Understanding Sibling Differences in Child Labor*

Forthcoming in the Journal of Population Economics

Eric V. Edmonds
Department of Economics
Dartmouth College
and the National Bureau of Economic Research

Address:
6106 Rockefeller Hall
Hanover NH 03755
fax: (603) 646-2122
email: eedmonds@dartmouth.edu

Abstract: This study considers sibling differences in child labor in Nepal. The data are consistent with a model where parents care equally for all children but siblings differ in comparative advantage in household production, although parental preferences and credit constraints could also be important. Girls, especially older girls, tend to work more than their brothers. This extra work is increasing in the number of younger siblings and the spacing between siblings. The extra work performed by girls is such that at the modal birth spacing, the younger girl actually spends significantly more time working than her older brother.

Keywords: Gender, Birth Order, Household Production, Investments in Children

JEL Classification: O15, D13, J13

This version: January 2005

*This research has benefited from the comments of Deborah Cobb-Clark, three anonymous referees, Douglas Miller, Nina Pavcnik, and Bruce Sacerdote as well as seminar participants at Dartmouth College and NEUDC. I am grateful to Andreea Gorbatai for her able research assistance, and I appreciate Keshev Karmacharya's help in acquiring the data used in this paper. First draft: October 2000. Correspondence to: Eric Edmonds, 6106 Rockefeller Hall, Department of Economics, Dartmouth College, Hanover NH 03755 USA, eric.edmonds@dartmouth.edu.

1. Introduction

Recent studies of the determinants of child labor emphasize the role played by extreme deprivation (Basu and Van 1998), credit market imperfections (Baland and Robinson 2000), and parental preferences (various papers – see Basu 1999 for a survey). Many empirical studies of child labor document differences in child labor supply across siblings, and these sibling differences are sometimes cited as support for the idea that parental attitudes are an important determinant of why children work (Patrinos and Psacharopoulos 1997, Binder 1998, and Ejrnæs and Pörtner 2000). However, child labor is most prevalent in the world's poorest nations (Edmonds and Pavcnik 2005), and households in these countries consume a significant quantity of non-traded, home produced goods (Locay 1990).

In this paper, I consider how the household production of non-traded goods generates sibling differences in child labor even when parents care equally about their children. My purpose is not to argue against a role for parental preferences in child labor. Rather, I am interested in whether there is an economic explanation for the patterns of sibling differences in child labor that are often ascribed to parental preferences. Home production leads to sibling differences in child labor that exploit comparative advantage. For example, older children are better at caring for other children than are the youngest children in the household. If comparative advantage is increasing in the age spacing between siblings ("the age gap"), the difference between siblings in hours worked increases in the age gap. If genders differ in their return to schooling or their productivity in household production, the model predicts an association between child labor and sibling sex composition.

I examine the implications of the comparative advantage model in data on sibling differences in child labor from the 1998/1999 Nepali Labor Force Survey. In my analysis, I focus on children between the ages of 6 and 15. Children in this age group work on average 14.9 hours per week. I estimate the conditional expectation of hours worked in the last week for children with different sibling environments. Comparing hours worked across siblings is difficult, because households choose their members. Sibling composition varies with both child and household characteristics. I employ nonparametric methods and flexible functional forms to concentrate my analysis on sibling environments that appear most comparable, although I cannot address the potential endogeneity of household composition.

When I compare siblings in the same household and control for differences between siblings associated with age and gender, the labor activities of girls are more sensitive to sibling composition than are the labor activities of boys. The oldest girl in a household works on average 2.6 hours per week more than any other sibling in the household. It is not just the oldest girl who works more. "Age rank" is defined as a child's birth order among resident siblings (non-resident siblings are not observed in the data). The age rank of the oldest child in the household is one, the second oldest is two, etc. An increase in age rank by one for a female is associated with 2.8 hours less work on average. Moreover, the magnitude of the difference between steps in age rank depends on the total number of resident siblings and the age gap between siblings. For example, in a household with four children, the oldest resident girl works 4.2 more hours per week than the second oldest girl. However, in a household with six or more children, the oldest girl works 9.8 hours more her next oldest resident sister. The extra work performed by an oldest girl increases by 2 hours with each additional year separating the oldest girls and her sister.

I consider the type of work performed by children. Most of the observed sibling differences associated with age rank appear in time spent in domestic work such as cooking, cleaning, childminding, or caring for other household members. I also consider the association between the gender of siblings and the economic activities of children. Both boys and girls work more with younger brothers than with younger sisters. For boys, additional younger sisters are not associated with additional work whereas for girls both younger sisters and brothers are associated with more domestic work. However, the presence of younger brothers increases the time spent in market work for both older boys and girls. This appears to explain why I observe more time in total hours of work associated with younger boys. That is, additional younger siblings bring additional domestic work to the household, but a boy adds additional market work for his older siblings. This additional market work with younger boys may reflect additional financial resources needed to support a boy.

The paper is structured as follows. In the next section, I show how the presence of a non-tradable good can lead to sibling differences in child labor. This paper does not attempt to test between this household production explanation for how siblings affect the economic activities of children and other explanations such as parental preferences or credit constraints. Section 3 presents the data and discusses the methodology used to explore the relationship between sibling composition and child labor. My aim in the empirical work of this paper is to explore how both the amount and type of child labor vary across different sibling structures. Section 4 presents the main patterns in the data and section 5 concludes with a discussion of how these patterns in sibling differences in child labor would be explained by a household production model.

2. Sibling composition in a model with household production

I explore the impact of siblings on child labor in a model with a single decision maker choosing to allocate each child's time between work (L) and schooling (E). Children are labeled $i=1, 2, \dots, N$. My analysis focuses on how siblings affect the allocation of child time. Thus, the analysis is conditional on the number of siblings within the household (N). This exercise can be viewed as the second stage of a problem faced by the household decision maker who chooses the number of children in the household in the first stage. Implicitly, I assume that children cannot borrow to finance their education, nor can they use their labor earnings to pay for their own schooling. This simplifying assumption does not affect the basic, comparative advantage result of this section. In the empirical work, I consider only differences across resident siblings within a given household of a given size. Thus, in developing the theoretical framework, I abstract from problems of parental labor supply or household formation.

Each child i is endowed with total time $T_i = E_i + L_i$. The household chooses to have a child work today or attend school. Conditional on household characteristics, H, child labor today leads to consumption today through a process represented by the function h: $c = h(L_1, L_2, ..., L_N; H)$. As is typical in the household production literature, I assume that *h* has positive, diminishing marginal products in each type of labor. The function *h(-)* is the production function for the composite commodity *c*. In making *c*, child *i*'s labor may be allocated to the production of several different goods (some purchased, some produced solely within the household) that produce the composite commodity.

If a household chooses to send child *i* to school, the present value of the child's future well-being from having attended school for E_i hours is $R_i(E_i)$. I assume positive diminishing returns to education. The purpose of this model is to generate sibling differences in child labor without parental preferences that favor certain children. I implement this in the model by defining *w* as the sum of the returns to education across children: $w = \sum_{i=1}^{N} R_i(E_i)$. I interpret *w* as the present value of the future welfare of the resident children in the household. Parental preferences are defined over the space of consumption today and the sum of their children's future welfare. Parental preferences are conditional on household characteristics *H*. Let the function $U(c, w; H)$ represent these preferences. Plugging in for *c* and *w*, then substituting the time constraints, the household's problem is to choose the labor supply of each child:

$$U(c, w) = U\left(h(L_1, L_2, ..., L_N; H), \sum_{i=1}^{N} R_i(T_i - L_i); H\right) \tag{1}$$

The household solves (1) such that for each child, the household's marginal rate of substitution between consumption today and the welfare of its children tomorrow equals the marginal rate of transformation between the child time devoted to education and child labor devoted to household production:

$$\frac{\partial U(c, w; H) / \partial c}{\partial U(c, w; H) / \partial w} = \frac{\partial R_i(E_i) / \partial E_i}{\partial h(L_1, L_2, ..., L_N) / \partial L_i} \tag{2}$$

The left hand side of (2) does not vary across children. Thus, if I compare any two children in the household, the ratio of their marginal products of labor in household production equals the ratio of their marginal returns to education:

$$\frac{\partial h\left(L_1, L_2, ..., L_N; H\right) / \partial L_i}{\partial h\left(L_1, L_2, ..., L_N; H\right) / \partial L_j} = \frac{\partial R_i\left(E_i\right) / \partial E_i}{\partial R_j\left(E_j\right) / \partial E_j} \qquad (3)$$

This simple model has strong implications for the impact of the sibling sex and age composition on child labor. In a different model without household production or credit constraints, the amount of child labor is determined by market rates of return on investment in schooling. I expect gender differences in child labor if boys and girls have different opportunity costs of time (returns to education), but gender differences do not vary with the sex or age composition of siblings. In a model with credit constraints but without household production, Garg and Morduch (1998) show that both boys and girls benefit from having fewer siblings with greater returns on investments. In the model of this paper, regardless of the presence of credit constraints, the existence of household production implies that the age and sex composition of siblings affects a child's labor supply.[1]

Consider several examples. First, assume the return to education is the same for both children ($R_i\left(E\right) = R_j\left(E\right)$ for all *E*) and that children get better in household production as they age ($\partial h\left(L_1, L_2, ..., L_N; H\right)/\partial L_i > \partial h\left(L_1, L_2, ..., L_N; H\right)/\partial L_j$ when $L_i = L_j$ for all *L* if *i* is older than *j*). The older child (with the lower age rank) will tend to work more even after controlling for a child's opportunity set at a given age, because the older child (lower age rank) has comparative advantage in household production. Further, if productivity in household production is increasing in age, child labor differences between sibling *i* and *j* should increase as their difference in age increases.

Consider a second example. Both children have equal productivities in household production ($\partial h\left(L_1, L_2, ..., L_N; H\right) / \partial L_i = \partial h\left(L_1, L_2, ..., L_N; H\right) / \partial L_j$ when $L_i = L_j$), but at a given level of education, child *i*'s return to education is greater than child *j*'s return ($\partial R_i\left(E\right) / \partial E_i > \partial R_j\left(E\right) / \partial E_j$ for all *E*). This might follow if *i* and *j* differ in gender. Women in Nepal are much less likely to work outside of the household, and some researchers such as Shakti (1995) have posited that the return to female education in Nepal may be very low. In this case, if *j* is a girl, *i* must lower its household production and increase its education in order to maintain the household equilibrium (3). Thus, if the return to education for boys is greater than the return to education for girls, I will observe boys performing less work and receiving more education.

What about a combination of these two examples? Consider the case where child *j* has a lower return to education at a given level of education ($\partial R_i\left(E\right) / \partial E_i > \partial R_j\left(E\right) / \partial E_j$), but at a given level of labor, child *j* has a higher marginal product in household production because child *j* is older (has a lower age rank - $\partial h\left(L_1, L_2, ..., L_N; H\right) / \partial L_i < \partial h\left(L_1, L_2, ..., L_N; H\right) / \partial L_j$ when $L_i = L_j$). This situation exacerbates the differences between child *i* and child *j*. Child *j* must shift even more labor away from schooling and child *i* to schooling in order to maintain the household equilibrium (3). Consider the following example. Child *j* is female. If it were possible to take away an older female sibling and replace her with a younger female sibling, child *j* would have to work more because of comparative advantage in household production. If that younger female sibling was replaced with a younger male sibling and men have greater returns to education than women, then the younger male child's comparative advantage in education further induces child *j* to work even more than when her younger sibling was a girl (who would share more household duties). Moreover, this thought experiment of switching a sibling from an older sister to a younger brother would increase age rank differences more for a girl than a boy (assuming all boys have the same return on investments in education).[2] Hence, incorporating household production allows for same sex substitution of labor and age rank and age gap effects. All of which mean that siblings benefit differently from changing the composition of siblings.

3. Data and Methodology

The model in the previous section is a causal model: it implies that changes in sibling composition cause changes in the economic activities of children. However, my empirical work aims to document the statistical association between variation in the economic activities of children and sibling composition without addressing the endogeneity of household composition that has been the focus of other work (Edmonds, Mammen, and Miller 2005). Most of the variation in child labor associated sibling composition appears to be in household production.

I explore the relationship between sibling composition and child labor using the 1998/99 Nepal Labor Force Survey (NLFS). The NLFS is a nationally representative cross-sectional household survey interviewing 71,560 people residing in 14,355 households (CBS 2000). Nepal provides a good setting for the study of child labor and sibling composition. To begin with, child labor is endemic in Nepal. According to the NLFS, 55% of children ages 6-15 engage in some form of economic activity. Girls are more likely to engage in economic activity (66%) as are children living in rural areas (57%). Second, child labor in Nepal is an important international policy issue. Literacy rates are extremely low in Nepal (84% of adult women over the age of 20 report being unable to read) as is school attendance (37% of girls age 6 to 15 do not attend school). Nepal is one of the first developing countries to pass legislation banning work for children outside of the home. Thus, substantial political attention is directed towards child labor in Nepal. Third, sibling sex composition is likely to be an important issue. Men and women face very different labor market opportunities, and boys and girls generally perform different tasks.

[insert table 1 here]

For each household member over the age of five, the NLFS records the hours spent during the last seven days in sixteen different types of activities. Table 1 reports the mean hours worked in the last seven days in each category for resident children between the ages of six and fifteen.[3] I group the economic activities recorded in the NLFS into two categories: market work and domestic work. Market work includes activities in which a Nepali household might employ outside labor: wage employment, self-employment, agriculture, milling and food processing, handicrafts, construction, and "other work activities". Market work takes place inside or outside the household (the NLFS does not distinguish between the two). Domestic work includes food preparation, cleaning, minor household repairs, shopping, caring for household members (old, sick, infirm, children), community service, fetching water, and collecting firewood. Column 1 considers the composition of total hours worked for all children in the survey. In this study, I limit my analysis to children of the household head, for they are the only children for whom I can identify siblings. Because of this data limitation, an implicit assumption throughout my analysis is that non-sibling household composition does not interact with sibling attributes in affecting child labor supply. Column 2 describes the economic activities of children of the household head. My analysis is based on comparing the time allocation of different siblings within a household. Thus, I am limited to children in households with more than one child. The economic activities of the 14,394 sampled children analyzed in this study are detailed in column 3. Columns 4 and 5 bifurcate this group by gender. Later in the paper, I limit my sample to children with younger siblings; their activities are described in column 8.

Children of the household head with siblings work 15.3 hours per week on average (column 3, see figure 1 for the distribution of hours worked). The mean hours worked by girls is slightly less than double the number of hours worked by boys. Girls work slightly more hours in market work than boys. For all children, the largest component of market work is agricultural work. Most of the extra hours worked by girls come through additional time spent in domestic work. Childminding, cooking, and cleaning are the largest components of this domestic work for both boys and girls, although girls spend significantly more time in these three activities. In this paper, I find that most of the differences between siblings in total hours worked come in domestic work.

[insert figure 1 here]

The discussion in section two suggests that sibling sex composition, age rank, and the age gap should impact the allocation of child time. Table 2 describes sibling composition for the 14,394 resident children of the household head between the ages of 6 and 15 with siblings who I use in my analysis. Throughout this paper, the sibling count for child *i* does not include child *i*. Hence, a child with four siblings has four other brothers and sisters resident in the household; in this example, there are a total of five resident children of the household head. Sibling counts and age rank are based on resident children of the household head; they are not limited to children between the ages of 6 and 15. Consequently, in households with 5 children, I observe fifteen year olds and six year olds who are the fifth oldest.

[insert table 2 here]

Several characteristics stand out in table 2 that are important for my analysis below. First, I observe more brothers than sisters in the sample. Second, girls tend to be in larger households in both rural and urban areas. Third, on average, girls have slightly more siblings that are younger. These gender differences are not significant in a statistical sense but may be meaningful in my discussion below. If parents have preferences for boys, they could continue having children until they get the desired number of boys. This may explain why I see more brothers than sisters, girls in larger households, and girls having more, younger siblings. Sen (1992) and Das Gupta (1997) also suggest that there may be differential survival rates for girls as a result of either parental preferences or the greater resource competition faced by girls in larger households. These differences in household composition by gender complicate my discussion of the relationship between child labor and sibling composition and motivate many of my concerns in my empirical work.

My goal in the next section is to calculate the expected hours worked in the last week for a child in a given sibling setting. I then compare this conditional expectation across different sibling structures. The discussion in the next section focuses on what types of comparisons are feasible given that household composition is endogenous. I use two techniques to calculate conditional expectations. First, I present nonparametric results, using a local linear regression smoother with bandwidths chosen by visual inspection. Second, I employ a linear regression framework to control for differences in child labor across individuals that are likely correlated with sibling composition. Sibling structure is correlated with a child's age and gender. Thus, I remove age means with a vector of dummy variables indicating the child's age and allow the age means to vary by gender by including an indicator for if the child is female and a complete set of gender-age interactions. I refer to this set of controls collectively as "age/gender effects." The omitted category is a boy, age fifteen. Also, since I observe multiple children per household, I include household fixed effects. The household fixed effect removes the mean child labor in each household from my analysis. This captures any difference between households that are captured by this mean (sibling size, land endowments, community characteristics). In this case, my analysis has the interpretation of being within a given household.

4. Main Findings

In this section, I consider the implications of the model of section two. Relatively older kids should have comparative advantage in home production, so I begin by considering age rank. Gender differences in the return to schooling or in productivity in home production cause the sex composition of siblings to affect child labor. Hence, I consider sibling sex composition second. I end this section by considering the role of the spacing of children (the age gap) and the gender of that next child.

A. Age Rank

Most birth order studies follow one of two approaches in modeling the relationship between age rank (or birth order) and child outcomes. Either age rank is modeled including a dummy variable indicating that a child is the oldest of siblings (Parish and Willis 1993), or age rank is included as an additive term (Behrman and Taubman 1986). In the oldest child dummy variable case, the inclusion of the household fixed effect and age/gender controls cause the estimated coefficient on age rank to be interpreted as the extra amount the oldest child works relative to all of the other siblings in the household after controlling for age and gender differences. Similarly the regression coefficient in the additive age rank regression captures the average change in child labor associated with increasing age rank by one step within a household (after controlling for age and gender differences).

I allow the relationship between mean hours and the oldest child or age rank to differ for boys and girls. Let L_{ij} denote total hours worked in the last 7 days for child i in household j. A_i is a vector of dummies for each age 6-15 that takes on a value of one for child i's age. F_i is an indicator that is one for females. $Oldest_i$ is an indicator that is 1 if the child is the oldest of its resident siblings. Column one of table 3 contains estimates of the association between being the oldest child and total hours worked from the regression:

$$L_{ij} = a + b_1 * Oldest_i + b_2 * Oldest_i * F_i + A_i + F_i + A_i * F_i + D_j + e_{ij} \qquad (4)$$

where D_j is a household fixed effect and e_{ij} is mean zero regression error that allows for clustering at the PSU level. Column two of table 3 considers the association between age rank AR_i and total hours worked in the last 7 days:

$$L_{ij} = a + b_1 * AR_i + b_2 * AR_i * F_i + AF_i + D_j + e_{ij} \qquad (5)$$

where age/gender effects are denoted $AF_i = A_i + F_i + A_i * F_i$ and everything else is as defined in (4). Since I include a female dummy variable in both of the regressions, the interpretation of the interactions of female with age of the oldest child or child's age rank is the extra increment to total hours worked associated with being female (in addition to that for boys) after controlling for average differences in hours worked for boys and girls.

[insert table 3 here]

In column 1 of table 3, I do not find evidence that the oldest boy devotes more time to work than younger boys within the same household. However, the oldest girl tends to work 2.6 hours more per week than her other siblings in the same household after controlling for differences associated with age. In column 2, increasing a child's age rank by one (for example, consider the though experiment of switching a child of a given age/gender from the second oldest in the household to the third) is associated with 2.2 hours less work for boys. Girls decrease their work by 2.8 hours per week on average for each age rank step.

Not every household has variation in the full range of possible age ranks, because higher age ranks only appear in larger households. Thus, I consider whether the association between hours worked and age rank varies by sibling size. Figure 2 contains the local regression of total hours worked in the last 7 days on the number of other siblings by age rank. Time working is increasing in the number of siblings and decreasing in age rank for both boys and girls. However, for females the differences between age ranks are much greater than for males. Also, the difference between age ranks increases in the number of siblings.

[insert figure 2 here]

The local regressions in figure 2 do not condition on age or any household characteristics. In Columns 3a and 3b of table 3, I mimic the specification of (5) but interact age rank with a vector of indicators for the number of siblings to child i in household j, S_j:

$$L_{ij} = a+b_1 * AR_i * S_j + b_2 * AR_i * F_i * S_j + AF_i + D_j + e_{ij}. \qquad (6)$$

Column 3a contains the vector of coefficients b_1 and 3b contains the additional increment in the association between age rank and total hours worked for females, b_2. For boys, higher age rank is associated with less work in larger households. For girls, the decrease in child labor as age rank increases is always greater than it is for boys. However, the magnitude of this decrease is less in larger households. Thus, in a household with four children (each child has three sibling), after controlling for age/gender differences, child labor decreases by 1.9 hours for each increment in age rank for boys and 4.1 hours for girls. However, for households with six or more children, each increment of age rank decreases child labor by 2.1 hours for boys but only 2.9 hours for girls.

A clear difficulty in interpreting these results is that the functional form in columns 2 and 3 constrains each change in a child's within household age rank to have the same effect on the child's labor supply. I relax this assumption by replacing age rank AR_i in (6) with a set of dummy variables rather than with an additive term. The results of this approach are in columns 1a and 1b of table 4.

[insert table 4 here]

I omit the youngest sibling for each household size. With the inclusion of household dummies, the interpretation of each regression coefficient in column 1a is the hours worked by a male child of the indicated age rank with the indicated number of other siblings relative to the youngest sibling in the household. Column 1b contains the hours in addition to column 1a that females incur (column 1a and 1b are estimated in the same regression). In table 4, I observe large gender differences in the effect of age rank on hours worked. With the exception of the smallest sibling set, first-born boys tend to work more than the youngest boy in the household, although this difference is typically not statistically different from zero. I do not in general observe any association between age rank and child labor for boys.

For girls, the data suggest that age rank is strongly correlated with variation in their labor supply. After controlling for gender differences, I still observe large, statistically significant differences between boys and girls. Oldest girls always work more than younger girls for all sibling sizes. Further, differences are increasing in the size of the sibling cohort. For example, after controlling for age differences, the oldest girl in a house with 4 siblings works 10.7 hours more a week than her youngest resident sibling if her youngest sibling is a girl (18.3 hours more a week than if her youngest sibling is a boy). An oldest girl with six or more siblings works 13.9 hours more per week than her youngest sibling if the youngest sibling is a girl. One problem in interpretation is that the characteristics of the reference (youngest) child can vary with household size. For example, the youngest child in a household with 5 children may be more likely to be a boy than the youngest child in a household with 2 children. Thus, part of the increase in child labor that I observe for older girls in larger households may be from differences in the characteristics of the youngest child. To the extent that all children are affected equally by the gender of the youngest child, the household fixed effect captures this. Nevertheless, it is possible that siblings are differentially affected by the gender of the youngest child.

In the remaining columns of table 4, I separate total hours worked in the last 7 days into market work and domestic work. The age rank differences observed in the first two columns of table 4 appear to be driven by time devoted to domestic work. Columns 2a and 2b of table 4 contain estimates for total hours worked in the last 7 days in market work. Columns 3a and 3b of table 4 contain estimates for total hours worked in domestic work. In general, there is no association between hours in market work and age rank. Similarly, there is little evidence of gender differences in the association between age rank and hours in market work. However, the results for domestic work correspond to those found in columns 1 and 2. For boys, I do not observe a statistical relationship between age rank and hours in domestic work, but for girls, first-born girls and second born girls work more hours than boys with the same age rank and they work more than younger siblings (with the oldest resident girls working more hours than second oldest girls). The magnitude of these differences increases with household size as I observed for total hours in columns 1 and 2.

This relationship is also apparent in the unconditional data in figure 3. Figure 3 contains the local regression of hours in domestic work in the last 7 days on the number of other siblings by age rank and gender. Unlike table 4, this nonparametric regression does not control for age differences or household fixed effects. Nevertheless, the pattern in table 4 is still evident. Males spend less time in domestic work than do females. In smaller households, the oldest male seems to put forth slightly more effort, but these age rank differences disappear entirely in larger households. The oldest females always work more than other siblings. The data suggest increases in age rank differences for the oldest two children as sibling size increases.

[insert figure 3 here]

B. Sibling Sex Composition

Within a household, I observe gender differences in the number of siblings in addition to age rank differences. In this section I focus on the association between sibling sex composition and child labor (Butcher and Case 1994 and Kaestner 1997 discuss sibling sex composition and educational investments using U.S. data). I look within a household at the extra labor associated with changing the gender of a child's younger siblings. My approach is similar to the previous section. I begin by regressing total hours worked on the number of younger resident siblings, Y_{ij}:

$$L_{ij} = a+b_1 * Y_{ij} + b_2 * Y_{ij} * F_i + AF_i + D_j + e_{ij} \qquad (7)$$

where all variables are defined in the context of equations (4) and (5). Then, I separate younger siblings into number of younger brothers YB_{ij} and number of younger sisters YS_{ij}. (7) then becomes:

$$L_{ij} = a+b_1 * YB_{ij} + b_2 * YB_{ij} * F_i + b_3 * YS_{ij} + b_4 * YS_{ij} * F_i + AF_i + D_j + e_{ij} \quad (8)$$

As before, all of the results in this section are within household, so the thought experiment is given the household's size, what are the differences in child labor associate with making one of child *i*'s siblings younger than *i*.

Column 1 of table 5 contains the results of regressing total hours of work in the last seven days on the number of younger children in the household, allowing the extra hours associated with an additional younger sibling to vary by the child's gender as in equation (7). Column 2 of table 5 distinguishes between the number of younger brothers and younger sisters as in (8). Keeping the number of siblings fixed but adding a younger child increases the total hours worked of boys by 1.7 hours and 3.4 hours for girls. For boys, the addition of a younger brother raises total hours worked in the last week by 2.2 hours whereas an additional younger brother increases a girl's hours of work by an additional 1.8 hours. I cannot reject the hypothesis that an additional younger sister does not impact the hours worked by a boy. For a girl, the addition of a younger sister increases her hours worked by a total of 3.0 hours (relative to if that sister were older), and this number is significantly different from the effect that adding a younger sister has on boys.

[insert table 5 here]

In columns 3 through 6 of table 5, I separate total hours of work into market work and domestic work. The addition of a younger sibling increases time spent in market work by 1.3 hours; I fail to reject the hypothesis that this correlation is the same for male children and female children. In breaking sibling sex into number of younger brothers and sisters in column 4, the addition of a younger brother increases market work by 1.9 hours. I do not find evidence that this relationship differs for girls. I also fail to reject the hypothesis that adding a younger sister has no impact on hours of market work. Domestic work differs substantially from market work. Most of the additional hours of work incurred by girls in column 1 come through additional domestic work. I cannot reject the hypothesis that adding a younger sibling (boy or girl) has no effect on the time devoted to domestic work for boys. However, for a girl, the addition of either a younger brother or a younger sister is associated with an additional 1.5 hours spent in domestic work.[4]

Endogeneity in household composition is particularly a concern in interpreting the sex ratio data. The patterns in child labor in the data may reflect how parents manage the living arrangements of their offspring. In this case, a household with two younger sisters may differ from a household with one younger sister in unobserved ways. The household fixed effect captures differences in household means. However, if sibling gender compositions vary systematically with how households treat some children (relative to the other children in their household), the household fixed effect does not capture this heterogeneity. In the present discussion, I need to assume that households with larger numbers of girls do not differ from households with larger numbers of boys other than in the mean amount of time all children within the domestic work.

C. Age Gap

The comparative advantage explanation for sibling composition effects on child labor suggests a role for birth order or age rank, because older kids are better at home production than are younger kids. This implies that the difference in ages between children should be associated with differences in the quantity of work performed by children. To consider the relationship between work and children, I sort children within a household from youngest to oldest and calculate the difference between the older child's age and the next oldest sibling. I call this age difference the “age gap.” My analysis in this section is limited to the 10,690 sample children ages 6-15 of the household head that have younger, resident siblings. The distribution of age gaps for boys and girls look similar. 70% of children have age gaps of 2 or 3 years. 2 years between siblings is the modal age gap.

Parents can choose the spacing between their children. In this section, I regress the difference in hours worked between child *i* and its next youngest sibling (child *i-1*) on the age gap between child *i* and child *i-1*. Denote the difference in hours worked between child *i* and his next youngest sibling in household *j* and community *k* as dL_{ijk}. Differencing of hours worked removes any fixed factor (the household fixed effect) that impacts the labor supply of both children. However, the age gap between siblings may be associated with household characteristics that are also correlated with differences in hours worked among those same siblings. This omitted variable problem plagues my interpretation of the correlation between child labor and the age gap, but the age gap findings are consistent with the comparative advantage explanation of sibling differences in previous sections. Further, while parents choose the number and spacing of children, conditional on deciding to have an additional child at a given spacing, parents cannot control that child's gender.[5]

Column 1 of table 6 contains the regression of the difference between children in hours worked dL_{ijk}.on their age gap AG_{ij}. The difference between a child's hours of work and a child's next youngest sibling may depend on its age, so as before I include the complete set of age/gender effects AF_i. I also control for the number of siblings in the household S_j. I also control for between community differences in the association between age gaps and hours worked with a community fixed effect, D_k.[6] Thus, column 1 of table 6 includes the results of:

$$dL_{ijk} = a+b_1 * AG_{ij} + c * S_j + AF_i + D_k + e_{ijk}. \qquad (9)$$

The omitted category in (9) is a fifteen-year-old boy. Hence, the coefficient on the female indicator reported in column 1of table 6 is the extra difference in hours (in addition to the constant) that a fifteen-year-old female must work. The difference in hours worked for girls is generally greater than it is for boy. An additional year difference in ages is associated with an additional 1.2 hours work per week.[7] In a supplementary regression (not shown), I was unable to reject the hypothesis that the slope term does not vary with gender. Thus, while I observe more work for older siblings the further apart siblings are, this extra work does not appear to overcome the gender gap in work.

[insert table 6 here]

I consider the association between differences in hours worked and the sex of the next oldest sibling in column 2 of table 6 and figure 4. NSF_{ij} is an indicator that is 1 if child i's next youngest sibling is female. The gender effect and the age gap are allowed to vary with the gender of the next youngest sibling. Thus, equation (9) is modified as:

(10) $dL_{ijk} = a + b_1 * AG_{ij} + b_2 * AG_{ij} * NSF_{ij} + b_3 * NSF_{ij} + b_4 * NSF_{ij} * F_i + c * S_j + AF_i + D_k + e_{ijk}$.

In column 2 of table 6, if the next youngest sibling is female, on average, the difference between child *i* and *i-1*'s labor supply is reduced by 5.9 hours for boys. This reduction is smaller for girls (3.7 hours). The slope with respect to the age gap increases if the next youngest sibling is female. Both males and females have to work more as the age gap increases when the next sibling is female rather than male. Perhaps this reflects that when the next sibling is female and close, she is better able to substitute for part of child *i*'s labor. Figure 4 shows the local regression of the difference in hours worked between child *i* and child *i-1* on the age gap. The first character for each line indicates child *i*'s gender. The second character indicates child *i-1*'s gender. For a female, the amount of work she contributes relative to her next youngest sibling is increasing in the age gap regardless of the gender of the next youngest sibling. However, the gap in hours work is mitigated for age gaps below 5 if her next oldest sibling is also female (90% of children have age gaps of 5 or less). For a male, the slope with respect to the age gap appears approximately flat if the next oldest sibling is also male. However, if the next oldest sibling is female and similar in age, then the younger female sibling may actually work more hours.

[insert figure 4 here]

The problem of choosing birth spacing complicates the interpretation of changes in the slope of the regression line in figure 4. However, conditional on the age gap and having a younger sibling resident, the household may not be able to choose the gender of the younger resident sibling (especially in small age gaps). If the gender of the younger sibling is random conditional on the age gap and having a younger sibling, then the differences in figure 4 associated with differences in the gender of the next youngest child may be interpreted as causal. Does figure 4 indicate that girls work more than boys or does it suggest that older girls/boys work less in the presence of younger girls? I graph the density of hours worked of the older child *i* by the sex of the next youngest sibling (figure 5). I focus on children with age gaps of 2 to 3 years, because 70% of children have age gaps of 2 or 3 years. I also limit my sample to children ages 11-15, because the mass of the distribution of hours worked for children 6-10 is substantially more concentrated around 0.

[insert figure 5 here]

For both females and males, the mass of the distribution of hours worked is shifted forward if the next sibling is male. This is consistent with my findings in table 5 that both males and females work more in the presence of younger male siblings. In the present context, this suggests that at least part of the differences in hours worked observed in figure 4 come from both boys and girls working less in the presence of younger female siblings. In the theory of section 2, this pattern arises because younger female siblings fulfill some of the family's labor needs in ways that boys demand, thereby lowering household labor demand.

The remaining columns of table 6 contain the composition of total hours worked. Columns 3 and 4 of table 6 are for hours in market work; the last two columns are for hours in domestic work. In general, differences in hours worked are greater for females than males in both categories of work. Time spent in domestic work has a less steep slope with respect to the age gap. However, the slope for domestic work is steeper if the next younger sibling is female. This is consistent with a younger female taking care of many of the household responsibilities while younger males have comparative advantage in other activities (such as education). Figure 6 contains the local regression of the difference in hours worked on the age gap by the gender of the next younger siblings. For small age gaps, a female next sibling is associated with less additional work for both boys and girls in both categories of work. Perhaps the most pronounced difference between the regression lines in figure 6A and that of figure 6B is that for boys, the presence of a younger boy is associated with some additional domestic work. However, the presence of a younger sister is associated with less domestic work for boys. The younger sister spends more time working at home for age gaps less than 6 years.

[insert figure 6 here]

5. Discussion and Conclusion

This paper considers the relationship between sibling composition and child labor in Nepal. I find that the difference in hours worked between older and younger children is greater for girls than boys. As household sizes increase, the extra work associated with being an older girl increases significantly. Most of this additional work for girls comes from spending additional time in domestic activities such as childminding, cooking, and cleaning. I also observe that differences in the type and the amount of work performed by older siblings are correlated with the gender of younger siblings. For both boys and girls, adding a younger boy to a household (while keeping the total number of siblings constant) is associated with more time spent in market work such as agriculture or wage employment. However, I do not find that adding a younger girl is associated with a change the time allocation of boys, but I observe increases in the time spent in domestic work for girls. Since the variation in child labor attributable to sibling composition appears to be associated with time in domestic work, this study emphasizes the role household production plays in child labor.

The model in section 2 generates sibling differences in child labor as a result of comparative advantage in household production. The empirical finding that being a relatively older child is associated with more work even after controlling for differences in the age distribution of labor activities is consistent with my first example in section 2 where lower age rank children work more, because they are better at household production. The model explains the finding that the difference in the time worked by the oldest resident child and the youngest resident child increases with the total number of other children in the household if, in household production, the oldest child's advantage relative to the youngest child increases with the distance (in age rank or age) between the oldest and youngest child. The observation that the difference in child labor between siblings is larger for a female than a male is consistent with age rank differences augmented by differences in the returns to education.

When I decompose the effect of being an older sibling by the gender of younger siblings, Younger brothers are associated with more work for older boys and girls. However, younger girls are associated with more work only for girls. This additional work for girls is concentrated in domestic work. For a girl, the additional work from adding a younger boy is in both domestic and market work. However for an older boy, the additional work from adding younger brothers is in market work only. In the model of section 2, changes in the age-gender composition of younger siblings could affect the household production function through changes in H. For example, the addition of a younger sibling might increase the amount of time an older child spends at home childminding. In this case, if girls are better at childminding than boys, then the relative marginal product of girl's labor would be higher. Thus, I observe increases in domestic work with the addition of both boys and girls. The presence of younger boys might increase the amount of purchased inputs necessary to produce c. For example, younger boys might require more books or clothing than a younger girl. In this case, the impact of adding younger boys in this model depends on labor market characteristics and the substitutability of different types of labor. The data suggest that older boys and girls shift approximately the same amount of time to market work as a result of younger boys.

The effect of household production on child labor has received surprisingly little attention in the academic literature. In illustrating how a model of home production can be used to explain sibling differences in child labor, this study does not intend to rule out other reasons for sibling differences in child labor such as parental preferences or credit constraints. In reality, parental preferences, credit constraints, and household production all likely play an important role in child labor supply. However, the omission of household production from most discussions of child labor supply may lead research to miss an important channel for changes in child labor through time and an important influence on sibling and gender differences in child labor.

References

Baland JM, Robinson JA (2000) Is Child Labor Inefficient. *Journal of Political Economy* 108(4): 663-79

Basu K (1999) Child Labor: Cause, Consequence, and Cure, with Remarks on International Labor Standards. *Journal of Economic Literature* 37(3): 1083-1119

Basu K, Van PH (1998) The Economics of Child Labor. *American Economic Review* 88(3): 412-427

Behrman J, Taubman P (1986) Birth order, Schooling, and Earnings. *Journal of Labor Economics* 4(3): S121-S150

Binder M (1998) Family Background, Gender, and Schooling in Mexico. *Journal of Development Studies* 35(2): 54-71

Butcher K, Case A (1994) The Effect of Sibling Sex Composition on Women's Education and Earnings. *Quarterly Journal of Economics* 109(3): 531-563

Central Bureau of Statistics (1999) *Report On The Nepal Labour Force Survey* 1998/99. National Planning Commission Secretariat of His Majesty's Government, Kathmandu

Das Gupta M (1997) Selective Discrimination against female children in rural Punjab, India. *Population and Development Review* 13(1): 77-100

Edmonds EV (2003) Child Labor in South Asia. *OECD Social, Employment and Migration Working Papers* No. 5. OECD, Paris

Edmonds EV, Miller DL, Mammen K (2005) Rearranging the Family? Household Composition Responses to Large Pension Receipts. *Journal of Human Resources* 40(1): forthcoming

Edmonds EV, Pavcnik N (2005). Child Labor in the Global Economy. *Journal of Economic Perspectives,* forthcoming

Ejrnæs M, Pörtner CC (2004) Birth order and the Intrahousehold Allocation of Time and Education. *Review of Economics and Statistics* 86(4): 1008-1019

Garg A, Morduch J (1998) Sibling Rivalry and the Gender Gap: Evidence from Child Health Outcomes in Ghana. *Journal of Population Economics* 11(4): 471-493

Kaestner R (1997) Are Brothers Really Better? Sibling Sex Composition and Educational Achievement Revisited. *Journal of Human Resources* 32(2): 250-284

Locay L (1990) Economic Development and the Division of Production between Households and Markets. *Journal of Political Economy* 98(5): 965-982

Parish W, Willis R (1993) Daughters, Education, and Family Budgets: Taiwan Experiences. *Journal of Human Resources* 28(4): 862-898

Patrinos HA, Psacharopoulos G (1997) Family Size, Schooling, and Child Labor in Peru – An Empirical Analysis. *Journal of Population Economics* 10(4): 387-405

Sen A (1992) Missing Women. *British Medical Journal* 304 (March): 587-588

Shakti S (1995) *Women, Development, and Democracy: A study of the socio-economic changes in the profile of women in Nepal.* Raj Press, New Delhi

[1] The model has been written without allowing explicitly transfers between consumption *c* and the present value of future earnings. Removing credit constraints is simply a matter of adding a transfer *B* into the household production function and subtracting the cost of that transfer from the return to education function. Allowing borrowing between *c* and *w* changes the equilibrium value of (2) but (3) still follows.

[2] The degree of substitutability or complementarities between types of labor in household production technology can affect the relationship between sibling composition and child labor. Consider an example where child *i* and *j* have the same return to educational investments. The child with comparative advantage in household production works more. Assume child *i* is the older child who has comparative advantage in household production. If child *j*'s marginal product of labor in household production improves with increases in child *i*'s labor in household production, sibling differences owing to age rank can be mitigated.

[3] The model in the previous section describes the allocation of child time for *resident* children, and I follow this approach in the empirical work. The NLFS does not provide information about non-resident children. In a separate analysis, I use data from a nationally representative, multi-purpose household survey from Nepal in 1996 to compare resident children to children ever born to the household head. 45% of the ever-born children who are not resident are deceased. Of the living, non-resident, ever-born children 97% are over the age of 15 and likely economic independent. 50% of the remaining non-resident, living, ever-born children are female.

[4] In table 4, I find that non-linearities are important in the relationship between age rank and child labor. To check for non-linearities in the relationships in table 5, I included dummy variables for the number of younger sisters and the number of younger brothers, allowing boys and girls to have different means in the presence of additional siblings of a specific gender. The results of this more flexible functional form did not differ from those reported in table 5 and hence are not reported here.

[5] This statement requires a caveat, because my data are limited to surviving resident children rather than children ever born. It is possible that genders differ in their mortality rates (I find no evidence of this in the supplementary analysis described in footnote 12), and thus the gender ordering of two equally spaced siblings would reflect some household characteristic. However, with age gaps less than or equal to three years (as with 80% of the sample), it is unlikely that this differential mortality could seriously impact my estimates of means given the natural period of infertility that accompanies pregnancy and birth.

[6] I prefer the community fixed effects specification, because I then report means after controlling for community average sibling differences. Regression coefficients barely change if I do not include community fixed effects. I do not include household fixed effects, because I am already differencing out the household fixed effect. Also, inclusion of the household fixed effect (a fixed effect in the difference) would limit my identifying sample to households with 3 or more children.

[7] If instead of constraining the age gap to enter additively, I included a dummy variable for each year (not shown), I cannot reject that the increment between each year is 1.2. Similarly, if I allow the association between the age gap and differences in hours work to vary by sibling size, I cannot reject the hypothesis that an additional year age gap is associated with 1.2 hours of additional work for all sibling sizes.

Figure 1: Distribution of Total Hours Worked for Children 6-15

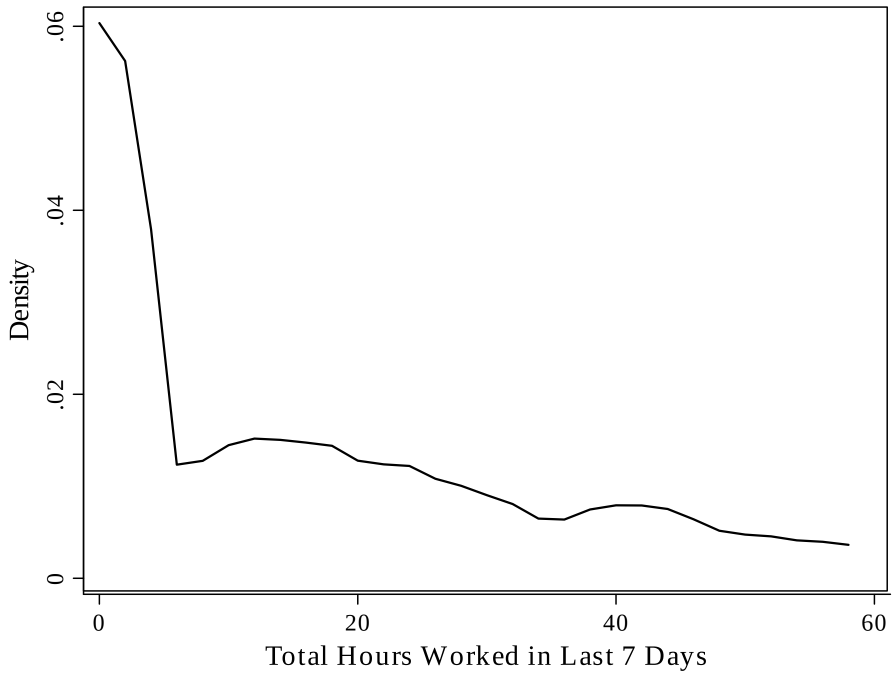
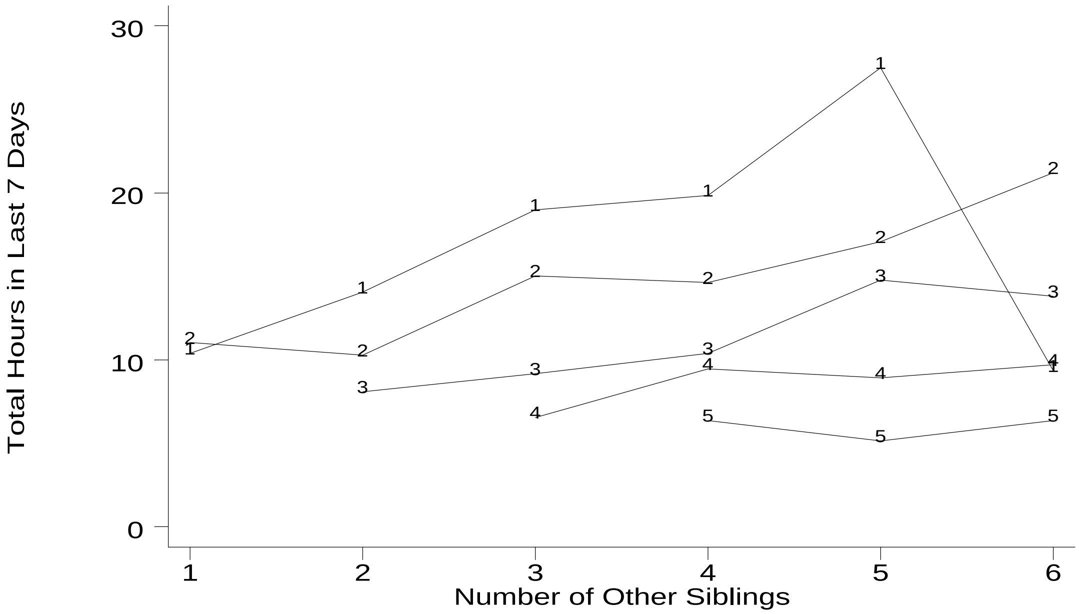
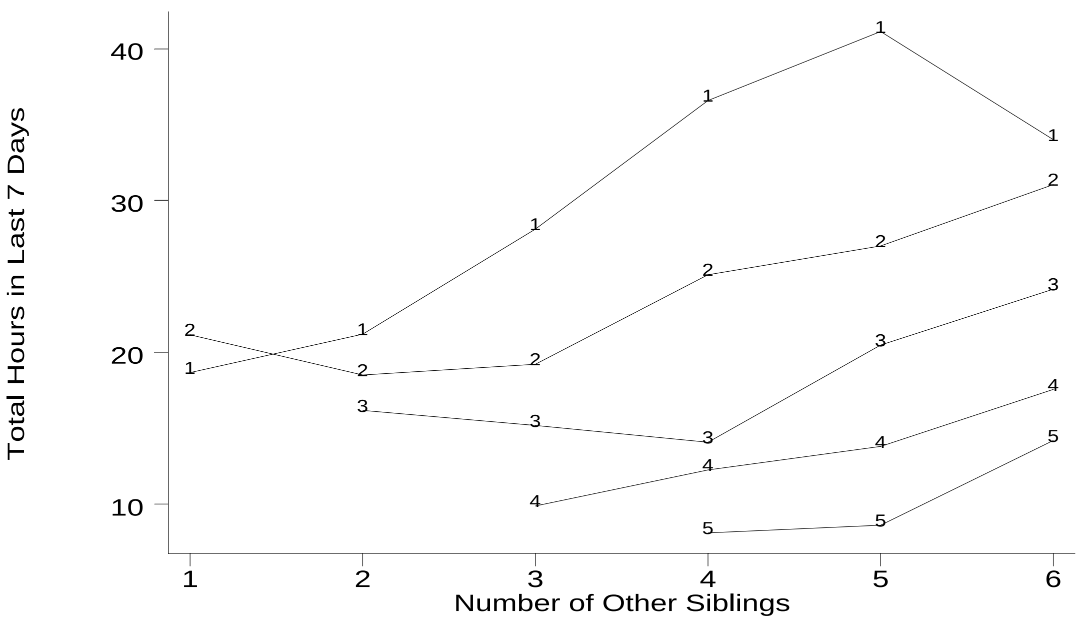


Figure 2: Total Hours Worked in the Last 7 Days and the Number of Siblings by Gender and Age Rank

A. Males



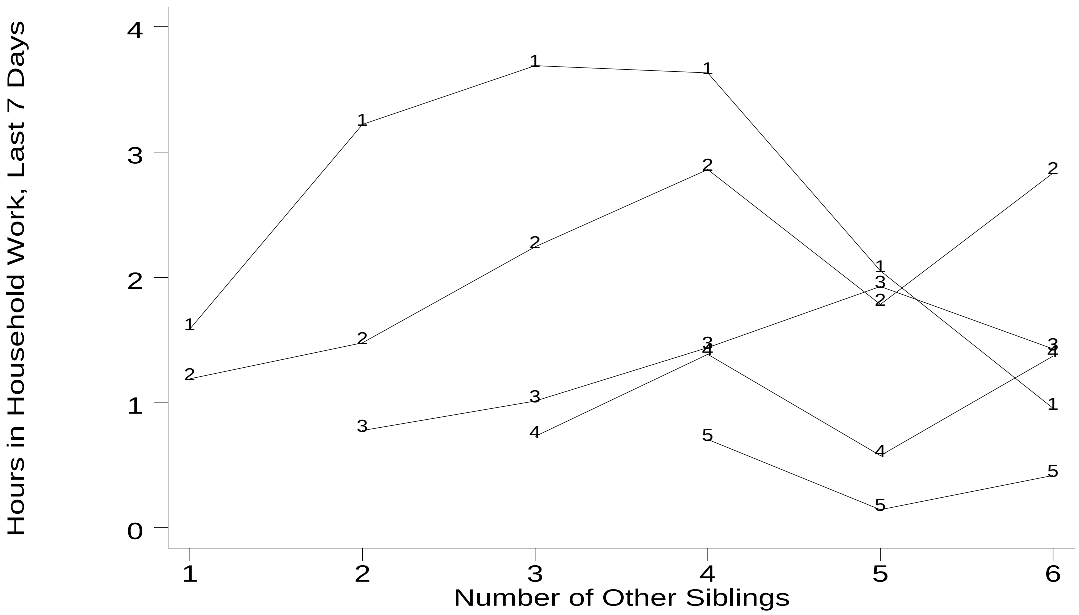
B. Females



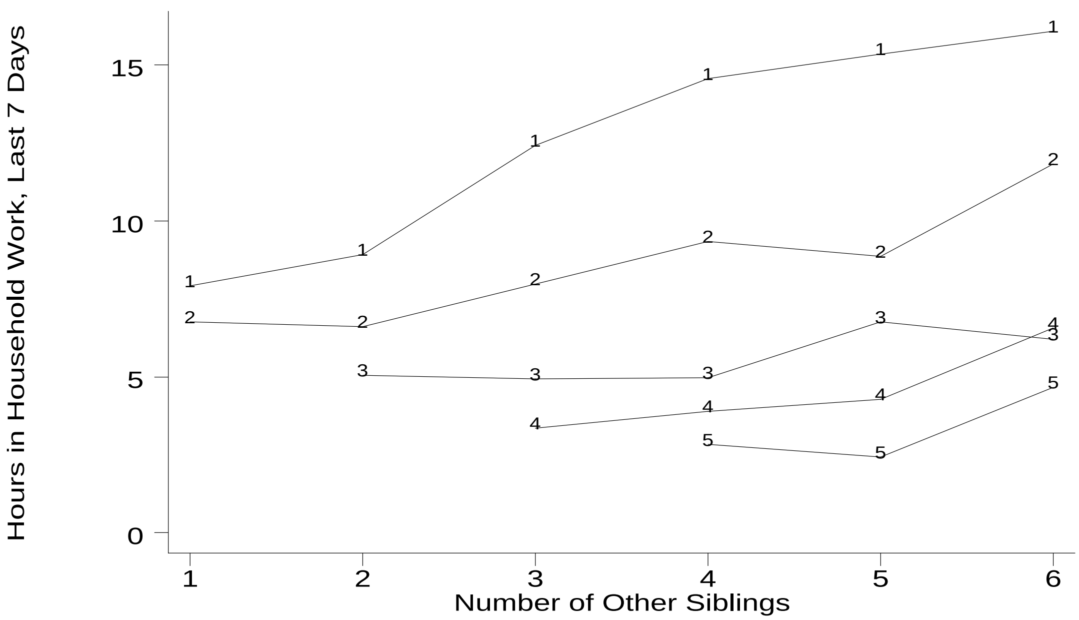
Age Rank is the marker on the graph. Means are estimated using a local-linear smoother.

Figure 3: Hours in Domestic work and the Number of Siblings by Age Rank and Gender

A. Males

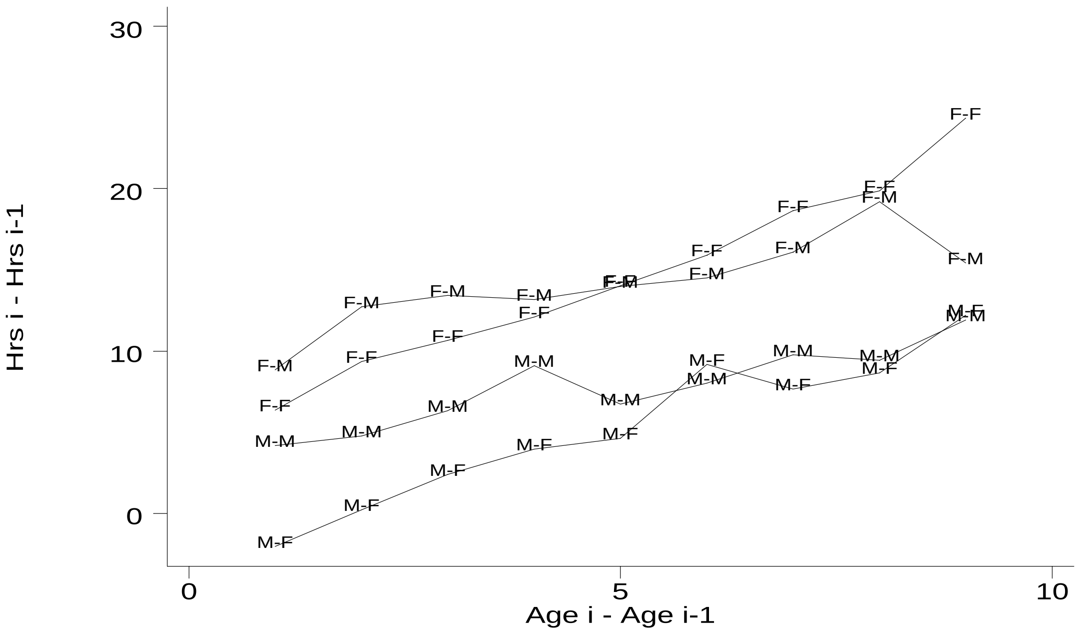


B. Females



Age Rank is the marker on the graph. Results are smoothed with local-linear regression.

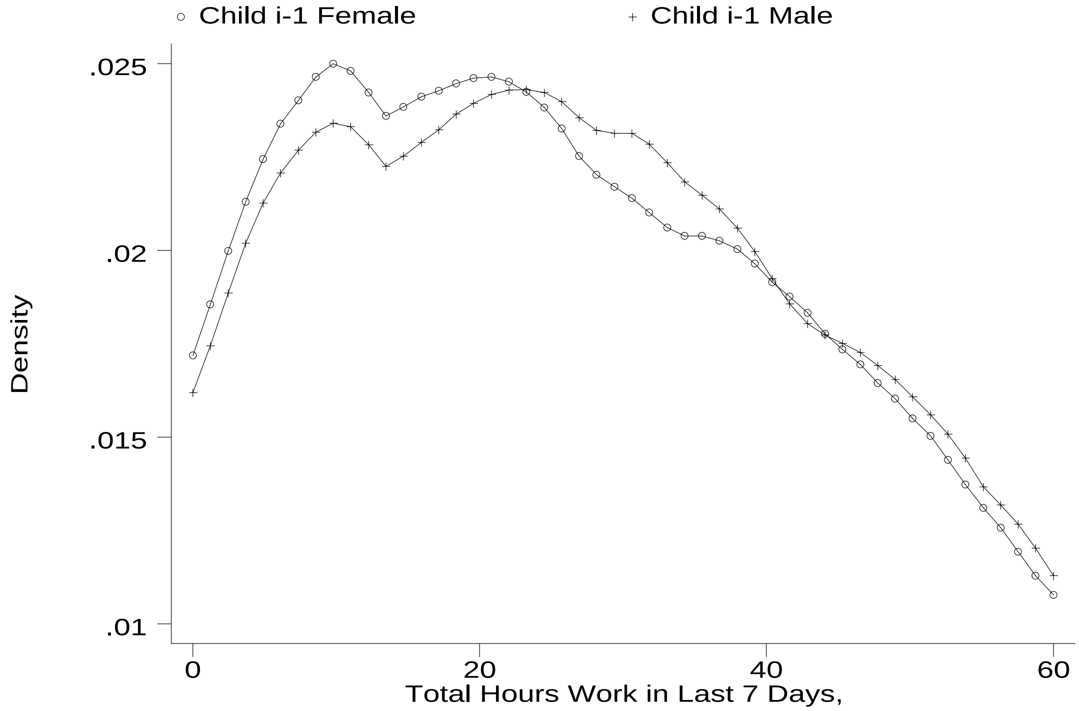
Figure 4: Total Hours Worked i – Total Hours Worked i-1 on Age i – Age i-1 by Gender of Next Younger Sibling



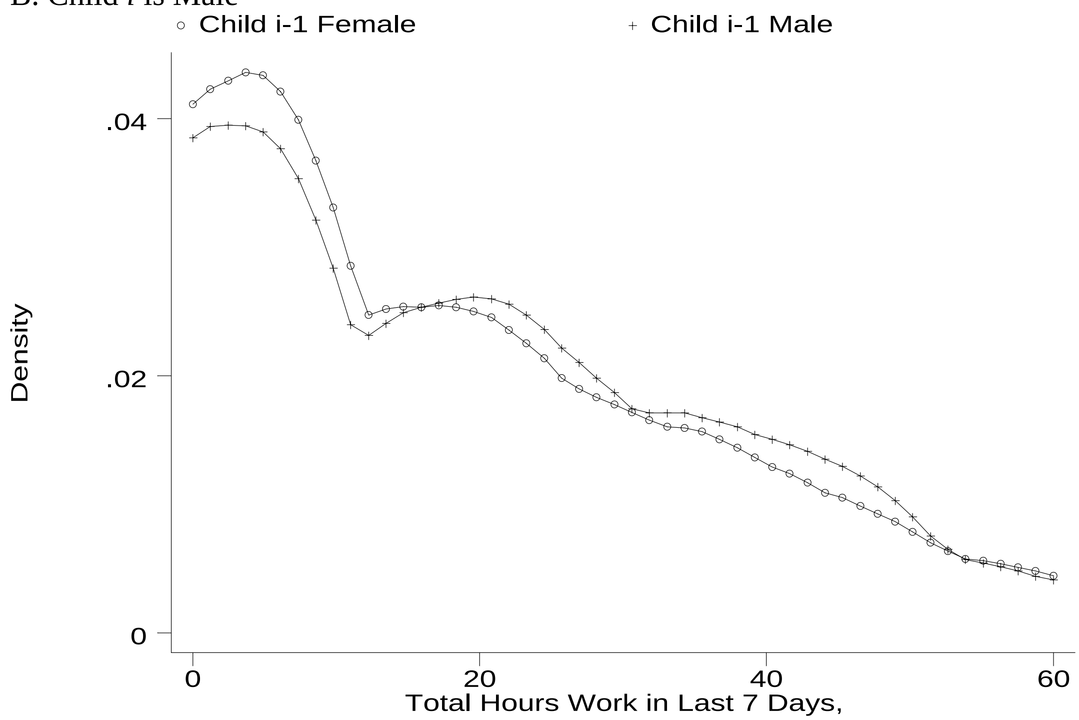
The first character indicates child *i's* gender (F=Female / M=Male) and the second character indicates the next younger siblings gender. Results are smoothed with local-linear regression.

Figure 5: The Density of Total Hours Worked in the Last 7 Days by the Gender of Your Next Oldest Sibling for Children 11-15 with 2 or 3 Year Age Gaps

A. Child *i* is Female



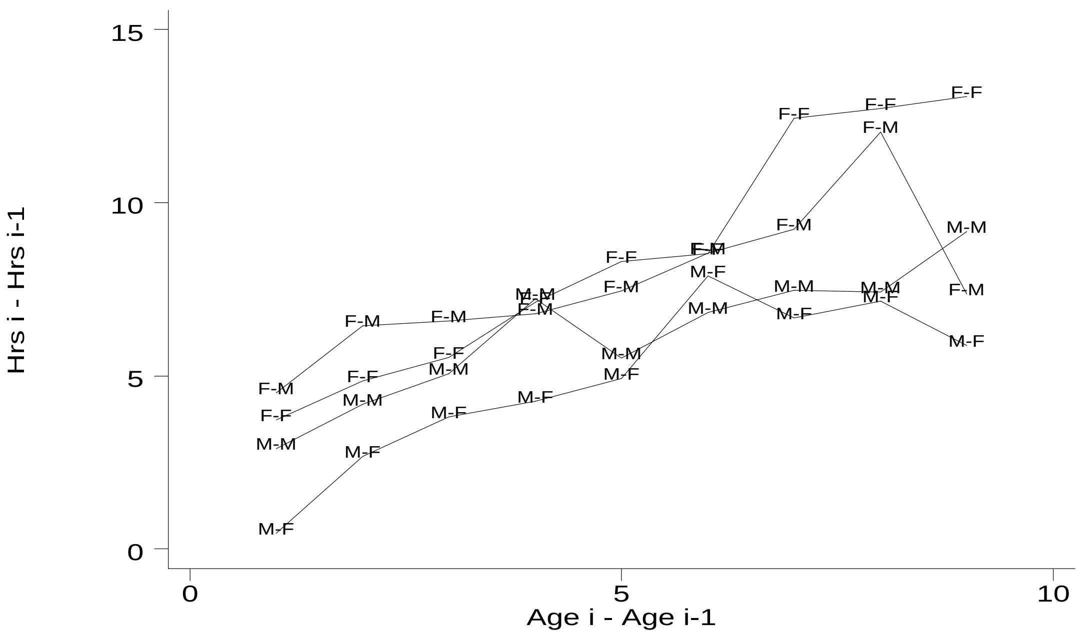
B. Child *i* is Male



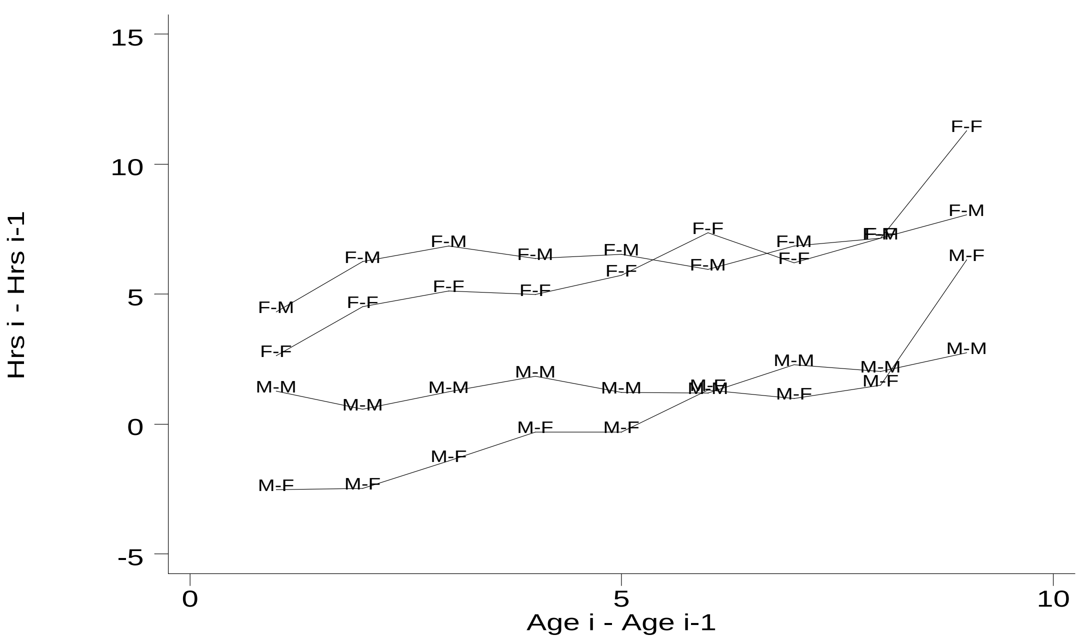
Density estimates are based on a univariate kernel.

Figure 6: Differences in Hours Worked and the Age Gap by Gender of Next Younger Sibling

A. Market work



B. Domestic work



The first character indicates child *i*'s gender (F=Female / M=Male) and the second character indicates the next younger siblings gender. Results are smoothed with local-linear regression.

Table 1: Mean Hours Spent in Various Economic Activities over the Last 7 Days
Children, Ages 6-15

	All Children in Household (HH)	Children of the HH Head	Children of HH Head with Siblings			Children of HH Head w/ Younger Sibs
			Population	Male	Female	
	1	2	3	4	5	6
Sample Size	18,181	15,084	14,394	7,450	6,944	10,690
Population Estimate	5,019,450	4,240,289	4,041,154	2,075,822	1,965,332	3,092,682
Total Hours	14.872	15.193	15.334	11.485	19.400	16.579
Market Work	10.577	10.847	10.925	9.762	12.153	11.606
Wage Work	0.851	0.726	0.686	0.844	0.519	0.800
Self Employment	0.397	0.427	0.413	0.411	0.415	0.450
Agriculture	9.274	9.567	9.464	8.326	10.666	9.937
Milling & Food Processing	0.171	0.164	0.156	0.049	0.270	0.176
Handicrafts	0.069	0.069	0.070	0.022	0.121	0.072
Construction	0.033	0.039	0.035	0.044	0.025	0.045
Other Work Activities	0.095	0.100	0.100	0.066	0.136	0.125
Domestic Work	4.295	4.346	4.409	1.722	7.247	4.973
Cooking / Serving Food	1.047	1.039	1.021	0.211	1.877	1.130
Cleaning	1.142	1.126	1.106	0.250	2.010	1.180
Minor Household Repairs	0.080	0.077	0.077	0.020	0.137	0.082
Shopping	0.068	0.070	0.068	0.076	0.059	0.073
Caring for Old/Sick/Infirm	0.031	0.031	0.030	0.019	0.042	0.029
Childminding	1.154	1.180	1.210	0.635	1.817	1.500
Volunteer/Community Service	0.007	0.008	0.008	0.004	0.011	0.009
Fetching Water	0.389	0.413	0.401	0.231	0.580	0.432
Collecting Firewood	0.504	0.500	0.488	0.276	0.713	0.538

Each cell contains the mean hours worked in the last seven days for the indicated activity. Means are weighted to be representive for the population of children of the household head age 6-15. Column 1 contains means for all children ages 6 to 15. Column 2 reports means for resident children of the household head. Columns 3-5 limits the sample to resident children of the household head with siblings. Column 6 limits the sample to resident children of the household head with younger siblings. See Appendix Table 1 for standard errors. Nepal Labor Force Survey, 1999.

Table 2: Sibling Composition for Children of the Household Head, Ages 6-15

	Full Sample with Siblings			Sample with Younger Siblings
	Population	Male	Female	
Sample Size	14,394	7,450	6,944	10,690
Population Estimate	4,041,154	2,075,822	1,965,332	3,092,682
Resident Siblings	2.944	2.813	3.082	3.172
Number of Brothers	1.616	1.554	1.682	1.679
Number of Sisters	1.328	1.259	1.401	1.493
Age	10.333	10.373	10.290	10.398
Fraction that Are Oldest Sibling	0.275	0.268	0.282	0.359
Age Rank (Residential Birth Order)	2.397	2.400	2.395	2.151
Female	0.486	0.000	1.000	0.506
Age Gap Between Siblings*	3.185	3.246	3.126	3.185
Next (Younger) Sibling is Female*	0.479	0.473	0.485	0.479
Number of Younger Siblings	1.547	1.413	1.688	2.021
Younger Brothers	0.795	0.733	0.860	1.039
Younger Sisters	0.752	0.680	0.828	0.982

Each cell contains the mean of the indicated variable. Means are weighted to be representive for the population of children of the household head age 6-15 that have siblings. All sibling counts for child *i* are not inclusive of child *i* (if a child in a given household has 3 resident siblings, there are 4 children of the household head in the household). Sibling counts are not limited to children between 6 and 15 (though means are only calculated for children between 6 and 15), but they are limited to resident children only. * Indicates that the specified mean can only be calculated for children with a younger sibling. Thus, these means are calculated from the 10,690 sampled children of the household head with resident siblings. See Appendix Table 2 for standard errors. Nepal Labor Force Survey, 1999.

Table 3: Within Household Age Rank Regressions

Dependent Variable: Total Hours Worked in Last Seven Days

	1	2	3a	3b (3a*Female)
Oldest	0.038			
	(0.719)			
Oldest Female	2.609 **			
	(1.011)			
Age Rank (AR)		-2.187 **		
		(0.617)		
AR * Female		-0.659 **		
		(0.332)		
AR * 1 Sibling			1.587	-4.595 **
			(1.057)	(1.086)
AR * 2 Siblings			-0.691	-2.666 **
			(0.806)	(0.693)
AR * 3 Siblings			-1.907 **	-2.208 **
			(0.734)	(0.518)
AR * 4 Siblings			-1.530 **	-1.567 **
			(0.759)	(0.467)
AR * 5 or More Siblings			-2.076 **	-0.880 **
			(0.721)	(0.364)
Female	11.755 **	13.962 **		16.288 **
	(2.042)	(2.122)		(2.201)
Constant	21.264 **	23.248 **	21.702 **	
	(1.398)	(1.438)	(1.463)	
Age/Gender Effects	Yes	Yes	Yes	
Household Effects	Yes	Yes	Yes	
Adj R2	0.541	0.543	0.546	

Dependent variable: Total hours worked (all activities) by child 6-15 in last seven days. * Significant at 10%. ** Significant at 5%. Standard errors in parenthesis. Standard errors corrected for clustered sample design and arbitrary heteroskedasticity. Age/gender effects include a vector of dummy variables for the child's age and a vector of dummy variables for age interacted with the female indicator. A 15 year old boy is the omitted category. Household effects indicate a dummy variable is included for each household. Regressions for the 14,394 aged 6-15 children (with siblings) of the household head.

Table 4: Within Household Age Rank Regressions

Dummy Variable Specification

		Total Hours		Market Work		Domestic Work	
		Male	*Female	Male	*Female	Male	*Female
# Siblings	Age Rank	1a	1b	2a	2b	3a	3b
1	1	-2.27 *	4.44 **	-2.22 **	2.15	-0.05	2.29 **
		(1.16)	(1.93)	(1.06)	(1.57)	(0.45)	(0.87)
2	1	1.23	3.02 *	0.25	0.12	0.97	2.90 **
		(1.59)	(1.70)	(1.44)	(1.50)	(0.74)	(0.85)
	2	-1.13	4.43 **	-1.14	2.44 **	0.01	1.99 **
		(1.01)	(1.43)	(0.89)	(1.23)	(0.44)	(0.71)
3	1	3.64 *	6.17 **	3.13 *	0.18	0.51	5.99 **
		(2.14)	(2.09)	(1.89)	(1.75)	(1.10)	(1.22)
	2	2.17	3.43 **	1.88	0.22	0.29	3.21 **
		(1.64)	(1.63)	(1.49)	(1.37)	(0.72)	(0.83)
	3	-0.09	2.41	-0.04	1.78	-0.05	0.62
		(1.19)	(1.61)	(1.10)	(1.44)	(0.48)	(0.71)
4	1	1.61	9.12 **	3.03	1.75	-1.42	7.37 **
		(3.26)	(3.00)	(3.00)	(2.67)	(1.51)	(1.71)
	2	-2.12	7.28 **	-0.83	4.00 **	-1.29	3.28 **
		(2.44)	(2.14)	(2.22)	(1.92)	(1.12)	(1.14)
	3	-2.92	2.93 *	-1.82	2.36	-1.11	0.57
		(1.89)	(1.77)	(1.72)	(1.65)	(0.81)	(0.87)
	4	-2.04	2.78	-1.31	2.07	-0.73	0.72
		(1.63)	(2.09)	(1.47)	(1.84)	(0.63)	(0.94)
5 or More	1	1.12	12.86 **	3.02	3.51	-1.90	9.35 **
		(4.38)	(3.73)	(4.05)	(3.52)	(2.29)	(2.69)
	2	-3.44	7.60 **	-0.61	2.60	-2.83 *	4.99 **
		(3.73)	(2.95)	(3.46)	(2.66)	(1.54)	(1.76)
	3	-3.74	5.54 **	-2.98	3.82 *	-0.76	1.73
		(2.68)	(2.46)	(2.46)	(2.22)	(1.07)	(1.30)
	4	-3.18	2.55	-1.80	1.56	-1.38	0.99
		(2.68)	(2.11)	(2.46)	(1.92)	(1.07)	(1.20)
	5	-4.66 *	4.50 **	-3.81	4.13 **	-0.85	0.38
		(2.68)	(1.99)	(2.56)	(1.80)	(0.91)	(0.73)
Female			7.60 **		0.37		7.23 **
			(2.34)		(1.96)		(1.06)
Constant		20.44 **		17.97 **		2.47 **	
		(2.02)		(1.81)		(0.89)	
Adj R2		0.55		0.48		0.38	

* Significant at 10%. ** Significant at 5%. Standard errors in parenthesis. Standard errors corrected for clustered sample design and arbitrary heteroskedasticity. "# other sibling" refers to the number of siblings other than child *i* in the household. For each grouping of "# other siblings", the youngest sibling is omitted. For each dependent variable (top row), column a contains the coefficient on the indicated dummy variable; column b contains the coefficient of the dummy variable interacted with a female indicator. "Total Hours" is total hours worked in last seven days. "Market work" is total hours worked in traditional economic activities (see text) in the last seven days. "Domestic work" is total hours worked in household activities (see text) in the last seven days. All regressions include household fixed effects, a vector of dummy variables for the child's age, and a vector of dummy variables for age interacted with the female indicator. A 15 year old boy is the omitted category. Regressions for the 14,394 aged 6-15 children (with siblings) of the household head.

Table 5: Within Household Sibling Sex Composition Regressions

	Total Hours		Market Work		Domestic Work	
	1	2	3	4	5	6
# Younger	1.651 **		1.270 **		0.382	
	(0.622)		(0.548)		(0.292)	
# Younger * Female	1.739 **		0.499		1.240 **	
	(0.387)		(0.344)		(0.212)	
# Younger Bro		2.181 **		1.852 **		0.328
		(0.753)		(0.670)		(0.332)
#Younger Bro * Fem		1.796 **		0.562		1.235 **
		(0.595)		(0.507)		(0.321)
# Younger Sisters		1.068		0.627		0.440
		(0.805)		(0.706)		(0.388)
# Younger Sis * Fem		1.942 **		0.723		1.219 **
		(0.513)		(0.462)		(0.277)
Female	8.736 **	8.462 **	0.889	0.588	7.847 **	7.875 **
	(2.213)	(2.263)	(1.868)	(1.895)	(1.033)	(1.066)
Constant	16.142 **	16.109 **	14.649 **	14.612 **	1.493	1.497
	(2.308)	(2.310)	(1.980)	(1.984)	(1.002)	(1.001)
Adj R2	0.546	0.546	0.475	0.475	0.366	0.366

* Significant at 10%. ** Significant at 5%. Standard errors in parenthesis. Standard errors corrected for clustered sample design and arbitrary heteroskedasticity. All regressions include household fixed effects, a vector of dummy variables for the child's age, and a vector of dummy variables for age interacted with the female indicator. A 15 year old boy is the omitted category. Regressions for the 14,394 aged 6-15 children (with siblings) of the household head. The dependent variable is indicated in the top row. "Total Hours" is total hours worked in last seven days. "Marketl work" is total hours worked in traditional economic activities (see text) in the last seven days. "Domestic work" is total hours worked in household activities (see text) in the last seven days.

Table 6: Within Community Age Gap Regressions

Dependent Variable: Hours Worked in Last 7 Days for Child (i) - Child (i-1)

	Total Hours		Market Work		Domestic Work	
	1	2	3	4	5	6
Age Gap	1.163 **	0.886 **	0.782 **	0.689 **	0.381 **	0.197 **
	(0.098)	(0.124)	(0.085)	(0.107)	(0.050)	(0.061)
Age Gap * NSF		0.622 **		0.210		0.413 **
		(0.191)		(0.165)		(0.096)
Next Sibling is Female (NSF)		-5.881 **		-2.180 **		-3.701 **
		(0.725)		(0.633)		(0.366)
NSF * Female		2.153 **		0.921 *		1.232 **
		(0.586)		(0.501)		(0.332)
Siblings	-0.452 **	-0.354 **	-0.086	-0.051	-0.366 **	-0.303 **
	(0.101)	(0.101)	(0.085)	(0.086)	(0.051)	(0.051)
Female	13.341 **	12.373 **	2.536 **	2.120 *	10.805 **	10.253 **
	(1.370)	(1.381)	(1.169)	(1.188)	(0.709)	(0.703)
Constant	3.550 **	5.860 **	5.421 **	6.280 **	-1.871 **	-0.419
	(1.087)	(1.102)	(0.944)	(0.957)	(0.553)	(0.540)
Community Effects	Yes	Yes	Yes	Yes	Yes	Yes
Adj R2	0.184	0.194	0.105	0.107	0.147	0.160

* is significant at 10%. ** is significant at 5%. Standard errors are corrected for arbitrary heteroskedasticity and household clustering. Children are sorted from oldest to youngest. Let i represent the child's ranking in this sorting. The dependent variable is calculated by substrating the hours worked of child i from the hours worked of child i-1. The age gap is child i's age minus the age of child i-1 in years. All regressions include age/gender effects. The omitted category is a 15 year old male. Regressions are run on the 10,690 children of the household head (ages 6-15) who have younger siblings.