

# Siblings, child labor, and schooling in Nicaragua and Guatemala

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**Abstract** This paper explores empirically within-household gender and sibling differences in child labor, domestic work, and schooling of Guatemalan and Nicaraguan children. The main results show that older boys spend more time engaged in market and domestic work, whereas older girls spend more time in domestic work than their younger siblings. These results are independent of whether the younger sibling is a boy or a girl, which suggests that there is no substitution within the household of younger for older siblings in market and domestic work. This paper's findings show the relevance of domestic work and gender differentials in children's allocation of time in developing countries.

**Keywords** Child labor · Siblings · Gender

**JEL Classification** J13 · O15

## 1 Introduction

Child labor is widespread in developing countries. According to the International Labor Organization (ILO), it is estimated that, in 2001, at least 211 million children were working around the world, mostly in developing countries, with over eight million engaged in hazardous and exploitative forms of child labor (ILO 2002). Although estimates of child labor vary depending on the definition of a child, types of work, and collection of data, few deny that

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it is a complex phenomenon.<sup>1</sup> Many argue that the issue of child labor deserves attention because, by virtue of being in the labor force today, children are disinvesting in human capital formation, which might hurt them in the future and thus affect the economic development of a country.

Theoretical research about the causes of child labor has increased in recent times, emphasizing the role of income constraints (Basu and Van 1998) and access to credit (Baland and Robinson 2000), among others.<sup>2</sup> Not surprisingly, an extensive empirical literature attempts to explain the determinants of child labor to assess the relative importance of each of the factors influencing child labor and schooling decisions. This paper focuses on the role that birth order and sibling composition play in children's allocation of time. There are a variety of mechanisms through which birth order may affect children's allocation of time. In credit-constrained households, children grow up in an environment where siblings compete with each other for scarce resources. Older siblings may be encouraged to leave school early to help provide resources for the family, while later birth order children go to school (Morduch 2000). As family income grows over the life cycle, however, younger siblings might benefit from higher parental earnings and savings (Parish and Willis 1993). Direct interactions may exist between siblings as well if, for example, there are complementarities in home or farm production (Edmonds 2007b). Biological factors may matter too; higher birth order children have older mothers, which might have a negative effect on birth weight. Since birth weight is correlated with ability and access to resources, children born later may fare worse.

In addition to birth order, sibling sex composition matters as well. For example, if parents are more altruistic toward their sons than their daughters, as is often the case in traditional societies, the total investments in sons' schooling will be larger. Using Taiwanese data, Parish and Willis (1993) find that having an older sister has a positive effect on siblings' education. Another mechanism is through older sisters leaving the household early and marrying. Morduch (2000) and Garg and Morduch (1998) find that moving from one scenario where all siblings are brothers to one in which all are sisters raises the level of completed schooling of young teenagers in Tanzania and Ghana.

Children, however, are not only engaged in market activities but also in domestic activities within their own households, such as cooking, cleaning, and caring for other household members. Previous work for Latin America

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<sup>1</sup>Employment may harm children's intellectual and physical development with consequent negative effects on school performance and attendance (Gunnarsson et al. 2006; Heady 2003). It can also affect their health (Graitcer and Lerer 1998). In poor economies, however, not all forms of child labor are necessarily "bad" because such labor may contribute to household income that improves child outcomes (Blunch and Verner 2001) by introducing a child to work activities and survival skills (Grootaert and Kanbur 1995). Child labor may also increase returns to work over short time horizons if the return to experience outweighs the return to education (Beegle et al. 2006).

<sup>2</sup>See Basu (1999) and Edmonds (2007a) for an extensive review.

has shown that teenage girls spend significant time taking care of younger siblings in the household, which has detrimental effects on their schooling (Levison and Moe 1998; Ilahi 2001). If the child assumes extensive household responsibilities, she would appear not to be working, and this could distort the results if we do not consider domestic work as child labor. Edmonds (2007b) documents that the presence of younger siblings, especially younger boys, correlates with older girls doing more domestic work than boys within the same household. He argues that this may be due to differences in comparative advantage in household production.

The aim of this paper is to complement the existing literature by analyzing the role of gender and sibling composition on the usual definition of child labor (as children engage in market activities) and domestic work in Guatemala and Nicaragua, countries in which the employment of children in market and domestic work is common. In addition, both countries have higher illiteracy rates and lower school enrollment rates than other countries in Central and Latin America. In the context of high fertility and poverty rates, the effects of birth order and sibling composition on children's outcomes might get worse.

One of the main difficulties in estimating the effect of sibling composition and birth order, including in the present study, is the complexity of overcoming the endogeneity problem. Potential explanations for the results include the possibility that unobserved factors (e.g., unobserved taste for large families and child labor) drive the correlation between birth order and child labor. Another factor behind this correlation could be reverse causation (e.g., families increase the number of children they bear as a response to income constraints, so that children's contribution supplements family income or the children might provide labor within the family enterprise or farm). To address these concerns, I include household fixed effects in the estimation to examine siblings in the same household after aggregate (i.e., community) and non-time varying household factors have been purged. To the extent that unobserved household characteristics affect all children in the same household similarly, this approach should control for the potential bias in the estimates due to household heterogeneity. This approach, however, is unable to account for time or child-varying unobservable factors that directly influence, or are correlated with, both siblings and child labor.<sup>3</sup>

This paper explores sibling differences in market and domestic work in the 2000 Guatemala Living Standards Measurement Study and the 2001 Nicaragua Living Standards Measurement Study. The analysis focuses on children between the ages of 7 and 14 years. In Guatemala, about 21% of children in this

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<sup>3</sup>I can use twins as an instrument for family size to overcome the endogeneity problem (Rosenzweig and Wolpin 1980). One of the shortcomings of using household surveys, however, is that twins occur in only a small fraction of births. For example, only one percent of children aged 7 to 14 years have a twin brother or sister in the Guatemala data. Another option is to use sibling-sex composition as an instrument. As Schultz (2007) points out, however, this instrument might not be valid in contexts where a child's sex involves many culturally distinct costs and benefits for his or her parents, thus affecting child time allocation. In addition, two-sibling composition might not be valid in countries with son preferences (Lee 2008).

age group are engaged in market work, mostly in non-wage work, and 49% are engaged in domestic work for more than 7 h per week. In Nicaragua, about 15% of children in this age group are engaged in market work and 56% are engaged in domestic work for more than 7 h per week.

Several results emerge when comparing siblings in the same household and controlling for differences associated with age and gender in each country separately. First, using age rank as an indicator for birth order among resident siblings, the findings show that there is no additional effect of increasing age rank on hours and participation in market and domestic work for girls compared to their brothers. For boys, increasing age rank is associated with less time spent in market and domestic work. If we consider, however, differences in family size, the main findings suggest that relatively younger girls spend less time in domestic work and more in market work, while younger boys spend more time in domestic work with no change in market work. Second, there is a positive association between child labor and the number of younger siblings. For boys, additional younger siblings are associated with additional market work, whereas for girls, additional younger siblings are associated with more domestic work. These results hold regardless of the gender of younger siblings, which suggests for example that for older girls, having younger sisters does not reduce the burden of doing domestic work. Finally, increases in age rank and the number of younger siblings are not negatively associated with changes in school attendance. On the contrary, increases in relative age rank are associated with positive changes in school attendance for girls in Guatemala. Overall, estimates show that the time allocation of girls is more sensitive to household composition than is the time allocation of boys, especially if we consider household work in the definition of child labor.

The remainder of the paper is organized as follows: The next section summarizes related literature, Section 3 presents descriptive statistics, Section 4 presents the empirical strategy, and Section 5 presents the main results and concluding comments.

## 2 Related literature

Neoclassical models of household decision-making are commonly employed in the analysis of schooling and child labor. In this framework, parents make decisions about the allocation of a child's time, the time of other household members, and the purchase of goods and services. Parents will invest in each child's schooling up to the point where the marginal costs of a child's time in school equal the marginal benefits, considering the opportunity cost of schooling or the foregone earnings from work.

The main implication of the quantity–quality model is that an increasing marginal cost of quality (child outcome) with respect to quantity (number of children) leads parents to view the human capital of their children as a substitute for their number of children (Becker 1991). In the sociology literature, this model is known as the resource dilution model, which posits

that parental resources, i.e., inputs of child quality production, are allocated among siblings and each additional sibling results in a reduction of household resources available to each child (Blake 1981). To the extent that greater parental investments translate into higher educational achievements, schooling outcomes will be higher for children born earlier.

Life-cycle effects matter as well. If young parents are at an early stage of their careers, resources might be lower for their first-born children. As family income grows over the life cycle, younger siblings might benefit from higher parental earnings and savings (Parish and Willis 1993). This effect may be more important for credit-constrained households in low-income countries where credit markets are imperfect. On the other hand, biological factors may matter, too. Higher birth order children have older mothers, which might have an effect on birth weight. Since birth weight is correlated with ability and access to resources, later children may fare worse. Other factors can also play an important role. In poor and credit-constrained households, older siblings may be encouraged to leave school early to help provide resources for the family, while children born later go to school. Ultimately, it is an empirical question as to which effect dominates.

Empirical evidence for developing countries is mixed. Rosenzweig and Wolpin (1980) find that family size has a negative effect on schooling in India; Lee (2008) finds that family size in Korea has no effect on education, while Gomes (1984) finds that family size in Kenya is positively correlated with education attainment for first-born children. Quian (2006) investigated the relaxation of China's one-child policy and the event of multiple births to find that, for children in one-child families, an exogenous increase in family size has a positive effect on the first child's school attendance, although the effect is reversed for first-born children in families with more than two children. Rosenzweig and Zhang (2006), however, using the same identification strategy in China, argue that considering the birth-weight deficit of multiple births (twins), an extra child significantly decreases schooling progress, expected college enrollment, and school grades of all children in the family.<sup>4</sup>

In the child labor literature, the main finding is that later-born children are less likely to work (e.g., Patrinos and Psacharopoulos 1997; Emerson and Portela Souza 2008). This might be explained by poverty and credit constraints, as long as older children are working more than their siblings because they can command relatively higher wages. If we consider household work, this result might also be explained by the fact that older girls have a comparative

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<sup>4</sup>The evidence is also mixed for developed countries. Some papers find a negative effect of sibship size (also referred to as the number of siblings or family size) on children's educational attainment, even controlling for family socioeconomic background (e.g., Blake 1981) and considering the endogeneity of the fertility decision using twins (e.g., Berhman et al. 1989) in the USA. Other papers failed to find significant effects, for example, on wages (Kessler 1991) and dropout and school grade progression (Cáceres-Delpiano 2006). Furthermore, Black et al. (2005) find that children in one-child families perform worse in various schooling outcomes than those with siblings in Norway.

advantage in household production. For example, Edmonds (2007b) finds that the presence of younger siblings is correlated with more domestic work by older girls and more market work by older boys in Nepal, compared to their siblings in the same household.

Sibling sex composition is another important dimension that can influence the allocation of children's time. For example, if parents are more altruistic toward their sons than their daughters, the total investments in sons' schooling will be larger. Using Taiwanese data, Parish and Willis (1993) find that having an older sister has a positive effect on siblings' education. The effect of older sisters is through the care of younger children and by bringing in extra income through wage employment. This extra income makes it possible for younger children to pay school fees and allows siblings' later entry into the labor force. Another mechanism is through older sisters leaving the household early and marrying. Morduch (2000) observes that moving from one scenario where all siblings are brothers to one in which all are sisters raises the completed schooling of young teenagers by 0.44 years in Tanzania. The author points out that credit constraints and son preferences might explain this result.

### 3 Child labor context: the case of Guatemala and Nicaragua

Although Guatemala is a lower middle-income economy with a per capita GDP of US\$1,668, civil conflict and financial crises have affected the economy's stability (World Bank 2003a). Estimates show that poverty is a serious concern in the country, since more than half of Guatemalans lived below the poverty line in 2000. Most of them were concentrated in rural areas where 75% of the population was poor. Nicaragua is a lower middle-income country, as well. With an estimated per capita GDP of US\$817 in 2004, Nicaragua remains the second poorest country in Latin America and the Caribbean region after Haiti. In 2001, over 45.8% of the population lived in poverty, about 15.1% in extreme poverty.

Guatemala and Nicaragua provide an important context for the study of siblings, schooling, and child labor, including domestic work. First, child labor is very common in Guatemala and Nicaragua. For example, in Guatemala, about 506,000 children aged 7–14 years, representing 20% of total children in this age group, are engaged in market work. Most are employed on family farms and are located in rural areas. Of the 14 Latin American and Caribbean countries where data are available, Guatemala has the third highest prevalence of child labor (defined as market work), behind Bolivia and Ecuador (UCW 2003).<sup>5</sup> Second, Nicaragua has one of the highest illiteracy rates and one of the

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<sup>5</sup>The Guatemalan Labor Code sets the minimum age for employment at 14 years. Children under the age of 14 can work if the work is related to an apprenticeship, is light work of short duration and intensity, is necessary due to conditions of extreme poverty within the child's family, and enables the child to meet compulsory education requirements. In those cases, the workday for minors under the age of 14 years is limited to 6 h. The Nicaraguan Labor Code sets the minimum age for employment at 14 years (Source: Bureau of International Labor Affairs, <http://www.dol.gov/ilab/>).

lowest school enrollment rates in Latin America (World Bank 2003b). Third, in both countries, the performance of domestic work consumes an important share of children's time, especially among girls, probably because of the role traditionally assigned to women in the household. About 46.0 and 19.8% of girls aged 7 to 14 years are involved in domestic chores for more than 14 h a week in Nicaragua and Guatemala, respectively. Finally, the rate of fertility in Nicaragua remains above the Latin American average, while fertility in Guatemala is the highest in Latin America (World Bank 2003a).

This paper explores the relationship between siblings and children's allocation of time using the 2000 Guatemala Living Standards Measurement Study (hereafter LSMS) survey and the 2001 Nicaraguan LSMS survey. Both datasets are nationally representative cross-sectional household surveys that collect information about household characteristics and individual employment information for all family members aged 6 years and above. The data include household-level information for 4,694 and 7,276 households and individual-level information for 22,576 and 37,771 individuals in Nicaragua and Guatemala, respectively.

Children's activities are grouped into domestic and market work. Market work includes wage employment, self-employment, agriculture, unpaid work in a family business, and helping on the family farm, among others. Domestic work includes housekeeping and caretaking activities within the child's own household such as cleaning, cooking, taking care of siblings, fetching water, collecting firewood, throwing out garbage, and washing/ironing clothes. For each member of the household, the Guatemala LSMS records the number of hours spent the day previous to the interview in different types of activities within the child's own household, while the Nicaragua LSMS records the number of hours people spent the previous week doing domestic chores.<sup>6</sup> *Child labor* refers to children engaged in market work, while *any work* refers to children engaged in market and/or domestic work.<sup>7</sup> Both surveys provide information about labor outcomes and domestic chores for children older than 7 years. Therefore, they allow estimation of the labor supply of children aged

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<sup>6</sup>I do not include time spent shopping in Guatemala to facilitate comparison between the two countries. In addition, it may pick up other effects such as distance to markets. The Nicaraguan LSMS does not ask for each activity but asks about household chores in the last week, where household chores refer to ironing, cleaning, fetching water, helping siblings do homework, taking care of siblings, helping disabled family members and the elderly, among others. The Guatemalan LSMS asks for the number of hours and minutes spent on each activity the day before the day of the survey. I assume that children allocate the same amount of time each day doing household chores during the week.

<sup>7</sup>The International Labor Organization distinguishes between *children engaged in an economic activity* and *child labor*. The former is a broad concept that encompasses most productive activities by children, including unpaid and illegal work as well as work in the informal sector. The latter is a narrower concept excluding all those children 12 years and older who are working only a few hours a week in permitted light work and those 15 years and above whose work is not classified as "hazardous" (ILO 2002). Using household surveys, it is not possible to distinguish between hazardous and non-hazardous work.

7 to 14 years without including older children with different skills and labor attachments and, under most definitions, not viewed as child labor.

Tables 1 and 2 present summary statistics for the outcome measures and main individual characteristics for both countries. In Guatemala, of the 7,133 children of household heads aged 7 to 14, half are male, 76% attend school, 21% are engaged in market activities, and 49% work in domestic activities for more than seven hours per week. On average, children spend 6.7 hours per week engaged in market work and 1.95 h per day engaged in domestic work. Those who work spent on average 32 h per week and 3.1 h per day in market and domestic activities, respectively. Girls spent, on average, 4.3 h a week in market activities and 2.9 hours per day in domestic work. Boys spent an average of 8.9 h per week in market activities and 1.1 h per day in domestic activities. The largest component of market work is non-wage work for all children. In Nicaragua, more children of the household head aged 7 to 14 years old attend school (83%), less engage in market activities (15%), and more engage in domestic work for more than 7 h a week (55%) than those in Guatemala. Those who work spend, on average, 26 h a week engaged in market activities and 15 h a week in domestic work.

**Table 1** Descriptive statistics for children aged 7–14 and their households: Guatemala

	All children of household head			Children of household head with siblings		
	All	Male	Female	All	Male	Female
Age	10.364	10.392	10.335	10.357	10.386	10.327
Gender (1 = male)	0.517	–	–	0.518	–	–
Age rank	2.626	2.608	2.644	2.659	2.640	2.679
Relative age rank	–	–	–	0.434	0.441	0.427
Number of younger siblings	2.038	2.014	2.064	2.080	2.054	2.106
Number of younger sisters	0.998	0.973	1.026	1.019	0.992	1.047
Number of younger brothers	1.040	1.042	1.038	1.061	1.062	1.059
School attendance	0.759	0.780	0.736	0.758	0.780	0.735
Any work	0.599	0.529	0.675	0.602	0.532	0.677
Market work	0.205	0.270	0.136	0.206	0.270	0.137
Wage work	0.050	0.065	0.034	0.050	0.065	0.034
Non-wage work	0.157	0.207	0.103	0.158	0.208	0.104
Domestic work ( $\geq 7$ h a week)	0.487	0.346	0.638	0.489	0.349	0.640
Weekly hours market worked	6.718	8.936	4.341	6.732	8.946	4.357
Weekly hours market worked (for work = 1)	32.423	32.843	31.534	32.436	32.860	31.539
Daily hours domestic work	1.948	1.070	2.888	1.958	1.080	2.899
Daily hours domestic work (for domestic work = 1)	3.089	2.151	3.736	3.101	2.167	3.745
By type of activity						
Only school	63.15	61.13	65.32	63.05	61.07	65.16
School and market work	12.73	16.86	8.31	12.78	16.89	8.36
Only market work	7.81	10.14	5.32	7.80	10.12	5.31
Neither	16.31	11.87	21.06	16.38	11.92	21.17
<i>N</i>	7,133	3,690	3,443	6,991	3,618	3,373

All sibling variables for child *i* are not inclusive of child *i*. Age rank variables and sibling counts are not limited to children aged 7 to 14 years, but they are limited to resident children since the data do not survey non-resident children.



**Table 2** Descriptive statistics for children aged 7–14 and their households: Nicaragua

	All children of household head			Children of household head with siblings		
	All	Male	Female	All	Male	Female
Age	10.423	10.494	10.348	10.434	10.509	10.356
Gender (1 = male)	0.514	–	–	0.512	–	–
Age rank	2.744	2.695	2.795	2.794	2.753	2.837
Relative age rank	–	–	–	0.481	0.477	0.486
Number of younger siblings	1.540	1.553	1.527	1.585	1.606	1.563
Number of younger sisters	0.758	0.756	0.761	0.780	0.782	0.778
Number of younger brothers	0.782	0.796	0.766	0.804	0.824	0.784
School attendance	0.831	0.814	0.849	0.829	0.812	0.847
Any work	0.705	0.676	0.736	0.708	0.679	0.738
Market work	0.148	0.217	0.074	0.148	0.219	0.074
Wage work	0.024	0.040	0.006	0.023	0.039	0.006
Non-wage work	0.123	0.175	0.068	0.124	0.178	0.068
Domestic Work ( $\geq 7$ h a week)	0.557	0.459	0.662	0.559	0.460	0.664
Weekly hours market worked	3.843	5.977	1.585	3.841	5.997	1.584
Weekly hours market worked (for work = 1)	26.014	27.500	21.399	25.885	27.356	21.336
Weekly hours domestic work	9.262	6.860	11.805	9.300	6.868	11.848
Weekly hours domestic work (for domestic work = 1)	15.040	13.272	16.418	15.050	13.252	16.437
By type of activity						
Only school	73.45	68.58	78.60	73.19	68.20	78.42
School and market work	9.67	12.87	6.27	9.71	12.96	6.31
Only market work	5.11	8.86	1.14	5.13	8.96	1.11
Neither	11.78	9.69	13.99	11.97	9.87	14.16
<i>N</i>	3,973	2,043	1,930	3,861	1,975	1,886

All sibling variables for child  $i$  are not inclusive of child  $i$ . Age rank variables and sibling counts are not limited to children aged 7 to 14 years, but they are limited to resident children since the data do not survey non-resident children.

Tables 1 and 2 also present the time children allocate to schooling, market work, or both, by gender. In Guatemala, about 63% of children of the household head aged 7 to 14 attend school exclusively, while 13% undertake both schooling and market employment activities. In Nicaragua, about 73% of children attend school exclusively, while 9.7% engage in market work and attend school. Interestingly, in both countries, the proportion of children who neither report at school nor are engaged in market work is higher than the proportion of children who both work and go to school and those who are employed only. This is driven by the high proportion of girls who neither report at school nor are working. They are probably engaged in domestic work within their own households.

Analyzing children's activities in domestic work by gender in Guatemala, where disaggregate data are available, we can see that cleaning, cooking, washing dishes, and caring for children are the largest components of domestic work for girls. For boys, the largest components are cleaning, caring for children, and collecting firewood. On average, children spent 2.5 h per day caring for children, 1.5 h per day cooking and serving food, and 1.4 h per day washing or ironing clothes.

In Guatemala, children of the household head with siblings have an average age rank of 2.6, 2.1 younger siblings, and a similar number of younger brothers and sisters. Similarly, Nicaraguan children with siblings have an average age rank of 2.8 and 1.6 younger siblings.<sup>8</sup> Sibling counts and age rank are based on resident children of the household head and are not limited to children between the ages of 7 and 14 years. A sibling is defined as an individual of any age who shares one or two parents with the child. The analysis in this paper is based on comparing activities of different siblings within the household. For that reason, the sample is limited to children in households with at least one sibling. As Tables 1 and 2 show, few children in the sample (142 children in Guatemala and 112 children in Nicaragua) have no siblings. Therefore, observable characteristics are very similar for the sample of all children, compared with the sample of children with siblings.

#### 4 Empirical methodology

This section presents a series of ordinary least square regressions aimed at analyzing the relationship between birth order and sibling composition in households with at least two children, allowing for this relationship to differ between boys and girls. The dependent variables are a market work indicator that equals one if the child is working in market-oriented activities, a domestic work indicator that equals one if the child is engaged in domestic chores at least 7 hours a week, hours worked in each activity, and a schooling indicator that equals one if the child attends school the week prior to the survey.

The estimation considers the relationship between age rank and children's allocation of time as follows:

$$y_{ij} = \beta_0 + \beta_1 \text{Female}_i + \beta_2 \text{AgeRank}_i + \beta_3 \text{AgeRank}_i \times \text{Female}_i + \sum_{i=7}^{14} \delta_i A_i + \sum_{i=7}^{14} \varphi_i (A_i \times \text{Female}_i) + H_j + \varepsilon_{ij} \quad (1)$$

where AgeRank represents the residential age rank of the child  $i$  residing in household  $j$ ,  $A_i$  is a dummy for each child that takes the value 1 for child  $i$ 's age, and  $H_j$  is a household fixed effect, which controls for unobservables at the household level. AgeRank represents the child's birth order among resident siblings; for example, the first-born child (or oldest) is given age rank 1, the second child is given age rank 2, the third child is given age rank 3 and so on.

The estimation allows for age  $\times$  gender effects by the interaction of age dummies and the female indicator. The inclusion of the fixed effect and age  $\times$  gender controls causes the coefficient of age rank to be interpreted as the

<sup>8</sup>It is important to recognize that because the data is based on a household survey, it may not take into account some children who may no longer live with their parents. Since most children move out of the house at a later age, restricting the sample to children aged at most 14 might attenuate the problem.

average change in the outcome associated with increasing age rank within a household. The interpretation of the coefficients is as follows:  $\beta_2$  is an estimate of the effect associated with age rank for boys,  $\beta_3$  is the extra increment in the outcome associated with being female in addition to the effect for boys. The corresponding effect of age rank for girls is given by the sum of the coefficients  $\beta_2 + \beta_3$ , after controlling for age and gender differences. A negative association is expected to be found between age rank and child labor ( $\beta_2 < 0$  and  $\beta_2 + \beta_3 < 0$ ), if we expect older children to engage more in market and domestic activities than their younger siblings because of their ability to command higher wages (Emerson and Portela Souza 2008) or due to their comparative advantage in household production (Edmonds 2007b). This approach allows us to test whether the effect of age rank is the same for boys and girls within the same household ( $H_0: \beta_3 = 0$ ).

To analyze the association between siblings and child labor, Eq. 2 interacts the female dummy with the number of younger resident siblings as follows:

$$y_{ij} = \beta_0 + \beta_1 \text{Female}_i + \beta_2 \text{YS}_{ij} + \beta_3 \text{YS}_{ij} \times \text{Female}_i + \sum_{i=7}^{14} \delta_i A_i + \sum_{i=7}^{14} \varphi_i (A_i \times \text{Female}_i) + H_j + \varepsilon_{ij} \quad (2)$$

where  $\text{YS}_{ij}$  represents the number of residential younger siblings, which is not limited to children aged 7 to 14. As before, the interpretation of the coefficients after controlling for household and age  $\times$  gender effects is as follows:  $\beta_2$  is an estimate of the effect associated with changes in the number of younger siblings for boys,  $\beta_3$  is the extra increment in the outcome associated with being female in addition to that for boys, and the corresponding effect of younger siblings for girls is given by the sum of the coefficients  $\beta_2 + \beta_3$ .

Furthermore, I separate younger siblings into younger brothers ( $\text{YBrothers}_{ij}$ ) and younger sisters ( $\text{YSisters}_{ij}$ ) as follows

$$y_{ij} = \beta_0 + \beta_1 \text{Female}_i + \beta_2 \text{YSisters}_{ij} + \beta_3 \text{YSisters}_{ij} \times \text{Female}_i + \beta_4 \text{YBrothers}_{ij} + \beta_5 \text{YBrothers}_{ij} \times \text{Female}_i + \sum_{i=7}^{14} \delta_i A_i + \sum_{i=7}^{14} \varphi_i (A_i \times \text{Female}_i) + H_j + \varepsilon_{ij}. \quad (3)$$

For girls, the effect associated with an increase in the number of younger sisters is given by the sum of the coefficients  $\beta_2 + \beta_3$ , and the effect associated with an increase in the number of younger brothers is given by  $\beta_4 + \beta_5$ . For boys,  $\beta_2$  and  $\beta_4$  are estimates of the effect associated with changes in the number of younger sisters and brothers, respectively. Given gender differences in child labor previously documented, one mechanism through which gender of the siblings matters, for example, is that having more sisters may help reduce the burden of domestic work for girls, while for boys, having younger sisters may increase the number of hours engaged in market work under income

constraints. If parents favor sons over daughters, however, having younger sisters may decrease the intensity of market work for boys since younger sisters may engage in market activities while the older sons go to school.

## 5 Siblings, child labor, and schooling

This section analyzes the association between siblings and children's allocation of time. In each table, the first columns present the coefficient for school attendance and children's activities for Guatemala, and the last columns show the estimates for Nicaragua. I also include total weekly hours worked in market and domestic work as dependent variables to analyze the intensive margin of child labor. Each column header indicates the dependent variable.

Tables 3 and 4 report estimates of regressing children's activities and hours on age rank; all specifications control for age and gender effects in addition to household fixed effects. The results show that none of the interacted terms on the age rank  $\times$  female are significant, and there is no evidence against the hypothesis that the effects of age rank are the same for boys and girls. Overall, the estimates suggest that increasing age rank is negatively related to market and domestic work; thus, older children in the household spend more time in these activities than their siblings, with no differences across genders.

In Guatemala, Table 3 shows that an increase in age rank by one is associated with a decrease in market and domestic work of 4.1 and 5.4 percentage points, respectively, for boys, relative to the oldest sibling in the household, with small effects on school attendance. For girls, an increase in age rank by one is associated with a decrease in market and domestic work of 3.6 and 4.2 percentage points, respectively. Similarly, in Table 4, an increase in age rank by one is associated with a decrease in hours worked of 1.1 h in market activities and 1.5 h in domestic work for boys. On average, an increase in age rank is associated with a decrease of about 2.61 and 3.1 h in any type of activity for boys and girls, mostly driven by the change in hours in which they are engaged in domestic work. In Nicaragua, however, an increase in age rank by one is associated with small changes in schooling, child labor, and domestic work (albeit statistically not significant).

To examine how each age rank category is related to changes in child labor in Guatemala, unreported regressions include a dummy for each age rank, instead of one variable, and their interactions with the female dummy. The omitted category is the oldest child for each household. The data suggest that, after controlling for age and gender differences, boys with an age rank of five have a 12 percentage points less probability of engaging in market activities and 16 percentage points less probability of working in domestic activities than the oldest sibling. On average, boys with an age rank of five experienced a decrease of about 4.9 and 6.4 h a week than their eldest sibling in market and domestic work, respectively. Girls with an age rank of five have a 15 percentage points less probability of engaging in domestic activities than their eldest sibling (albeit not significant). These results are consistent with previous

**Table 3** Within-household regressions of children's activities on age rank (standard errors in parentheses)

	Guatemala				Nicaragua			
	School attendance	Market work	Domestic work	Any work	School attendance	Market work	Domestic work	Any work
Female	-0.144** (0.04)	-0.269** (0.04)	0.482** (0.05)	0.185** (0.05)	0.104* (0.05)	-0.248** (0.05)	0.239** (0.07)	-0.009 (0.05)
Age rank	-0.005 (0.02)	-0.041** (0.04)	-0.054** (0.02)	-0.067** (0.02)	0.007 (0.01)	-0.007 (0.01)	0.007 (0.01)	-0.001 (0.01)
Age rank × female	0.005 (0.01)	0.005 (0.01)	0.012 (0.01)	0.009 (0.01)	-0.001 (0.01)	-0.008 (0.01)	0.014 (0.01)	0.005 (0.01)
Constant	0.659** (0.03)	0.628** (0.03)	0.411** (0.04)	0.825** (0.04)	0.665** (0.04)	0.468** (0.04)	0.449** (0.05)	0.917** (0.04)
Age/gender effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Household fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R <sup>2</sup>	0.51	0.45	0.45	0.49	0.55	0.42	0.40	0.52

Age rank represents the child's birth order among resident siblings. Age/gender effects include a vector of dummy variables for the child's age and dummy variables for age interacted with the female indicator. The omitted category is a 14-year-old boy. Household fixed effects indicate a vector of dummy variables for each household. The sample includes 6,991 and 3,861 resident children of the household head aged 7 to 14 years with siblings in Guatemala and Nicaragua, respectively.

\*  $p < 0.05$

\*\*  $p < 0.01$

**Table 4** Within-household regressions of hours worked on age rank (standard errors in parentheses)

	Guatemala			Nicaragua		
	Market work	Domestic work	Any work	Market work	Domestic work	Any work
Female	-9.115** (2.07)	25.214** (2.13)	16.099** (2.55)	-10.370** (1.75)	10.027** (1.51)	-0.312 (1.76)
Age rank	-1.069 (0.65)	-1.535* (0.75)	-2.605** (0.91)	-0.048 (0.25)	0.187 (0.21)	0.139 (0.24)
Age rank × female	-0.022 (0.32)	-0.479 (0.40)	-0.500 (0.46)	-0.443 (0.29)	-0.017 (0.25)	-0.473 (0.27)
Constant	23.873** (1.55)	8.096** (1.42)	31.969** (1.88)	14.997** (1.46)	7.060** (0.88)	22.057** (1.29)
Age/gender effects	Yes	Yes	Yes	Yes	Yes	Yes
Household Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R <sup>2</sup>	0.38	0.45	0.51	0.34	0.52	0.56

Age rank represents the child's birth order among resident siblings. Age/gender effects include a vector of dummy variables for the child's age and dummy variables for age interacted with the female indicator. The omitted category is a 14-year-old boy. Household fixed effects indicate a vector of dummy variables for each household. The sample includes 6,991 and 3,861 resident children of the household head aged 7 to 14 years with siblings in Guatemala and Nicaragua, respectively.

\**p* < 0.05  
 \*\* *p* < 0.01

research that finds that older children engage more in work activities than their siblings.

The main problem with using the absolute birth order or age rank is that most of the variation is due to larger families. For that reason, this analysis includes a measure of relative birth order defined as  $\frac{p-1}{n-1}$ , where  $p$  is the residential age rank and  $n-1$  is the number of siblings in the household (Ejrnæs and Pörtner 2004). Thus, the oldest relative order equals zero and the youngest relative order equals one. Tables 5 and 6 report the estimates of regressing children's activities and hours on relative age rank controlling for age and gender effects, in addition to household fixed effects.

Interestingly, after controlling for the size of the household, the results suggest that some of the interactions take significant coefficients and some are large, yielding an important impact on gender gaps, which is different from the estimates in Tables 3 and 4. As Table 5 shows, in Guatemala, increasing girls' relative age rank is associated with an increase in school attendance by 4.8 percentage points and the probability of engaging in market activities by 9.5 percentage points. Similarly, in Nicaragua, an increase in girls' relative age rank is associated with an increase in the probability of engaging in market activities of 3.4 percentage points for girls and a decrease of 6.8 percentage points for boys with small effects on schooling.

In Table 6, the estimates suggest that relative age rank differentially affects the number of hours that children engage in labor market activities as well. Note that the regressions control for age and gender of the child, so it is not the age difference between observations that is driving these results. An increment in relative age rank is associated with an increase of 4.7 h in domestic work for boys and a decrease of 6.1 h in domestic work for girls in Guatemala, while in Nicaragua, it is associated with an increase of 1.2 h in market work and a decrease of 1.6 h in domestic work for girls. On average, an increase in relative age rank is associated with 5.4 more hours and 2.35 less hours in any activity relative to older siblings in the household, for boys and girls, respectively, in Guatemala. This result appears to be driven by the time that children devote to domestic work.

One would expect to see that relatively older girls and boys have a higher opportunity cost and should be expected to do more market work and less domestic work. The data shows that this might not be true for older girls, however, probably because they have comparative advantage in home production (Edmonds 2007b). Indeed, the estimates suggest that relatively younger girls in the household attend more school but also engage more in market work than their older siblings in Guatemalan households. In addition, older sisters engage more in domestic work relative to their siblings in households in both countries. One plausible interpretation is that young siblings raise the demand for the older girl's time in childcare and other home activities. The presence of younger siblings requires, among other things, the attention of older children, which may reduce their availability for school activities or market work. For example, 17% of non-enrolled Guatemalan girls aged 12 to 14 attributes non-enrollment due to household chores reasons.

**Table 5** Within-household regressions of children's activities on relative age rank (standard errors in parentheses)

	Guatemala				Nicaragua			
	School attendance	Market work	Domestic work	Any work	School attendance	Market work	Domestic work	Any work
Female	-0.155** (0.04)	-0.289** (0.04)	0.518** (0.05)	0.192** (0.04)	0.106* (0.05)	-0.306** (0.05)	0.314** (0.07)	0.008 (0.05)
Relative birth order	-0.049 (0.03)	-0.026 (0.03)	-0.083 (0.05)	-0.088 (0.04)	0.018 (0.03)	-0.068* (0.03)	0.065 (0.04)	-0.003 (0.03)
Relative birth order × female	0.097* (0.04)	0.121** (0.04)	-0.053 (0.05)	0.03 (0.05)	-0.006 (0.04)	0.102* (0.04)	-0.112 (0.06)	-0.01 (0.05)
Constant	0.662** (0.03)	0.586** (0.03)	0.339** (0.03)	0.744** (0.03)	0.672** (0.03)	0.481** (0.04)	0.433** (0.04)	0.914** (0.03)
Age/gender effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Household fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R <sup>2</sup>	0.51	0.45	0.45	0.48	0.55	0.42	0.40	0.52

Relative birth order is defined as (age rank-1)/ (number of siblings). Age/gender effects include a vector of dummy variables for the child's age and dummy variables for age interacted with the female indicator. The omitted category is a 14-year-old boy. Household fixed effects indicate a vector of dummy variables for each household. The sample includes 6,991 and 3,861 resident children of the household head aged 7 to 14 years with siblings in Guatemala and Nicaragua, respectively.

\*  $p < 0.05$

\*\*  $p < 0.01$



**Table 6** Within-household regressions of hours worked on relative age rank (standard errors in parentheses)

	Guatemala		Nicaragua		Any work	Domestic work	Market work	Any work
	Market work	Domestic work	Market work	Domestic work				
Female	-9.946** (2.03)	26.649** (2.01)	-12.420** (1.74)	11.127** (1.47)	-1.269 (1.76)			
Relative birth order	0.666 (1.52)	4.693** (1.64)	-1.470 (0.97)	1.568 (0.82)	0.112 (0.94)			
Relative birth order × female	3.106 (1.64)	-10.815** (1.99)	2.617* (1.28)	-3.182** (1.20)	-0.64 (1.31)			
Constant	22.741** (1.26)	5.141** (0.99)	15.583** (1.41)	6.836** (0.80)	22.415** (1.26)			
Age/gender effects	Yes	Yes	Yes	Yes	Yes			Yes
Household fixed effects	Yes	Yes	Yes	Yes	Yes			Yes
Adjusted $R^2$	0.38	0.45	0.34	0.53	0.56			

Relative birth order is defined as (age rank-1)/(number of siblings). Age/gender effects include a vector of dummy variables for the child's age and dummy variables for age interacted with the female indicator. The omitted category is a 14-year-old boy. Household fixed effects indicate a vector of dummy variables for each household. The sample includes 6,991 and 3,861 resident children of the household head aged 7 to 14 years with siblings in Guatemala and Nicaragua, respectively.

\*  $p < 0.05$

\*\*  $p < 0.01$

To further analyze the effect of having younger siblings, Tables 7, 8, 9, and 10 present the estimates considering the number of younger siblings and the gender composition of those siblings. The results show that most of the interacted terms on the number of younger siblings  $\times$  female are significant, and there is evidence against the hypothesis that the effects of siblings are the same for boys and girls. The data do not suggest that school attendance changes with increments in the number of younger siblings, though. Most of the gender differential is present in market and domestic work. Table 7 shows that, in Guatemala, an increase in the number of younger siblings by one is associated with a six-percentage-point increase in the probability of engaging in labor activities, and a four-percentage-point increase in the probability of doing domestic chores for boys. In Nicaragua, an increase in the number of younger siblings is associated with an increase in market work and a decrease in domestic work for boys. For girls, an increase in the number of younger siblings is associated with a small change in the probability of engaging in labor activities in both countries, but in Guatemala, it increases the probability of doing domestic chores by six percentage points.

As Table 8 shows, there is a gender gap in the intensity of work as well; in Guatemala, boys and girls increase their work by 2.4 and 3.8 h, respectively. Interestingly, most of the increase in hours devoted to any type of work comes from more hours engaged in market work for boys and more hours engaged in domestic work for girls. An increase in the number of younger siblings by one is associated with an increase of 2.0 h in market work for boys, with small effects on hours devoted to household work. On the contrary, girls experience an increase in their household work of 3.1 h a week, on average, with small effects on their time devoted to market work activities. In Nicaragua, boys and girls increase their market and domestic work but the change in hours is small.

To examine whether the gender of younger siblings affects the gender differential in child labor, Table 9 presents the estimates considering the gender of the younger sibling.<sup>9</sup> The estimates show that an increase in the number of younger brothers and sisters is associated with small changes in the probability of engaging in market work for girls. For boys, having younger sisters increases this probability by eight and seven percentage points in Guatemala and Nicaragua, respectively, while having younger brothers increases the probability by five percentage points in Guatemala. The estimates do not suggest that sibling composition affects the probability of doing domestic work for Guatemalan boys. In Nicaragua, however, having younger sisters decreased the probability of doing domestic work by about eight percentage points for boys.

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<sup>9</sup>It may also matter if the elder boy is a boy or a girl. The data, however, provide information only for children living in the household. If the probability of moving out of the household is correlated with gender (i.e., teenage boys have higher probability of living outside their households than teenage girls), the estimate of the labor supply of the child on the gender of the older siblings may be biased.

**Table 7** Within-household regressions of children's activities on younger siblings (standard errors in parentheses)

	Guatemala				Nicaragua			
	School attendance	Market work	Domestic work	Any work	School attendance	Market work	Domestic work	Any work
Female	-0.077 (0.04)	-0.122** (0.05)	0.406** (0.05)	0.218** (0.05)	0.098 (0.05)	-0.152** (0.05)	0.113 (0.07)	-0.039 (0.06)
Younger siblings	0.010 (0.02)	0.062** (0.02)	0.035 (0.02)	0.071** (0.02)	-0.007 (0.01)	0.043** (0.01)	-0.053** (0.01)	-0.01 (0.01)
Younger siblings × female	-0.018* (0.01)	-0.043** (0.01)	0.032** (0.01)	-0.005 (0.01)	0.002 (0.01)	-0.046** (0.01)	0.064** (0.02)	0.017 (0.01)
Constant	0.619** (0.06)	0.368** (0.06)	0.211** (0.08)	0.489** (0.07)	0.694** (0.04)	0.345** (0.04)	0.594** (0.06)	0.939** (0.04)
Age/gender effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Household fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R <sup>2</sup>	0.51	0.46	0.45	0.49	0.55	0.43	0.41	0.52

Relative birth order is defined as (age rank-1)/(number of siblings). Age/gender effects include a vector of dummy variables for the child's age and dummy variables for age interacted with the female indicator. The omitted category is a 14-year-old boy. Household fixed effects indicate a vector of dummy variables for each household. The sample includes 6,991 and 3,861 resident children of the household head aged 7 to 14 years with siblings in Guatemala and Nicaragua, respectively.

\*  $p < 0.05$

\*\*  $p < 0.01$

**Table 8** Within-household regressions of hours worked on younger siblings (standard errors in parentheses)

	Guatemala			Nicaragua		
	Market work	Domestic work	Any work	Market work	Domestic work	Any work
Female	-3.998 (2.14)	14.436** (2.25)	10.437** (2.78)	-7.814** (1.76)	6.866** (1.59)	-0.991 (1.81)
Younger siblings	2.014** (0.67)	0.341	2.354** (0.90)	1.181** (0.37)	-0.880** (0.28)	0.307 (0.33)
Younger siblings × female	-1.621** (0.36)	3.084** (0.43)	1.463** (0.49)	-1.451** (0.39)	1.240** (0.33)	-0.194 (0.37)
Constant	15.818** (2.54)	4.628	20.446** (3.30)	11.989** (1.55)	9.698** (1.06)	21.675** (1.44)
Age/gender effects	Yes	Yes	Yes	Yes	Yes	Yes
Household fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted $R^2$	0.39	0.46	0.52	0.35	0.53	0.56

Number of younger siblings refers to the number of younger siblings other than child  $i$  in the household. Age/gender effects include a vector of dummy variables for the child's age and dummy variables for age interacted with the female indicator. The omitted category is a 14-year-old boy. Household fixed effects indicate a vector of dummy variables for each household. The sample includes 6,991 and 3,861 resident children of the household head aged 7 to 14 years with siblings in Guatemala and Nicaragua, respectively.

\*  $p < 0.05$

\*\*  $p < 0.01$

**Table 9** Within-household regressions of children's activities on gender of younger siblings (standard errors in parentheses)

	Guatemala				Nicaragua			
	School attendance	Market work	Domestic work	Any work	School attendance	Market work	Domestic work	Any work
Female	-0.085 (0.04)	-0.117* (0.05)	0.407** (0.05)	0.216** (0.05)	0.104 (0.06)	-0.135* (0.06)	0.091 (0.08)	-0.044 (0.06)
Younger brothers	0.028 (0.02)	0.045* (0.02)	0.027 (0.02)	0.064** (0.02)	-0.004 (0.02)	0.023 (0.02)	-0.031 (0.02)	-0.008 (0.02)
Younger brothers × female	-0.019 (0.01)	-0.039** (0.01)	0.038** (0.01)	0.009 (0.01)	-0.015 (0.01)	-0.031* (0.02)	0.054* (0.02)	0.022 (0.02)
Younger sisters	-0.009 (0.02)	0.080** (0.02)	0.044 (0.03)	0.079** (0.02)	-0.008 (0.02)	0.070** (0.02)	-0.082** (0.03)	-0.012 (0.02)
Younger sisters × female	-0.012 (0.01)	-0.051** (0.01)	0.024 (0.01)	-0.019 (0.01)	0.016 (0.01)	-0.071** (0.02)	0.085** (0.02)	0.014 (0.02)
Constant	0.619** (0.06)	0.369** (0.06)	0.212** (0.08)	0.490** (0.07)	0.690** (0.04)	0.334** (0.04)	0.606** (0.06)	0.940** (0.04)
Age/gender effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Household fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R <sup>2</sup>	0.51	0.46	0.45	0.49	0.55	0.43	0.41	0.52

Number of siblings refers to the number of younger siblings other than child  $i$  in the household. Age/gender effects include a vector of dummy variables for the child's age and dummy variables for age interacted with the female indicator. The omitted category is a 14-year-old boy. Household fixed effects indicate a vector of dummy variables for each household. The sample includes 6,991 and 3,861 resident children of the household head aged 7 to 14 years with siblings in Guatemala and Nicaragua, respectively.

\*  $p < 0.05$

\*\*  $p < 0.01$

**Table 10** Within-household regressions of hours worked on gender of younger siblings (standard errors in parentheses)

	Guatemala		Nicaragua		Any work
	Market work	Domestic work	Market work	Domestic work	
Female	-3.708 (2.15)	14.340** (2.27)	-7.229** (1.83)	6.861** (1.62)	-0.432 (1.85)
Younger brothers	0.984 (0.84)	0.575 (0.88)	0.62 (0.59)	-0.953* (0.44)	-0.316 (0.54)
Younger brothers × female	-1.235** (0.48)	3.070** (0.58)	-1.294* (0.55)	1.365** (0.46)	0.105 (0.56)
Younger Sisters	3.100** (0.87)	0.091 (0.99)	1.952** (0.64)	-0.803 (0.53)	1.137 (0.59)
Younger sisters*Female	-2.224** (0.52)	3.154** (0.60)	-1.900** (0.58)	1.126* (0.49)	-0.765 (0.50)
Constant	15.854** (2.54)	4.624 (2.66)	11.616** (1.55)	9.691** (1.08)	21.307** (1.45)
Age/gender effects	Yes	Yes	Yes	Yes	Yes
Household fixed effects	Yes	Yes	Yes	Yes	Yes
Adjusted $R^2$	0.39	0.46	0.35	0.53	0.56

Number of siblings refers to the number of younger siblings other than child  $i$  in the household. Age/gender effects include a vector of dummy variables for the child's age and dummy variables for age interacted with the female indicator. The omitted category is a 14-year-old boy. Household fixed effects indicate a vector of dummy variables for each household. The sample includes 6,991 and 3,861 resident children of the household head aged 7 to 14 years with siblings in Guatemala and Nicaragua, respectively.

\*  $p < 0.05$

\*\*  $p < 0.01$

**Table 11** Within-household regressions of hours worked on age spacing (standard errors in parentheses)

	Guatemala			Nicaragua		
	Market work	Domestic work	Any work	Market work	Domestic work	Any work
Female	0.763 (3.27)	7.923* (3.20)	8.686* (4.07)	-5.159 (2.91)	4.353 (2.48)	-0.828 (2.85)
Age difference with the youngest sibling	3.443** (0.26)	-0.047 (0.23)	3.395** (0.30)	2.375** (0.29)	0.259 (0.19)	2.634** (0.27)
Age difference with the youngest sibling × female	-1.096** (0.24)	1.851** (0.26)	0.755* (0.31)	-0.712** (0.26)	0.633** (0.19)	-0.077 (0.24)

All equations include age/gender effects and household fixed effects. Age/gender effects include a vector of dummy variables for the child's age and dummy variables for age interacted with the female indicator. The omitted category is a 14-year-old boy. Household fixed effects indicate a vector of dummy variables for each household. The sample includes 5,752 and 3,007 resident children of the household head aged 7 to 14 years with younger siblings in Guatemala and Nicaragua, respectively.

\*  $p < 0.05$

\*\*  $p < 0.01$

In terms of hours devoted to market work, having a younger sister is associated with an additional 3.1 h for boys and 0.9 h for girls in Guatemala and 1.9 h for boys in Nicaragua. Increases in the number of younger brothers are associated with an additional 1 h for boys and a reduction of 0.3 h in market work for girls in Guatemala. The estimates also do not suggest that increases in the number of younger brothers or sisters affect time devoted to domestic work for boys. For girls, however, an increase in the number of younger sisters or brothers is associated with an additional 3.6 h in domestic activities in Guatemala.

These results show that girls spend more time than their brothers in domestic work, while boys spend more time than their sisters in market work in response to an additional young sibling in the family. It is important to note that in Guatemala the presence of additional young sisters or brothers is correlated with similar increases in the number of hours devoted to domestic work for girls. This suggests that having younger sisters does not reduce the burden of domestic work for older girls through substitution in domestic chores.

Finally, Table 11 presents the estimates of the age difference with the youngest resident sibling. In most cases the effect is positive and statistically significant (except domestic work for boys). In other words, the greater the age difference with the youngest resident sibling, the more likely it is for the child to work. For boys, an increase in the age difference with the youngest resident sibling is associated with an increase in market work of about 3.4 and 2.1 h in Guatemala and Nicaragua, respectively. The estimates also show that most of the interacted terms of the age difference with the youngest female are statistically significant. For example, an increase in the age difference with the youngest sibling is associated with an increase of 2.3 h in market work and 1.8 h in domestic work for girls.<sup>10</sup> Emerson and Portela Souza (2008) find similar results using Brazilian data.

## 6 Summary and conclusions

This paper has examined the link between age rank, sibling composition, and child labor. Consistent with findings in child labor literature, estimates suggest that children in the same household face different circumstances. For example, taking into consideration differences in family size, estimates show that girls are more sensitive to changes in family composition. The estimates suggest that relatively younger girls in the household attend more school but also engage more in market work than their older siblings in Guatemalan households. Older sisters engage more in domestic work relative to their siblings in both

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<sup>10</sup>Unreported regressions show similar results of age rank as the ones presented before if I include age spacing in the age rank equation. It is very difficult, however, to disentangle which effect is more important, the effect of age rank or the distance between siblings, since they are closely interrelated.



countries. In addition, for boys, an additional younger sibling is associated with additional market work, whereas for girls, an additional younger sibling is associated with more domestic work. These results hold, regardless of the gender of the younger siblings, which suggests there is no substitution within the household of younger for older siblings.

These results can help to improve the design of policies in developing countries. For instance, the most popular policy tool used to increase human capital during the past decade has been the conditional cash transfer program, which provides cash payments to households upon compliance with a defined set of requirements, such as regular attendance at school and visiting health clinics. Some of these programs fail to account for domestic work, family size, and composition. For example, the Social Protection Network in Nicaragua provided fixed transfers, i.e., independently of the number of children in the household and the gender of the child (Dammert 2009). Policies aimed at improving child outcomes need to consider the entire family composition and domestic work. In addition, the main results suggest the importance of child care programs. Much of the empirical literature for developing countries has focused on the effects of child care programs on maternal employment, for example, Hallman et al. (2005) and Attanasio and Vera-Hernandez (2004) for Guatemala and Colombia, respectively. What about the effect on daughters? Results from this paper suggest that childcare will have positive effects on older school-age girls who would otherwise stay at home and care for their siblings. More needs to be done in this direction.

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