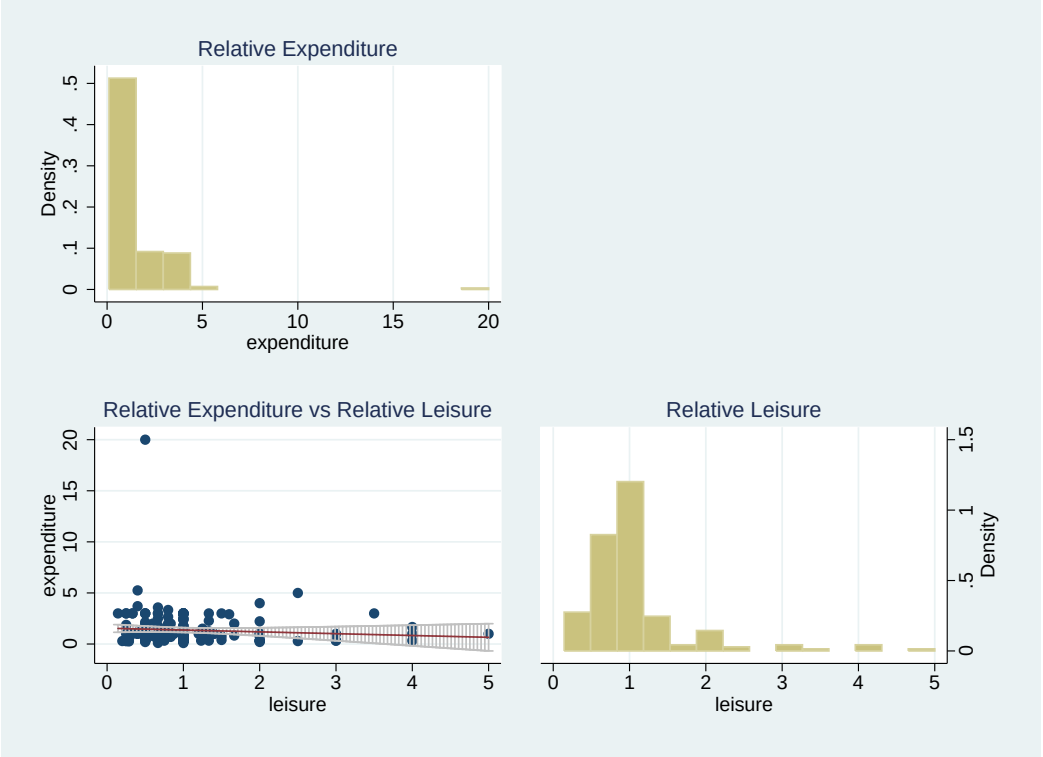
Notes: Activities are measured in hours.

Table 6: Clothes Expenditure per child

Ethiopia	2006				2009			
	mean	sd	min	max	mean	sd	min	max
Ethiopia								
Index Child								
Clothes	75.9	52.5	7.5	337.5	164.9	166.3	4.25	1000
male	72.0	50.7	7.5	235	151.9	121.1	4.25	600
female	79.2	54.3	19	337.5	179.4	206.0	25	1000
Sibling								
Clothes	112.3	114.2	2.5	640	159.7	158.9	12.75	750
male	123.2	134.2	2.5	640	169.2	161.3	12.75	710
female	99.2	83.6	5	400	143.9	155.7	20	750
India								
Index Child								
Clothes	584.1	424.8	50	2500	1104.4	1133.6	100	13500
male	603.5	412.3	120	2500	1072.9	666.3	200	5000
female	564.3	437.7	50	2500	1138.6	1485.4	100	13500
Sibling								
Clothes	655.0	550.9	60	5000	1285.7	1287.4	50	15000
male	584.5	538.7	60	5000	1260.8	1027.2	50	8000
female	745.2	555.3	100	3000	1325.3	1621.8	100	15000
Peru								
Index Child								
Clothes	106.2	91.1	6	750	162.4	201.8	8	1300
male	104.3	73.2	6	300	157.8	218.6	8	1300
female	109.1	114.9	20	750	169.0	176.5	10	1000
Sibling								
Clothes	108.2	90.6	9	525	138.7	156.1	8	1000
male	107.7	95.6	15	525	161.4	244.0	15	1500
female	108.7	85.0	9	500	149.9	203.7	8	1500
Vietnam								
Index Child								
Clothes	198.4	189.9	15	2000	489.4	790.4	20	10000
male	180.6	151.9	45	1500	489.9	712.1	37.5	7000
female	218.6	224.2	15	2000	488.9	854.7	20	10000
Sibling								
Clothes	212.0	231.7	15	3000	408.7	767.7	12.5	10000
male	220.8	284.8	15	3000	383.6	613.4	12.5	7000
female	200.5	135.0	30	750	440.2	926.7	20	10000

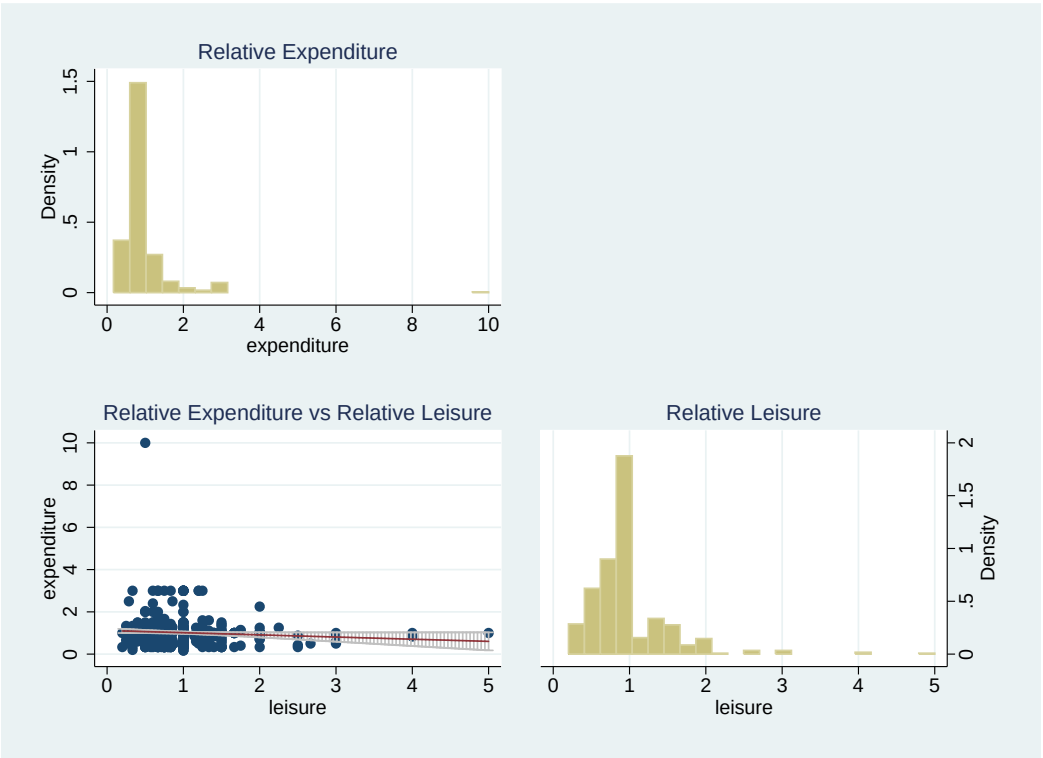
Notes: Measured in local currencies.

Figure 1: Relative Leisure and Consumption in Ethiopia



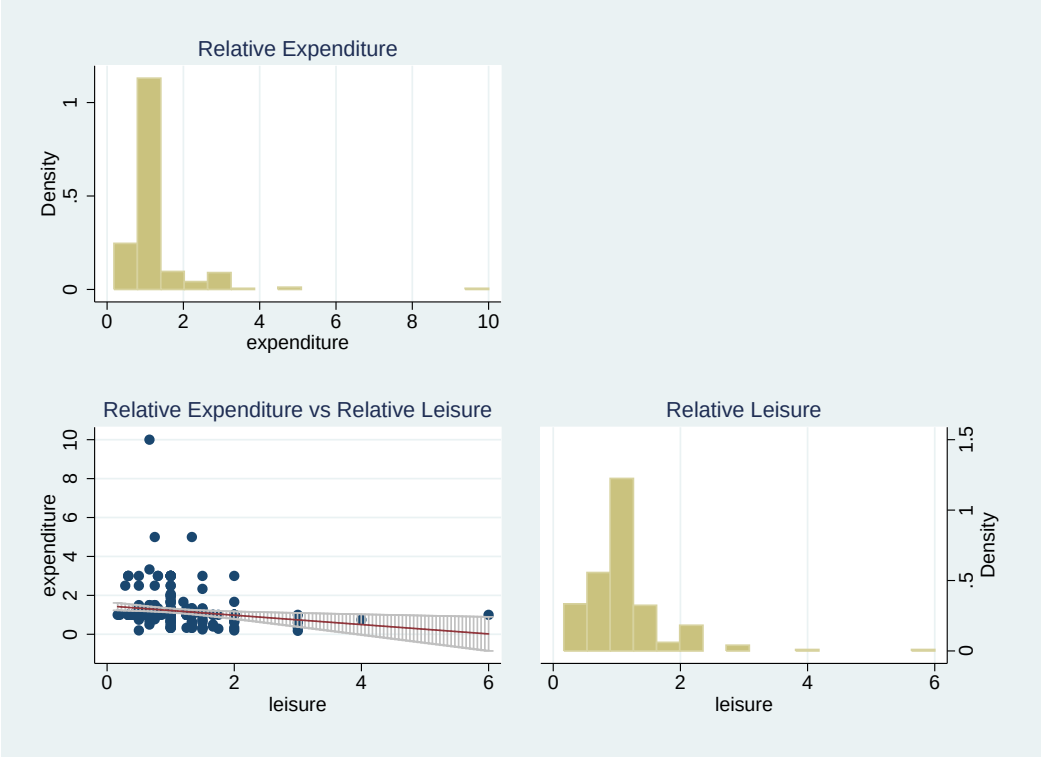
Notes: Linear regression of relative leisure on relative consumption with 95% confidence interval in the south-west panel.

Figure 2: Relative leisure and consumption in India



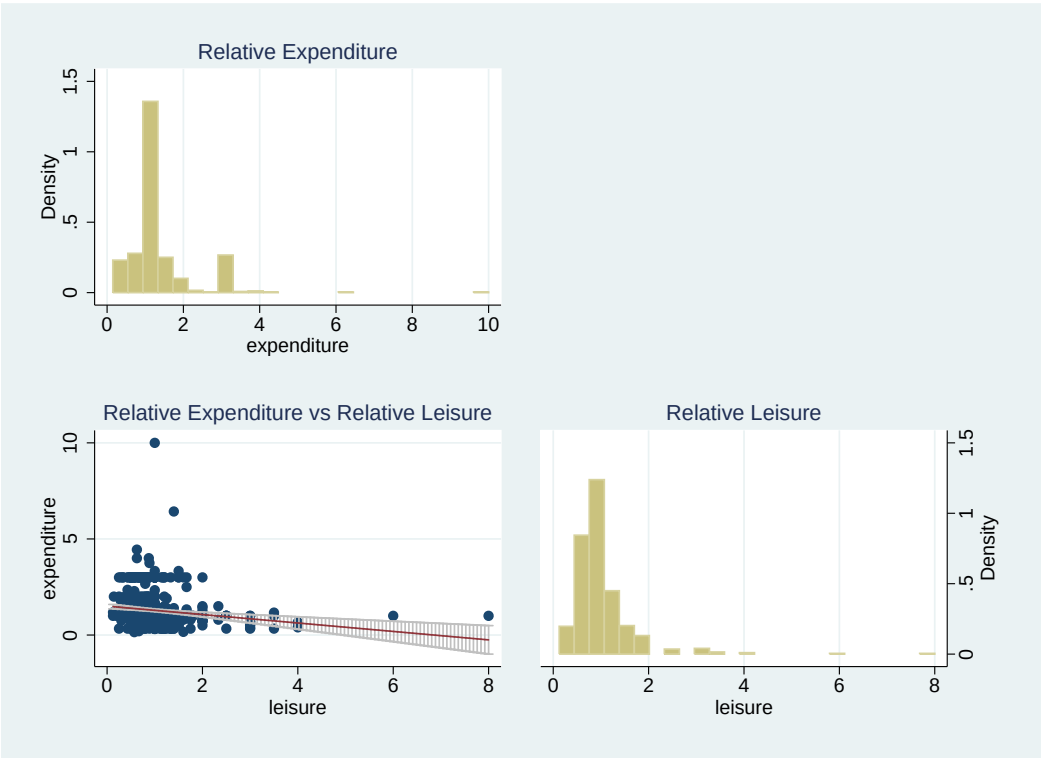
Notes: Linear regression of relative leisure on relative consumption with 95% confidence interval in the south-west panel.

Figure 3: Relative Leisure and Consumption in Peru



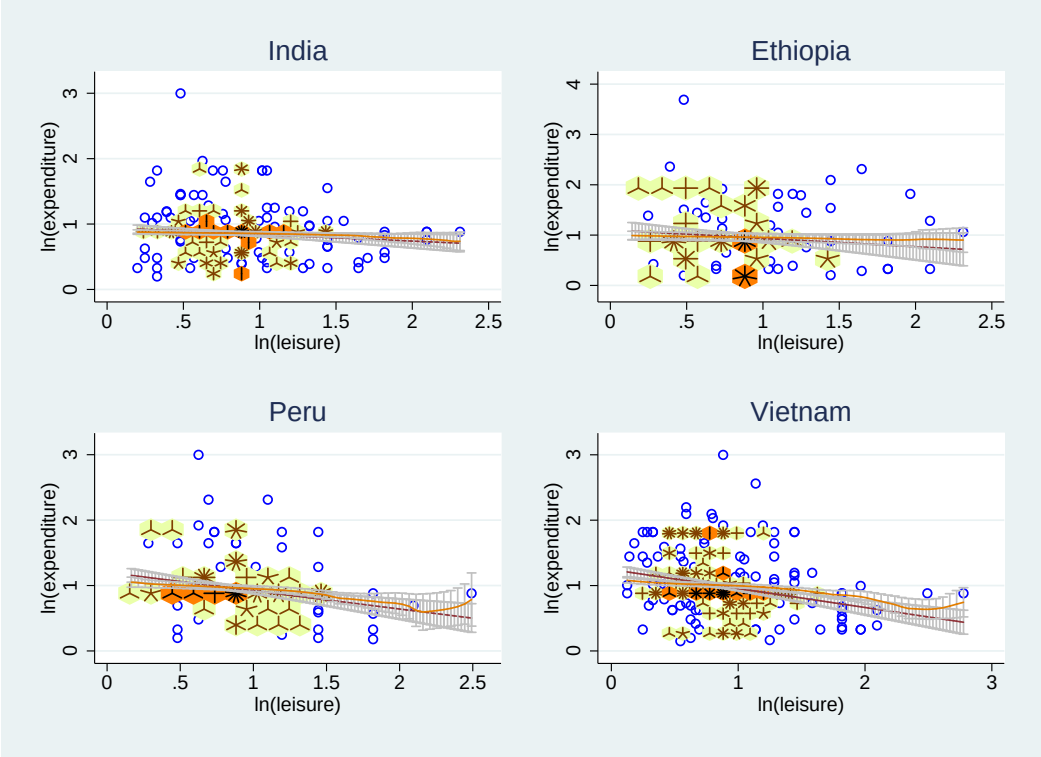
Notes: Linear regression of relative leisure on relative consumption with 95% confidence interval in the south-west panel.

Figure 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.

Figure 5: Unconditional joint distribution of $\ln x_{it}$ and $\ln l_{it}$



Notes: Circles represent individual data points; in a light sunflower each petal represents one observation; in a dark sunflower, each petal represents four observations; overlaid are a linear regression and local polynomial regression with 95% confidence intervals.

Table 7: Correlation ρ of residuals of an intercept-only model

	$\ln x$ cont $\ln l$ cont	x categ $\ln l$ cont	x categ l categ
	(1)	(2)	(3)
Ethiopia (n=199)	-.1072	-.125	-.1581
	(.0778)	(.0847)	(.0939)*
India (n=554)	-.077	-.1180	-.114
	(.0379)**	(.0470)**	(.0543)**
Peru (n=271)	-.238	-.2901	-.2937
	(.0569)***	(.0646)***	(.0782)***
Vietnam (n=628)	-.2243	-.2955	-.3798
	(.0346)***	(.0416)***	(.0466)***
Pooled (n=1652)	-.1594	-.2064	-.2471
	(.0242)***	(.0273)***	(.0305)***

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

Table 8: Base Model

	$\ln x$ cont $\ln l$ cont	x categ $\ln l$ cont	x categ l categ
	(1)	(2)	(3)
Relative Expenditure			
A's age	0.017 (0.02)	0.078 (0.059)	0.078 (0.059)
B's age	-.036 (0.003)***	-.125 (0.009)***	-.125 (0.009)***
A=male, B=male	-.012 (0.029)	0.006 (0.068)	0.006 (0.068)
A=male, B=female	-.003 (0.03)	0.071 (0.085)	0.071 (0.085)
A=female, B=male	0.044 (0.028)	0.304 (0.08)***	0.304 (0.08)***
Urban	0.029 (0.022)	0.097 (0.066)	0.097 (0.066)
Measurement Error	-.129 (0.032)***	-.377 (0.1)***	-.378 (0.099)***
Obs.	1652	1652	1652
R^2	0.1507	0.0856	0.0856
Relative Leisure			
A's age	-.018 (0.015)	-.018 (0.015)	-.045 (0.059)
B's age	0.035 (0.002)***	0.035 (0.002)***	0.154 (0.009)***
A=male, B=male	0.001 (0.02)	0.001 (0.02)	0.09 (0.085)
A=male, B=female	0.07 (0.022)***	0.07 (0.022)***	0.341 (0.087)***
A=female, B=male	-.071 (0.021)***	-.071 (0.021)***	-.263 (0.082)***
Urban	-.006 (0.018)	-.006 (0.018)	-.011 (0.069)
Obs.	1652	1652	1652
R^2	0.1877	0.1877	0.1143
Correlation ρ	-.0302 (.0258)	-.0504 (.0289)*	-.0571 (.0336)*

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.

Table 9: Parsimonious Model

	$\ln x$ cont $\ln l$ cont	x categ $\ln l$ cont	x categ l categ
	(1)	(2)	(3)
Relative Expenditure			
Relative Age	0.034 (0.003)***	0.118 (0.009)***	0.118 (0.009)***
A=male, B=male	-.026 (0.02)	-.130 (0.053)**	-.130 (0.053)**
Diff A=male, B=female	-.024 (0.011)**	-.119 (0.043)***	-.119 (0.043)***
Urban	0.026 (0.022)	0.078 (0.065)	0.079 (0.065)
Measurement Error	-.131 (0.032)***	-.386 (0.1)***	-.388 (0.1)***
Obs.	1652	1652	1652
R^2	0.1403	0.0800	0.0800
Relative Leisure			
Relative Age	-.034 (0.002)***	-.034 (0.002)***	-.148 (0.009)***
A=male, B=male	0.001 (0.015)	0.001 (0.015)	0.058 (0.065)
Diff A=male, B=female	0.069 (0.012)***	0.069 (0.012)***	0.276 (0.05)***
Urban	-.005 (0.018)	-.005 (0.018)	-.003 (0.068)
Obs.	1652	1652	1652
R^2	0.1777	0.1822	0.1103
Correlation ρ	-.040 (.0264)	-.058 (.0288)**	-.066 (.0337)**

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.

Table 10: Robustness Checks

	$\ln x$ cont $\ln l$ cont	x categ $\ln l$ cont	x categ l categ
	(1)	(2)	(3)
Full set of interaction effects (n=1652)	-.0330	-.0549	-.0545
	(.0259)	(.02842)*	(.03402)
Education included (n=1623)	-.0337	-.0542	-.0652
	(.0266)	(.0292)*	(.0335)*
Schooling as simultaneous choice (n=1652)	-.0401	-.0587	-.0663
	(.0264)	(.0288)**	(.0337)*
Non-linear age effect (n=1652)	-.0415	-.0588	-.0674
	(.0266)	(.028)**	(.0338)**
Biological siblings only (n=1565)	-.0400	-.0641	-.0598
	(.025)	(.0288)**	(.0343)*
Age specific productivity (n=1652)	-.0407	-.0598	-.0645
	(.0265)	(.0289)**	(.0338)*
11-18 year olds only (n=1063)	-.0547	-.0665	-.0666
	(.0349)	(.0362)*	(.0401)*
Work as dependent variable (n=1080)	.0438	.0652	.0827
	(.0323)	(.0343)*	(.0420)*

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.

7.1 Measurement Error

Measurement error in the expenditure data is due to the fact that we only know the allocation to child A with certainty, while we assign the remainder of children's expenditures to child B. In the presence of older siblings 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 we discuss cases for three children, A, B and C to illustrate when we can and can not identify expenditure shares.

Table 11: Identified Cases

	A	B	C	male x	female 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 12: Under-identified Cases

	A	B	C	male x	female 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.

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