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Gender differences in work-schooling decisions in rural North India

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Abstract Based on a rural sample of North Indian children and adolescents, this paper addresses the determinants of participation in work and schooling. The empirical model includes market and domestic work as separate alternatives to schooling in a trivariate probit framework, allowing also for combinations of these activities as well as idleness. This differentiation sheds new light on gender differences in the work-school decisions in North India. While more traditional determinants (like wealth or parental education) mostly affect the trade-off between schooling and the gender specific work activity (market work for boys and domestic work for girls), monetary incentives (wages and schooling costs) are more closely related to market work for both sexes. Girls are also more likely to work for the market if their economic contribution can be made *within* the family (for instance if the household owns animals). Proxies for cultural factors turn out to play especially a role for participation in the gender non-specific work activities; for instance, overall female labor force participation shifts girls' activities from domestic towards market work.

Keywords Child labor · Schooling · Domestic work · India · Multivariate probit

JEL Classification J22 · J13 · O15

1 Introduction

Household decisions on whether to send children to school or to let them work are clearly interdependent. Child labor and schooling are conflicting alternatives, although they are not exclusive and can often be combined to some extent. Work

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performed by children reduces the time spent in school,[1] as well as their educational attainment (Beegle et al. 2006; Heady 2003).[2] Models that consider work and schooling decisions in a joint framework can help to better understand their interrelationship and the factors affecting the decision between work and schooling. But simple approaches might fail to explore the gender aspects of this trade-off to a full extent because of the large heterogeneity of work, and especially the differences between market and domestic work.

Studies investigating the work-school trade-off in a joint framework take two approaches with respect to different forms of work, both of which pose some problems.[3] Those that concentrate on market work only, leave domestic work out of the choice set altogether (e.g., Maitra and Ray 2002; Pal 2004; Bacolod and Ranjan 2008). This underestimates the extent of child labor since, world-wide, most children work for their families, often performing domestic chores (Edmonds and Pavcnik 2005). It also disregards the gender aspects of child labor as it is mainly girls who perform domestic work.[4]

Most importantly, this procedure implicitly constrains the determinants of domestic work and idleness to be the same, which masks the underlying differences in the economic incentives for working in the household or staying idle.[5]

The second approach followed by empirical studies is to treat market work and domestic chores jointly as opposed to school attendance (e.g., Ravallion and Wodon 2000; Ersado 2005; Cigno and Rosati, 2005; Chamarbagwala and Tchernis 2010). In countries with relatively large gender disparities, such as the South Asian countries, this captures relatively well the work-school trade-off for boys, but it disregards the inherent differences between girls' domestic and market work by assuming that both are driven by the same determinants. In the presence of systematic differences between the determinants of market and domestic work as well as domestic work and idleness, it is more appropriate to address market work, domestic work, and schooling as separate alternatives. Simultaneous estimation of the choices between market and domestic work and school attendance can also help to investigate the determinants of inactivity, specialization in a specific activity, or combination of

[1] Substitution may be less than perfect: Ravallion and Wodon (2000) find that hours of child work decrease by less than the increase in their school participation as a response to a food subsidy in Bangladesh.

[2] Working as a child can also be expected to have negative long-term consequences, for instance in terms of adult earnings or health outcomes (Rosati and Straub 2007), although its medium-run effects are less clear-cut (Beegle et al. 2012).

[3] The literature on the trade-off between work and schooling of children started with Canagarajah and Coulombe (1997), Cartwright (1998), Grootaert (1998), Nielsen (1998); for the first study on India see Duraisamy (2000).

[4] This point is also emphasized by Levison et al. (2001) who compare the trade-off between school and market work or school and all types of work in Mexico, and find that the first procedure underestimates the trade-off for girls to a large extent.

[5] For instance, in the often applied multinomial logit framework [addressing the school only, work only, combine school and work, and stay idle alternatives, e.g., Levison et al. (2001, Maitra and Ray (2002), Bacolod and Ranjan (2008)], disregarding domestic work might violate the "Independence of Irrelevant Alternatives" assumption, which presupposes that the relative probabilities of any two alternative categories are not influenced by the existence of other alternatives.

multiple activities. Such an approach is especially well suited to capture the gender differences in the determinants of household decisions on work and school.

The North Indian case offers valuable insights into the gender aspects of the work-school trade-off since gender differences in work and schooling are especially large for children in this region. School attendance of girls is considerably lower, and it conflicts mostly with their domestic duties whereas most boys are involved in either school or market work. However, there is no total specialization by gender; a still considerable number of girls works for the market, while some boys are also performing domestic chores. This allows me to investigate the gender differences between the trade-off of the gender-specific activities with schooling, but also participation in the gender unspecific activity.

The present analysis is based on cross-sectional data from the 1997/1998 Survey of Living Conditions of two North Indian states, Uttar Pradesh and Bihar (World Bank LSMS). It estimates jointly participation of 10–17 years old children in market work, domestic work and schooling, separately for the two sexes. The regressions condition participation in work and schooling on individual characteristics, asset ownership, household composition and educational attainment, as well as village variables on costs of schooling, proxies for cultural norms, and median wages. The participation equations form a trivariate probit model which is estimated by the method of simulated maximum likelihood. Marginal effects on the joint probabilities of different occupational choices are calculated by a parametric bootstrap procedure.

By incorporating schooling, market and domestic work as separate outcomes in a multivariate framework, a more detailed picture on the determinants of child labor emerges. The results show systematic differences between the determinants of market and domestic work as well as those of domestic work and idleness for both boys and girls. Such differences would be blurred when lumping market and domestic work together and could not be captured without including domestic work explicitly in the choice set. These insights are the main contribution of this study.

Factors traditionally linked to child labor seem mainly to affect the decisions between the gender specific work activity (market work for boys and domestic work for girls) and schooling. Household wealth is increasing the likelihood that girls and boys attend school only, and decreasing the likelihood of specialization of girls in domestic and boys in market work, but the gender unspecific activities are less strongly related to wealth. Similarly, preferences for schooling captured by parental education reduce more strongly the likelihood of the gender specific work activity in favor of schooling.

By contrast, factors that shift the *monetary* incentives towards work are most closely related to participation in market related activities and tend to affect girls and boys in a similar way: Higher adult wages in the village increase participation in market work of both sexes, higher monetary costs of schooling additionally to that reduce school participation of girls and boys.

A third group of factors, mainly related to cultural norms, plays also an important role in explaining gender differences in child labor, and especially in participation in the gender non–specific work activities. Girls from lower castes are more likely to perform market work, upper caste boys are more likely to do domestic chores; this reflects that accepted gender roles differ among the different social strata. Animal ownership

increases not only girls' domestic but also market work: this might also be due to the fact that girls are usually less prohibited to work within the family than outside of the household by cultural norms. The norms with respect to the economic role of females, proxied by high adult female workforce participation in the village, are important determinants of gender differences also for children: a generally higher adult female labor force participation makes girls substitute market work for domestic work, while making it also more likely that boys perform domestic chores. These latter effects are thus gender specific and do not merely reflect overall higher economic activity.

Due to computational difficulties, multivariate models have not been typically applied in the analysis of child labor. The only exception to this is the work of Kambhampati and Rajan (2008) who estimate a multivariate probit model for Indian girls, and conclude that country-wide differences in the work-schooling trade-off of female children are driven by differences in cultural norms within the patriarchal kinship systems. This study differs from their work in several aspects. It concentrates on children from two North Indian states, and compares the trade-off between market work, domestic work, and school attendance for both sexes. More importantly, it specifies the probabilities of participation in activities in a more direct way and computes marginal effects of the determinants on trivariate probabilities of specific activities and their combinations. As a result, the gender differences in the determinants of specializing in one given activity or combining various activities can also be explicitly addressed.

The remainder of this paper is structured as follows. Section 2 shortly surveys the empirical evidence on child work and schooling in India. Section 3 describes the data, Sect. 4 outlines the estimation model. Results are presented and discussed in Sect. 5, while Sect. 6 concludes.

2 Child labor and schooling in India

Child labor and schooling can be seen as resulting from a human capital investment decision by the parents, who decide both on family consumption and the time use of their children for schooling, labor, and leisure subject to their income, asset ownership, and preferences. If financial markets were perfect, participation in schooling and child labor would largely depend on the expected net returns to education, which also include the opportunity costs of not working as a child.[6] But since credit (and insurance) constraints are binding for the rural poor, poverty is a crucial determinant of the work-schooling trade-off (Basu and Van 1998; Baland and Robinson 2000).[7] Thus, regional development affects the work-school trade-off both

[6] Several studies show that schooling responds to the returns to education in India: schooling increased strongly when technological change in agriculture raised its returns (Foster and Rosenzweig 1996), while the arising labor demand effects tended to decrease schooling of children from landless households (Foster and Rosenzweig 2004). Kochar (2004) also finds that the probability of rural boys completing middle school in India increases with urban wage growth of the higher skilled (but decreases with middle skilled wages).

[7] Schooling in rural India decreases when households are hit by adverse income shocks, even more so if these shocks are not anticipated (Jacoby and Skoufias 1997).

through reducing poverty and increasing current and future labor demand; the net effect on child work and schooling depends on the changes in the net expected returns to education.[8] As imperfect labor markets make hiring and supervising additional labor harder, land ownership has also been shown to increase child labor by raising the marginal productivity of children within the family (Bhalotra and Heady 2003; Basu et al. 2009). Idleness results in this conceptual framework from low net returns to human capital (due to low school availability and quality) paired with too low productivity of children (due to missing productive assets) (Cigno and Rosati 2005).

Gender inequalities in human capital investment are especially large in India. They are most fundamentally reflected in the survival gap resulting from discrimination against girls in the allocation of food and health care (Sen 1992), especially when families are hit by adverse shocks (Behrman 1988; Rose 1999). They have been argued to result from lower market returns to human capital of females (Rosenzweig and Schultz 1982), but they are also related to the patrilocal family structure (Kambhampati and Rajan 2008). As girls leave the family upon marriage, the future benefits from a girl's education do not accrue to her own parents; this further reduces the incentives to invest in girls' schooling.[9]

The large gender difference in work activities, with boys mostly performing market while girls specializing in domestic work, reflects both gender specific productivity differences in different tasks, as well as parental preferences and cultural norms. Girls are thought to be more suited to care for younger siblings; thus the strength of their comparative advantage in household production will also depend on family composition and birth spacing (Edmonds 2006). Additionally, in the North Indian patriarchal kinship system girls are often sheltered from outside influences (especially if they are higher caste or Muslim), which also raises the perceived costs of education and market work for girls (Kambhampati and Rajan 2008). Under such circumstances, market work of girls should be more prevalent in families that own productive assets, since this enables girls to perform market related work without leaving home. Norms with respect to the females' role can be expected to matter for both girls' labor market and school participation, and might also be behind some of the unexplained spatial variation in the propensity to work and study (Chamarbagwala and Tchernis 2010).

3 Data and main variables

The analysis is based on data from the "Survey of Living Conditions" of two North Indian states, Uttar Pradesh and Bihar. The survey was carried out between December 1997 and March 1998 as a part of the World Bank Living Standards

[8] Kambhampati and Rajan (2006) document that in India state level growth performance went along with increasing market work participation and reducing school enrolment of children which they attribute to labor demand effects. By contrast, Edmonds et al. (2010) interpret the smaller increases in schooling in those rural Indian districts that were more exposed to trade liberalization as a sign that trade liberalization failed to reduce poverty.

[9] Drèze and Kingdon (2001) also find that the schooling of Indian girls depends stronger on monetary incentives (school meals) and school quality variables than that of boys.

Measurement Study (LSMS) series. The quantitative part of the survey is comprised of a household questionnaire and a village level data set with community-level characteristics. It contains data from 120 villages in two selected regions of Uttar Pradesh (Eastern and Southern) and two of Bihar (Northern and Central) where 2,250 households were interviewed.

3.1 Activities of children and adolescents

The household survey presents detailed socio-economic information, and records the economic activities of each family member aged 10 or older for the previous 12 months. Due to this long recall period, the dataset captures seasonally recurring activities, most notably agricultural child labor, to a fuller extent than surveys relying on a 1-week recollection period (like NSS, the Indian National Sample Survey). As the data set does not contain information on time use for all types of work, the three dependent variables (market work/domestic work/schooling) are defined as binary indicator variables that show whether a child participated in that activity during the previous year.

Market work includes all directly productive activities of children, performed within or outside of the household (wage labor, unpaid work on the family farm, or in the family business, etc.).[10]

Domestic work includes mostly typical household chores (i.e. cleaning, cooking, or looking after younger siblings) but also activities like fetching water, collecting firewood, and foraging.[11]

Children are classified as in *school* if this has been one of their reported main economic activities for the previous year or if they actually attended school within the last week before the survey.

The data set records all major activities of children over the recollection period. This also allows for the fact that work and schooling need not be mutually exclusive, and enables me to consider explicitly those children who combine different activities. In the sample, 4.1 % of boys and 3.4 % of girls are reported to be combining work with school attendance, while girls also combine market and domestic work to some extent (cf. Table 1). By contrast, there is also a relatively large number of children who are reported as idle (6 % of girls and 9.3 % of boys).

The distribution of children's activities within the sample reveals a clear gender pattern; while 51.5 % of girls aged 10–17 are working, only 22.9 % of the boys of the same age perform any kind of work (cf. Table 1). The main source of this gender gap lies not in market activities (12.7 % of girls and 19.4 % of boys perform market work), but in domestic chores in which almost only girls are involved (43.6 % of

[10] This broad definition of market work is useful as it captures better the economic contribution of children. Globally only a relatively small fraction of children works for wages; most children are employed by their own parents and are working on family farms or in family businesses (Edmonds and Pavcnik 2005).

[11] This distinction between market and domestic work serves solely the purpose of distinguishing between activities that are at least potentially market oriented and activities that only produce goods and services for the household. This terminology labels most typically female activities as domestic, but does not pertain value judgements towards their relative productivity.

Table 1 Activities of children (10–17) by gender (%)

	Male	Female	Total
One occupation only	86.2	86.3	86.3
Market work	15.9	6.8	11.9
Domestic work	2.4	36.9	17.9
In school	67.8	42.6	56.6
Combine	4.6	7.7	6.0
Market and domestic work	0.5	4.3	2.2
Market work and school	2.9	1.0	2.1
Domestic work and school	1.1	1.9	1.5
All types	0.1	0.5	0.3
No occupation	9.3	6.0	7.8
Total	100.0	100.0	100.0
N	1,345	1,067	2,412

Source: World Bank LSMS, Uttar Pradesh and Bihar 1997/1998

Table 2 Activities of children (10–17) by age (%)

Age	N	Working only	In school only	At work and school	Being idle
10	525	19.4	65.5	2.9	12.2
11	184	16.3	73.4	2.2	8.2
12	443	27.1	63.0	4.5	5.4
13	245	22.0	66.5	4.5	6.9
14	244	30.3	60.3	4.1	5.3
15	318	45.9	42.1	4.4	7.6
16	283	55.5	33.2	3.9	7.4
17	143	54.6	36.4	3.5	5.6
18	384	66.4	20.3	3.1	10.2
10–17	2,412	31.9	56.5	3.8	7.8
Males	1,345	18.8	67.8	4.1	9.3
Females	1,067	48.1	42.6	3.4	6.0

Source: World Bank LSMS, Uttar Pradesh and Bihar 1997/1998

girls as compared to 4.1 % of boys). A significantly higher proportion of boys (71.9 %) than girls (45.9 %) in this age group is enrolled in school.

The relatively wide age range considered in this study (10–17 years) includes both children and adolescents until the age of leaving school. The use of this age span is justifiable because the age of 18 years marks one of the two major breaks in work participation and school attendance of children (the other break is occurring at the age of 15, cf. Table 2).

3.2 Explanatory variables

The vector of explanatory variables includes personal characteristics, socio-economic characteristics of the household, and village level controls (cf. Table 3

Table 3 Descriptive statistics

No. obs variable	Females		Males		Total	
	1,067		1,345		2,412	
	Mean	SD	Mean	SD	Min.	Max.
Market work*	0.13	0.34	0.22	0.41	0	1
Domestic work*	0.44	0.50	0.04	0.20	0	1
Student*	0.46	0.50	0.72	0.45	0	1
Middle wealth*	0.37	0.48	0.37	0.48	0	1
Larger wealth*	0.26	0.44	0.24	0.43	0	1
Large land*	0.09	0.28	0.10	0.31	0	1
Animals owned	2.20	2.83	2.21	2.93	0	51.7
Father literate*	0.17	0.37	0.21	0.41	0	1
Father sec. ed.*	0.34	0.47	0.36	0.48	0	1
No father*	0.13	0.33	0.06	0.24	0	1
Mother literate*	0.13	0.34	0.10	0.30	0	1
Mother sec. ed.*	0.08	0.27	0.08	0.28	0	1
No mother*	0.10	0.30	0.05	0.22	0	1
Female head*	0.04	0.19	0.03	0.16	0	1
No. infants	1.12	1.26	0.96	1.18	0	8
No. small children	1.02	0.97	0.92	0.92	0	7
No. boys	0.78	0.89	1.69	0.77	1	5
No. girls	1.64	0.86	0.62	0.82	1	5
No. adult males	1.72	1.04	1.69	1.08	0	7
No. adult females	1.58	0.99	1.58	0.97	0	6
No. elderly	0.43	0.68	0.46	0.69	0	4
Married*	0.11	0.32	0.02	0.15	0	1
Birth order	1.88	1.03	1.90	0.97	1	7
Lower caste*	0.49	0.50	0.52	0.50	0	1
Scheduled caste*	0.25	0.43	0.26	0.44	0	1
Muslim*	0.11	0.32	0.09	0.28	0	1
Time to school	0.34	0.59	0.37	0.93	0	27
School costs	0.30	0.19	0.30	0.19	0.02	1.86
Real wages	0.70	0.26	0.69	0.26	0.12	2.17
Female work high*	0.38	0.48	0.39	0.49	0	1

Indicator variables are marked by asterisks

for descriptive statistics and Table 4 for definitions). At the household level, information on household wealth and asset ownership, the presence and educational attainment of parents, the gender of the household head, and the number of household members by age group and gender is used. Village level controls include measures of labor market outcomes and median school costs. All regressions control for the marital status of a young person, and include a full set of age dummies.

Table 4 Definitions of explanatory variables

Variable	Description
Married	Variable takes 1 if individual is married, 0 otherwise
Middle (larger) wealth	Variables take 1 for the second (third) tercile of the first principal component of the ownership vector of fourteen durable assets (radio, camera, bicycle, motor, car, freezer, fan, heater, television, petromax, telephone, sewing machine, cooker, watch), 0 otherwise (comp. group: low wealth)
Large land	Variable takes 1 if the land owned per adult (18+) is larger than 2 acres, 0 otherwise.
Animals owned	Value of animals owned per adult (18+) (in 1,000 Rupees)
Father (mother) literate	Variable takes 1 if father (mother) lives in the household and is literate but did not finish junior secondary education (comp. group: illiterate father/mother)
Father (mother) sec.ed.	Variable takes 1 if father (mother) lives in the household and finished at least junior secondary education (comp. group: illiterate father (mother))
No father (mother)	Variable takes 1 if father (mother) does not live in the household (comp. group: illiterate father (mother) living in the hh.)
Female head	Variable takes 1 if household head is female (comp. group: male hh. head)
No. infants (small children)	No. of hh. members aged 0–5 (6–9) relative to adult hh. members (18+)
No. boys (girls)	No. of male (female) hh. members aged 10–17 relative to adults (18+)
No. adult males (females)	No. of male (female) hh. members aged 18–59
No. elderly	No. of hh. members aged 60 or above
Birth order	Birth order among siblings of the same sex (first born: 1)
Lower caste	Variable takes 1 if hh. belongs to a backward (agricultural or other) caste, 0 otherwise (comp. group: higher/middle caste)
Scheduled caste	Variable takes 1 if hh. belongs to a scheduled caste or tribe, 0 otherwise (comp. group: higher/middle castes). Definition is based on *The Scheduled Castes and the Scheduled Tribes Act, 1989*
Muslim	Variable takes 1 if hh. belongs to the Muslim religion, 0 otherwise
Time to school	Time to reach the nearest secondary school (in 10s of minutes)
School costs	The median of total yearly expenses per child in primary school (classes 1–5) in the village (in 1,000 Rupees), calculated from sample data
Real wages	Median of the daily agricultural wage rates for various occupations of an adult male worker normalized by the price of 1 kg wheat (in 10 Rupees), information based on the village questionnaire
Female work high	Variable takes 1 if based both on the LSMS sample (village level) and the NSS 1999/2000 sample (district level) workforce participation rate of adult (18+) females is above the median.

As outlined earlier, there is a clear theoretical linkage between household wealth and child labor. If child leisure is a normal good, children from wealthier households will be less likely involved in work. Additionally, when schooling investments are suboptimal due to credit constraints, a rise in household wealth will shift the work-school trade-off in favor of more schooling. Usual measures of household income (as well as expenditures) are endogenous to child labor to the extent that working adolescents contribute to household income or substitute for

adult labor in domestic work. Moreover, income variables are usually less reliable than wealth proxies, and the measurement error can attenuate the results. Instead, I proxy household wealth by an index reflecting the ownership of a vector of durable goods (cf. Table 4). In order to reduce endogeneity concerns, I do not use the index but include controls for the two upper wealth terciles, *middle* and *larger wealth* only, as child work is less likely to shift families between larger wealth categories.[12]

Ownership of productive assets (land or animals), can be expected to have both income and substitution effects on child labor. Families that own land or animals can be expected to be better-off everything else being equal. At the same time, the ownership of productive assets can also raise the marginal product of child work and hence the incentives for child work within the family. The regressions include a control for the ownership of *large land* (above 2 acres per adult), while the variable *animals owned* measures the market value of owned animals (in 1,000 Rupees) per adult.

For given levels of wealth, controls of parental educational attainment act as proxies for tastes and value judgments concerning education and work within the family. *Father literate/sec.ed.* and *mother literate/sec.ed.* capture different levels of parental education, and can be expected to affect parental attitudes towards education and work within the household. However, since the wealth proxies are rather crude, parental education can also control for additional income effects. The variables *no father* and *no mother* capture differences in family composition. When children's parents are missing from the household, this can reduce the overall investment into their human capital as own parents can be assumed to be more altruistic than other relatives or parents-in-law (cf. also Meyerhoefer and Chen 2011). *Female head* is an additional proxy for economic power of the household as female headed households have on average a lower income earning capacity; at the same time the resulting differences in the gender distribution of power might also affect child outcomes.

The regressions also include various controls of household size and composition. The variables *No. infants, No. children, No. girls* and *No. boys* measure the number of children for the age groups 0–5 years, 6–9 years, and 10–17 years (this last by gender) respectively. The larger the number of infants in a household, the larger the potential need for help in child-care related activities, especially from older girls. A larger number of children and adolescents might also raise the need for their economic contribution, but can also reduce the intensity of any individual contribution. However, as prior decisions on work and schooling of older children might also directly affect the number of younger children within the household, these results are not necessarily causal and will be interpreted with caution.

In order to capture potential birth order effects, the *birth order* among the siblings of the same sex is also included. Birth order effects might reflect parental preferences for first or later born as well as the presence of credit constraints: Earlier born children might have to work more while having older siblings might help to

[12] As pointed out by a referee, some of these electric appliances (like a freezer, fan, heater, petromax, sewing machine, or a cooker) can be also used in household production and thus proxy not only for wealth but might also directly substitute (or even complement) domestic child labor. In order to address these concerns I also reran the regressions distinguishing between domestic appliances and other goods, and found that especially for domestic goods, wealth and substitution effects cannot be disentangled (cf. fn. 20).

postpone employment (Psacharopoulos and Patrinos 1997; Emerson and Souza 2008) of the young.[13] *No. adult males/females* additionally controls for the number of working age household members and their sex composition; *no. of elderly* measures the number of elderly within the family (aged 60 years or older).

Schooling costs are measured along two main dimensions: the monetary costs of schooling, given by tuition fees, school supplies, uniforms, etc., and the opportunity costs of time, given by school availability. Differences in the direct costs of schooling are proxied by the median of yearly expenses for a primary school student (classes 1–5) in each village.[14] School availability is controlled for by the variable *time to school* which measures the time it takes to reach the nearest secondary school for each household. Higher costs of schooling can be expected to reduce school participation, while also reducing the opportunity costs of child work.

Differences in cultural norms are proxied by controls for the households' *caste* (among Hindu households) or *Muslim* religion. The local workforce status of the females is approximated by the workforce participation of adult females, which not only reflects local labor demand, but is also strongly related to social norms with respect to the economic role of females. As the individual LSMS sample is not representative at the village or district level, information from the 55th round of the Indian National Sample Survey (NSS 1999/2000) has been additionally used to build the variable *female work high* which indicates villages with higher than median female labor force participation based on both datasets. Whether children are more or less likely to work in villages where female workforce participation is higher, is a priori unclear. To the extent that market work by females reflects labor demand effects, it also indicates more opportunities for market (and eventually also domestic) work of children. In the long term, better opportunities in the labor market might favor both market work and schooling of girls as means of human capital accumulation. But the social aspect of female workforce participation is equally important, and especially relevant for girls: In villages where more females work, girls' labor force participation is also less prohibited by social norms.[15]

The regressions also include controls for adult wages, which can be expected to reflect the demand for unskilled labor, and more broadly, economic opportunities within the village. *Real wages* are based on the village questionnaire and represent the median of daily wages for males in different occupations in agriculture, normalized by the price of wheat in the village.[16] In general equilibrium, adult

[13] Edmonds (2006) shows that in Nepal the comparative advantage of older girls in household chores changes with younger siblings' number, gender, and birth spacing. On the role of the gender aspects of household and sibling composition see also Parish and Willis (1993) and Morduch (2000).

[14] This measure might overestimate the true costs of schooling if school choice is endogenous to the households' willingness to pay for education, or if school costs are positively correlated with unobservable school quality. This might counteract the expected negative effect of school costs on education; in this case the negative effect found in Sect. 5 gives an upper bound estimate of the true effect.

[15] These effects might be partly counteracted by the rising incomes and decision making power of females. If females are more concerned about child work and schooling, their economic power will shift the work-school trade-off in favor of more schooling.

[16] Only male wages are included in both girls' and boys' regressions because information on male wages is the one which is most consistently available throughout the villages.

wages should also reflect the supply of adult and child labor, and will be cet. par. smaller in a high child labor environment (Basu and Van 1998). This might thus lead to an underestimation of the positive incentive effects from higher adult wages on child labor.

4 Estimation strategy

In order to account for the interrelationship between decisions with respect to market work, domestic work and schooling, the empirical analysis estimates participation in these three activities simultaneously, in form of a trivariate probit model. Similarly to a seemingly unrelated regression framework, joint estimation of the three decisions allows for correlated error terms between the three participation equations (under the assumption of joint normality), and hence takes into account the interrelationship between these three processes. Idleness is the left-out category: for idle children all three participation equations take zero. The estimated correlation coefficients summarize the association between unobservable individual-specific factors determining the likelihood of being engaged in any two different types of occupations and thus show how strongly the three decisions are interrelated and whether joint estimation is warranted. I use the estimated parameter vectors to numerically calculate the effects of a unit increase on the probability for each individual and calculate average partial effects both for the marginal and the trivariate joint probabilities. This enables me to address also the determinants of specializing in any given activity, combining activities, or staying idle.

The model yields relatively more stable parameter estimates if combinations of the three main activities as well as inactivity also occur within the sample, which is true in the present case.[17]

More specifically, the three latent variables Y_j^*, market work ($j = L$), household chores ($j = H$), and school attendance ($j = S$), are assumed to depend on a vector of explanatory variables $\mathbf{X}$, three unknown vectors of parameters $\boldsymbol{\beta_j}$, and the jointly normally distributed error terms ϵ_j.

$$Y_j^* = \mathbf{X}'\boldsymbol{\beta}_j + \epsilon_j \quad j = L, H, S \tag{1}$$

The three Eqs. from (1) are mapped into three binary variables Y_j that take one if the child engages in a given activity, and zero otherwise.

$$Y_j = 1(\mathbf{X}'\boldsymbol{\beta}_j + \epsilon_j > 0) \quad j = L, H, S \tag{2}$$

The joint estimation of the three participation Eqs. (2) involves the evaluation of the log likelihood over N observations, based on a joint trivariate probability:

[17] Kambhampati and Rajan (2008) specify a multivariate probability model for Indian girls with four equations for the outcomes work, school, combine, and idle. However, this type of specification in a multivariate framework results in a degenerate participation probability space and less reliable estimates (cf. Edmonds 2007).

$$\ln \mathcal{L} = \sum_{i=1}^{N} \ln \Phi_3(\kappa_{Li}\mathbf{X}_i'\boldsymbol{\beta}_L, \kappa_{Hi}\mathbf{X}_i'\boldsymbol{\beta}_H, \kappa_{Si}\mathbf{X}_i'\boldsymbol{\beta}_S, \kappa_{Li}\kappa_{Hi}\rho_{LH}, \kappa_{Li}\kappa_{Si}\rho_{LS}, \kappa_{Hi}\kappa_{Si}\rho_{HS})$$

where Φ_3 is the trivariate normal cumulative density function, ρ_{LH}, ρ_{LS}, ρ_{HS} are the pairwise correlation coefficients between the three error terms, and κ_L, κ_H, κ_S are the corresponding sign variables that equal one if a child engages in a given activity, and minus one otherwise (Greene 2003, 710). The estimation of this function requires the computation of derivatives of third order integrals for which no general solution exists. However, the problem can be addressed by simulation techniques. The method of simulated maximum likelihood allows the estimation of a trivariate probit model by using the Geweke-Hajivassiliou-Keane smooth recursive estimator (Greene 2003, pp. 931–933).

The estimator decomposes the original three-dimensionally correlated error terms into a linear combination of uncorrelated one-dimensional standard normal variables. The trivariate distribution is thus transformed into three sequentially conditioned univariate distributions. In order to evaluate the resulting integral, D random draws of these standard normal variables are taken from truncated normal distributions, and a sample average of the simulated probabilities is used to estimate the probability that enters the likelihood function.[18]

I estimate the average partial effects (APE) by averaging sample partial effects, computed for each individual. Standard errors of the APE-s for the trivariate probabilities are estimated by an empirical Bayes procedure that redraws 500 replications of the estimated coefficient vectors $(\widehat{\boldsymbol{\beta}}_j, \widehat{\rho}_{LH}, \widehat{\rho}_{LS}, \widehat{\rho}_{HS})$ from a multivariate asymptotically normal distribution (characterized by the estimated variance-covariance matrix $\widehat{\Sigma}$), and computes the standard deviation of the partial effects. This serves as an approximation of the standard error of the partial effects.

5 Results

5.1 Trivariate results

Tables 5 and 6 present the results from the trivariate probit regressions.[19] The estimated correlation coefficients between market work, domestic work, and schooling reflect the strength of the main unexplained trade-offs between the three types of occupation. They confirm the fact that domestic work and school are the two most conflicting alternatives for girls, market work and school for boys. The estimated correlation coefficient between the unexplained part of domestic work and

[18] Estimations have been implemented with Stata, using the `mvprobit`, `mvnp` and `mdraws` routines of Cappellari and Jenkins (2003, 2006). The $D = 300$ random draws result in stable simulated parameters $\widehat{\boldsymbol{\beta}}$ and $\widehat{\rho}$.

[19] All regressions report robust standard errors that are clustered on the village level, allowing for correlation between unobserved characteristics of children within the same village.

Table 5 Trivariate probit results on work/schooling of girls

Dependent var.	Market work		Domestic work		Schooling	
	APE	SE	APE	SE	APE	SE
Middle wealth	−0.005	(0.022)	−0.051	(0.036)	0.101**	(0.028)
Larger wealth	−0.038	(0.028)	−0.175**	(0.053)	0.291**	(0.045)
Large land	0.058	(0.054)	0.111†	(0.058)	−0.053	(0.044)
Animals owned	0.010*	(0.005)	0.012†	(0.007)	−0.006	(0.004)
Father literate	0.006	(0.031)	−0.079*	(0.039)	0.101**	(0.033)
Father sec. ed.	−0.011	(0.032)	−0.116**	(0.042)	0.197**	(0.040)
No father	−0.027	(0.049)	−0.028	(0.066)	0.112*	(0.054)
Mother literate	−0.057	(0.036)	−0.159**	(0.060)	0.144*	(0.060)
Mother sec. ed.	−0.098**	(0.029)	−0.255**	(0.058)	0.202**	(0.064)
No mother	−0.071†	(0.041)	0.091	(0.068)	−0.168**	(0.058)
Female head	0.175*	(0.085)	0.020	(0.082)	0.011	(0.064)
No. infants	0.005	(0.010)	0.025†	(0.014)	−0.025†	(0.014)
No. small children	0.013	(0.011)	0.017	(0.018)	−0.026†	(0.015)
No. boys	−0.026†	(0.015)	0.008	(0.017)	−0.023	(0.015)
No. girls	−0.022	(0.014)	−0.007	(0.019)	−0.008	(0.019)
No. adult males	−0.004	(0.017)	0.029	(0.021)	−0.001	(0.020)
No. adult females	−0.012	(0.018)	−0.021	(0.024)	0.022	(0.024)
No. elderly	−0.002	(0.016)	−0.061**	(0.022)	0.059**	(0.022)
Married	0.016	(0.038)	0.108	(0.073)	−0.190**	(0.062)
Birth order	0.012	(0.009)	−0.015	(0.016)	0.035*	(0.015)
Lower caste	0.205**	(0.057)	0.142*	(0.057)	−0.180**	(0.049)
Scheduled caste	0.354**	(0.083)	0.106†	(0.060)	−0.136*	(0.057)
Muslim	0.221*	(0.107)	0.183**	(0.064)	−0.166**	(0.059)
Time to school	0.013	(0.021)	0.035	(0.025)	−0.023	(0.031)
School costs	0.080†	(0.045)	0.005	(0.071)	−0.123†	(0.074)
Real wages	0.097**	(0.028)	0.067	(0.055)	0.002	(0.055)
Female work high	0.074**	(0.024)	−0.083**	(0.030)	0.067*	(0.032)
Corr. coeff.	ρ_{21}	SE	ρ_{31}	SE	ρ_{32}	SE
	−0.167*	(0.068)	−0.167**	(0.060)	−0.895**	(0.222)

Results of the trivariate probit model are estimated by SML with 300 pseudorandom draws, clustered at village level. The model includes age dummies and a constant. The average partial effects (APE) are calculated with respect to the marginal univariate probability of each category. Sample size is $N = 1{,}067$ observations. Wald-test of the model χ^2 (105) = 5,130.67, $p = 0.0000$. **, *, † Significance at the 1, 5, and 10 % level

school of girls amounts to −0.90, between market work and school of boys to −0.87. For all other occupations the respective correlations are much smaller and less significant. For boys, the estimated correlation between the market and domestic work equations is not significant which is consistent with the evidence that it is the least likely that boys combine market work with domestic work (cf. Table 1).

Table 6 Trivariate probit results on work/schooling of boys

Dependent var.	Market work		Domestic work		Schooling	
	APE	SE	APE	SE	APE	SE
Middle wealth	−0.056**	(0.020)	−0.023*	(0.010)	0.098**	(0.024)
Larger wealth	−0.124**	(0.027)	−0.038**	(0.009)	0.136**	(0.031)
Large land	−0.013	(0.051)	0.016	(0.019)	0.066	(0.046)
Animals owned	−0.002	(0.004)	0.001	(0.001)	0.007	(0.005)
Father literate	−0.055*	(0.028)	−0.010	(0.013)	0.084**	(0.029)
Father sec. ed.	−0.065*	(0.029)	−0.051**	(0.011)	0.165**	(0.031)
No father	−0.008	(0.050)	0.063†	(0.036)	0.019	(0.052)
Mother literate	−0.056	(0.039)			0.178**	(0.035)
Mother sec. ed.	−0.114**	(0.039)			0.175**	(0.035)
No mother	0.014	(0.045)	0.012	(0.019)	−0.077†	(0.046)
Female head	0.042	(0.056)	−0.031*	(0.014)	−0.078	(0.075)
No. infants	0.004	(0.011)	−0.005	(0.007)	−0.013	(0.012)
No. small children	0.004	(0.014)	−0.019*	(0.009)	−0.001	(0.014)
No. boys	0.013	(0.019)	0.013†	(0.007)	−0.024	(0.020)
No. girls	−0.021	(0.016)	−0.011	(0.007)	0.020	(0.015)
No. adult males	−0.024†	(0.014)	0.011†	(0.006)	0.016	(0.016)
No. adult females	−0.008	(0.020)	−0.013	(0.008)	0.005	(0.018)
No. elderly	−0.029†	(0.017)	−0.018*	(0.009)	0.049**	(0.017)
Married	0.080	(0.078)	0.028	(0.043)	−0.109	(0.072)
Birth order	−0.002	(0.013)	0.012*	(0.005)	−0.002	(0.012)
Lower caste	0.053	(0.037)	−0.055†	(0.029)	−0.089†	(0.047)
Scheduled caste	0.058	(0.043)	−0.039	(0.024)	−0.088*	(0.056)
Muslim	0.085	(0.056)	−0.035*	(0.014)	−0.166**	(0.062)
Time to school	0.013	(0.008)	0.002	(0.002)	−0.020†	(0.011)
School costs	0.047	(0.034)	0.001	(0.022)	−0.115*	(0.054)
Real wages	0.065†	(0.039)	0.016	(0.024)	−0.078†	(0.043)
Female work high	−0.004	(0.024)	0.024†	(0.013)	0.003	(0.028)
Corr. coeff.	ρ_{21}	SE	ρ_{31}	SE	ρ_{32}	SE
	−0.077	(0.076)	−0.870**	(0.023)	−0.321**	(0.070)

Results of the trivariate probit model are estimated by SML with 300 pseudorandom draws, clustered at village level. The model includes age dummies and a constant. The average partial effects (APE) are calculated with respect to the marginal univariate probability of each category. Sample size is $N = 1{,}345$ observations. Wald-test of the model χ^2 (100) = 5,252.01, $p = 0.0000$. **, *, † Significance at the 1, 5, and 10 % level

Tables 5 and 6 give the estimated average partial effects of the explanatory variables on the marginal probability of each occupation, that is on the probability that a child is involved in a given activity at all. Tables 7 and 8 present selected average partial effects on the joint trivariate probability of a given combination of the three activities where average is taken across all girls or boys in the sample (cf. Sect. 4) They show the average effect of each explanatory variable on the

Table 7 Selected results for girls on specializing in/combining of activities

Outcome	Work, no school								School with				Idle	
	Market only		Domestic only		Combine M&D		School only		Combine M&S		Combine D&S		Do nothing	
	APE	SE	APE	SE	APE	SE	APE	SE	APE	SE	APE	SE	APE	SE
Middle wealth	−0.003	(0.006)	−0.054*	(0.024)	−0.009	(0.009)	0.062**	(0.022)	0.007	(0.006)	0.013	(0.011)	−0.018	(0.012)
Larger wealth	−0.012†	(0.007)	−0.154**	(0.034)	−0.034**	(0.009)	0.209**	(0.041)	0.011	(0.012)	0.019	(0.016)	−0.040**	(0.012)
Large land	0.003	(0.010)	0.036	(0.045)	0.044	(0.028)	−0.075*	(0.035)	0.008	(0.012)	0.017	(0.015)	−0.039*	(0.016)
Animals owned	0.001	(0.001)	0.004	(0.005)	0.005**	(0.002)	−0.009*	(0.004)	0.002	(0.001)	0.002	(0.002)	−0.005*	(0.002)
Father literate	0.002	(0.007)	−0.071**	(0.026)	−0.008	(0.012)	0.070*	(0.029)	0.012	(0.009)	0.001	(0.012)	−0.007	(0.014)
Father sec. ed.	−0.005	(0.007)	−0.113**	(0.031)	−0.020	(0.012)	0.132**	(0.034)	0.014	(0.011)	0.016	(0.011)	−0.026†	(0.014)
No father	−0.009	(0.012)	−0.038	(0.047)	−0.015	(0.019)	0.060	(0.047)	0.002	(0.015)	0.029	(0.024)	−0.030†	(0.017)
Mother literate	−0.008	(0.010)	−0.102*	(0.045)	−0.032**	(0.012)	0.138**	(0.053)	−0.002	(0.012)	−0.015	(0.012)	0.024†	(0.014)
Mother sec. ed.	−0.018†	(0.010)	−0.159**	(0.043)	−0.046**	(0.009)	0.226**	(0.058)	−0.015	(0.012)	−0.037*	(0.015)	0.052†	(0.028)
No mother	−0.013	(0.012)	0.130*	(0.060)	−0.021	(0.021)	−0.093*	(0.044)	−0.021**	(0.007)	−0.021	(0.016)	0.042	(0.027)
Female head	0.030	(0.023)	−0.070	(0.063)	0.075*	(0.037)	−0.051	(0.045)	0.049	(0.033)	0.000	(0.025)	−0.044†	(0.022)
No. adult males	−0.003	(0.004)	0.016	(0.017)	0.001	(0.007)	−0.011	(0.015)	−0.002	(0.004)	0.011†	(0.006)	−0.013*	(0.006)
No. adult females	−0.001	(0.004)	−0.013	(0.018)	−0.006	(0.007)	0.019	(0.019)	0.000	(0.004)	−0.001	(0.006)	0.003	(0.007)
No. elderly	0.001	(0.004)	−0.045**	(0.016)	−0.008	(0.006)	0.047**	(0.018)	0.005	(0.004)	−0.004	(0.006)	0.004	(0.008)
Birth order	0.002	(0.002)	−0.023†	(0.012)	0.003	(0.005)	0.017	(0.012)	0.006†	(0.003)	0.005	(0.004)	−0.010†	(0.006)

Table 7 continued

Outcome	Work, no school								School with				Idle	
	Market only		Domestic only		Combine M&D		School only		Combine M&S		Combine D&S		Do nothing	
	APE	SE	APE	SE	APE	SE	APE	SE	APE	SE	APE	SE	APE	SE
Lower caste	0.034**	(0.011)	0.021	(0.043)	0.121**	(0.037)	−0.171**	(0.043)	0.028*	(0.012)	−0.015	(0.010)	−0.028†	(0.014)
Scheduled caste	0.060**	(0.017)	−0.077†	(0.046)	0.185**	(0.054)	−0.173**	(0.046)	0.068**	(0.021)	−0.026*	(0.012)	−0.055**	(0.019)
Muslim	0.024	(0.018)	0.018	(0.065)	0.143*	(0.062)	−0.163**	(0.044)	0.022	(0.019)	−0.004	(0.016)	−0.051**	(0.016)
Time to school	0.001	(0.006)	0.016	(0.022)	0.009	(0.011)	−0.022	(0.025)	0.009	(0.011)	0.005	(0.011)	−0.011	(0.015)
School costs	0.023†	(0.012)	0.008	(0.056)	0.036†	(0.021)	−0.072	(0.056)	0.010	(0.012)	−0.039†	(0.022)	0.034	(0.027)
Real wages	0.013†	(0.007)	−0.008	(0.041)	0.048**	(0.015)	−0.048	(0.042)	0.022**	(0.008)	0.020	(0.013)	−0.053**	(0.018)
Female work high	0.020**	(0.007)	−0.088**	(0.023)	0.019	(0.012)	0.037	(0.023)	0.029**	(0.008)	−0.012	(0.009)	−0.007	(0.011)

Estimation results are based on the trivariate probit model (Table 5). The average partial effects (APE) are calculated with respect to the joint trivariate probability of each outcome. *Market only* refers to the outcome $P(L = 1, H = 0, S = 0)$, *Domestic only* to $P(L = 0, H = 1, S = 0)$, *Combine M&D* to $P(L = 1, H = 1, S = 0)$, *School only* to $P(L = 0, H = 0, S = 1)$, *Combine M&S* to $P(L = 1, H = 0, S = 1)$, *Combine D&S* to $P(L = 0, H = 1, S = 1)$, *Do nothing* to $P(L = 0, H = 0, S = 0)$. Standard errors are clustered at the village level and approximated by parametric bootstrap. Sample size is $N = 1{,}067$ observations. **, *, † Significance at 1, 5, 10 % level

Table 8 Selected results for boys on specializing in/combining of activities

Outcome	Work, no school						School with				Idle	
	Market only		Domestic only		School only		Combine M&S		Combine D&S		Do nothing	
	APE	SE	APE	SE	APE	SE	APE	SE	APE	SE	APE	SE
Middle wealth	−0.047**	(0.014)	−0.007*	(0.003)	0.094**	(0.022)	−0.003	(0.005)	−0.007	(0.005)	−0.023*	(0.011)
Larger wealth	−0.084**	(0.017)	−0.010**	(0.003)	0.160**	(0.031)	−0.026**	(0.007)	−0.015*	(0.006)	−0.014	(0.017)
Large land	−0.025	(0.033)	0.002	(0.005)	0.031	(0.047)	0.010	(0.009)	0.014	(0.014)	−0.036*	(0.016)
Animals owned	−0.003	(0.003)	0.000	(0.000)	0.004	(0.005)	0.001	(0.010)	0.001	(0.001)	−0.003	(0.002)
Father literate	−0.046*	(0.019)	−0.003	(0.004)	0.079**	(0.028)	−0.006	(0.018)	−0.001	(0.008)	−0.019	(0.012)
Father sec. ed.	−0.066**	(0.022)	−0.015**	(0.004)	0.166**	(0.034)	0.010	(0.001)	−0.026**	(0.008)	−0.056**	(0.014)
No father	−0.021	(0.035)	0.016	(0.011)	−0.024	(0.050)	0.000	(0.014)	0.036	(0.021)	−0.024	(0.020)
No mother	0.022	(0.034)	0.007	(0.007)	−0.060	(0.040)	−0.010	(0.010)	0.004	(0.009)	0.033	(0.027)
Female head	0.051	(0.046)	−0.006	(0.008)	−0.058	(0.065)	0.002	(0.011)	−0.013	(0.009)	0.029	(0.033)
No. adult males	−0.019*	(0.010)	0.004	(0.003)	0.014	(0.016)	−0.007†	(0.013)	0.008†	(0.004)	−0.002	(0.005)
No. adult females	−0.002	(0.015)	−0.003	(0.002)	0.011	(0.019)	−0.002	(0.030)	−0.005	(0.004)	0.004	(0.007)
No. elderly	−0.023*	(0.011)	−0.005*	(0.002)	0.049**	(0.018)	−0.002	(0.022)	−0.006	(0.004)	−0.010	(0.007)
Birth order	−0.004	(0.009)	0.004*	(0.002)	−0.007	(0.012)	−0.001	(0.004)	0.007*	(0.003)	−0.002	(0.006)
Lower caste	0.058*	(0.029)	−0.012†	(0.007)	−0.045	(0.042)	0.004	(0.014)	−0.031*	(0.015)	0.037†	(0.021)
Scheduled caste	0.059†	(0.035)	−0.009	(0.007)	−0.056	(0.046)	0.006	(0.017)	−0.022†	(0.012)	0.029	(0.023)
Muslim	0.093*	(0.043)	−0.009	(0.006)	−0.112*	(0.051)	−0.001	(0.015)	−0.020*	(0.008)	0.057*	(0.028)
Time to school	0.011†	(0.006)	0.001	(0.001)	−0.018*	(0.009)	0.001	(0.002)	0.000	(0.001)	0.004	(0.003)
School costs	0.052*	(0.025)	0.003	(0.006)	−0.089*	(0.040)	−0.005	(0.016)	−0.004	(0.011)	0.042	(0.034)
Real wages	0.049†	(0.027)	0.005	(0.008)	−0.085*	(0.039)	0.011	(0.016)	0.005	(0.013)	0.007	(0.021)

Table 8 continued

Outcome	Work, no school						School with				Idle	
	Market only		Domestic only		School only		Combine M&S		Combine D&S		Do nothing	
	APE	SE	APE	SE	APE	SE	APE	SE	APE	SE	APE	SE
Female work high	−0.008	(0.016)	0.007	(0.004)	−0.011	(0.025)	−0.001	(0.007)	0.013†	(0.008)	−0.008	(0.012)

Estimation results are based on the trivariate probit model (Table 5). The average partial effects (APE) are calculated with respect to the joint trivariate probability of each outcome. *Market only* refers to the outcome $P(L = 1, H = 0, S = 0)$, *Domestic only* to $P(L = 0, H = 1, S = 0)$, *School only* to $P(L = 0, H = 0, S = 1)$, *Combine M&S* to $P(L = 1, H = 0, S = 1)$, *Combine D&S* to $P(L = 0, H = 1, S = 1)$, *Do nothing* to $P(L = 0, H = 0, S = 0)$. Standard errors are clustered at the village level and approximated by parametric bootstrap. Sample size is $N = 1{,}345$ observations. **, *, † Significance at 1, 5, 10 % level

probability that a child specializes in one given activity (market work, domestic work, or school), combines different activities, or stays idle.[20]

As expected, the probability that a child works falls and the probability that he or she goes to school rises with household wealth. The wealth effects are larger for the gender specific work activities of girls and boys (domestic and market work respectively), and are generally larger for girls (although less significant for girls' market work). Girls (boys) living in the wealthiest third of families, measured in terms of durable goods ownership, are 29 (14) percentage points more likely to go to school than those in the poorest third. The difference in school attendance between the first and second wealth tercile amounts to about 10 pp. for both sexes. (cf. Tables 5, 6). Children from wealthier households are also less likely to specialize in any type of work or to combine market and domestic work or stay idle, while they are more likely to go to school only (cf. Tables 7, 8). Given the girls' lower (actual or perceived) returns to education, income constraints seem to be even more important for girls' schooling.[21]

Ownership of large productive assets (land or animals) also proxies for income effects, while at the same time also providing incentives for children to work by increasing their productivity within the household. Idleness tends to be higher in families with no asset ownership: as they are poorer, they can invest less in schooling, but at the same time, child productivity within such households tends also to be lower and hence child work is also less likely. Since animal care is considered to be mainly a female activity, the net effect of animals is overall zero for boys, while the incentive effects of animal ownership prevail for girls: animals both increase the likelihood of girls' market and domestic work and decrease the likelihood of girls going to school only. For girls, landholdings also increase the likelihood of domestic work and decrease the probability of specializing in schooling (or staying idle). Beyond incentive effects, this latter result might also reflect different cultural norms attached to the domestic work of females in land-rich households in Northern India (see also Kambhampati and Rajan 2008).

Parental education affects parental preferences for education but potentially it also proxies for income; these forces affect more strongly the trade-off between participation in schooling and the gender-specific activity. Children whose father (mother) is literate are about 8–10 (14–18) pp. more likely to attend school than children of illiterate parents. With literate fathers, children are less likely to specialize in the gender specific work activity and more likely to go to school only. When fathers have at least a junior secondary education, children are also less likely to stay idle and the likelihood of boys' domestic work also decreases. The results

[20] As only around half percent of boys combines market with domestic work, marginal effects for this joint category cannot be meaningfully computed due to convergence issues and are thus not reported.

[21] The above wealth proxies might also capture substitution effects to some extent as some of the durable goods have a productive use in domestic work, and might especially substitute for girls' and boys' domestic work. In regressions that distinguished between durable goods of domestic use (freezer, fan, heater, cooker, sewing machine, petromax) and other durable goods (car, bicycle, motor, television, radio, camera), only the domestic goods proxy was significantly related to boys' work and schooling, whereas domestic goods also had an overall larger effect on girls' work and schooling outcomes. However, as ownership of domestic and other durable assets are closely related in this sample, there might be not enough variation to disentangle their effects.

also corroborate the well-known importance of female education, which plays the more decisive role for both girls' and boys' work and education. As domestic work is relatively less frequent among boys, and no boy with at least a literate mother performs domestic work in the sample, the controls for mothers' education have to be excluded from the domestic work regressions and no joint trivariate probabilities can be calculated. For girls, however, it can be seen that maternal education reduces the likelihood of work to such an extent that girls of better educated mothers are not only more likely to go to school, but also somewhat more likely to stay idle. This effect stays in contrast with that of paternal education.

The absence of the child's father and/or mother from the household captures the effects of additional vulnerability, but also reveals gender differences in parental preferences. Girls and boys not living with their mothers are less likely to attend school than those living with their illiterate mothers (by 17 and 8 pp. respectively); this effect is considerably larger for girls. Girls without a mother in the household are also less likely to perform market work or combine school with market work, and are more likely to specialize in domestic chores. Beyond the effect of the mother's preferences, this might also be due to the fact that market work is more culturally acceptable for girls if they can work alongside their mothers. The effects of missing fathers on children's time use are less pronounced. Boys without a father are somewhat more likely to perform domestic work, whereas girls even seem to benefit from living without their fathers: Girls without a father are about 11 percentage points *more* likely to attend school (and are less likely to stay idle) than girls with an illiterate father living in the household. These latter results for girls highlight large differences in the preferences of less educated fathers and mothers towards girls' education. The results also show that girls are expected to make a larger economic contribution in female headed households: they are more likely to perform market work or combine it with domestic work and less likely to stay idle. For boys the effects of having a female household head are largely insignificant, although they seem cet. par. less likely to be involved in domestic work in such households.

The work-schooling decisions are also affected by household composition variables. With a rising number of infants (0–5 years old) girls are more likely to stay at home and be involved in domestic work (cf. Edmonds 2006 on Nepal). Children aged 6 to 9 years also reduce the likelihood of girls' schooling; however, they decrease the likelihood of older boys performing domestic work, which might point towards some substitution between smaller children and older boys in domestic chores. There is also some evidence for interdependence between the outcomes of teen-aged children: with larger numbers of boys in a household girls are less likely to perform market work, while boys are more likely to perform domestic work. However, as argued before, time allocation decisions of older children and the number of younger children within the household might also be jointly determined and should not be given a strictly causal interpretation.[22]

With more adult males in the household, both boys and girls are more likely to perform domestic chores or combine these with school attendance; boys also

[22] This is also the reason why I do not present and interpret the marginal effects on joint trivariate probabilities for these variables.

become less likely to specialize in market work or combine it with schooling and girls are less likely to stay idle. Overall, the presence of male household members tends to shift children towards domestic activities but also schooling and thus reflects income but potentially also preference effects. By contrast, the number of adult females in the household does not significantly affect the time use decisions of either boys or girls. However, the results emphasize the importance of the contributions of elderly for the outcomes of child work and schooling. Their presence reduces considerably participation in the gender specific work activity (although it also reduces boys' domestic work to a lesser extent), and increases the likelihood that children attend school.

As widely argued (e.g., Emerson and Souza 2008), later born can be expected to fare somewhat better due to birth order effects, although birth order effects are not entirely clear-cut here. Later born girls are less likely to specialize in domestic work or stay idle, but they are also more likely to combine market work and schooling. Later born boys are somewhat more likely to be involved in domestic work, and are also more likely to combine it with schooling.

School availability and average school costs are also negatively related to school attendance, although stronger so for boys than girls. School distance shifts boys from specializing in schooling towards specializing in market work. The monetary costs of schooling within the village reduce the likelihood of school attendance (or of exclusive school attendance for boys and combining school and domestic work for girls). At the same time higher school costs make it more likely that children of both sexes perform only market work, or girls even combine market and domestic work. One reason for this result could be that older children might be helping to cover the expenses of education of their younger siblings.

Cultural norms, proxied by controls for caste and religion, strongly influence preferences for education as well as the economic role of the sexes, and are also important in explaining the gender unspecific activities. Moreover, caste variables could also act as additional proxies for income/wealth. Upper caste girls (as compared to girls from lower or scheduled castes or Muslims) are less likely to perform market work or domestic work and more likely to go to school. They are also less likely to combine work activities or market work with schooling, and much more likely to go to school only. Splitting market work into wage work and home production and estimating a model with four distinct categories (results not reported) shows that ceteris paribus girls from scheduled castes are the most likely to work for wages, while girls from lower castes are the most likely to help out in the family business.[23] Upper caste boys are also more likely to go to school, but they are also more likely to help with domestic chores, or combine school with domestic chores.

Cultural norms might also be reflected in the role of adult female workforce participation which significantly raises market related work and reduces domestic work of girls. By contrast, higher female workforce participation makes boys more

[23] These findings support those of Kambhampati and Rajan (2008) who find similar patterns of caste-based differences among all Indian girls. They argue that this reflects the less patriarchal cultural norms among the lowest castes, which put less restrictions on the work of girls outside the household.

likely to perform domestic chores. Thus, these effects are strongly gender-specific and go beyond reflecting overall higher labor demand or average income effects. Moreover, both girls and boys are more likely to combine work with school in villages where more females work, which might be related to the better bargaining position of females.

Real wages in the village capture not only differences in average income across villages but also incentive effects: the median of unskilled male wages in the village is proxying for opportunity costs of non-working. With higher wages the probability of specializing in market work is higher for both boys and girls; for girls the probability of combining market work with any other activity is also increasing with real wages while idleness becomes less likely. In this particular case the incentive effects of higher adult wages seem to be larger than the additional income effects.[24] These incentive effects could be considered as lower bound estimates since larger prevalence of child work should depress adult wages in a general equilibrium setting, attenuating the positive wage coefficients.

The results also support the view that children are more likely to stay idle if families are not only poor but children also have less economic opportunities to work. Idleness decreases with land holdings and with animal ownership (this latter only for girls). Girls' idleness decreases also with adult real wages and is closely affected by the series of proxies for cultural norms and parental preferences.[25]

5.2 Robustness issues

The above results raise several robustness issues. The applied trivariate probit strategy relies on the assumption of joint normality of the error terms, and thus results might be sensitive towards functional form specifications. In order to investigate this issue, Tables 9 and 10 present three separate univariate regressions for the outcomes market work, domestic work and schooling for both sexes, estimated by linear probability models via OLS. As argued before, these univariate regressions have the disadvantage, as compared to the multivariate framework, of not accounting for the interrelation between these three decisions. This results in potentially too broad comparison groups as for instance in a market work regression students, domestic workers or idle children are all considered as a joint comparison group, which might blur some of the underlying differences. Moreover, slight divergence between the estimation results can also be due to differences between the probit and linear probability specifications. Nevertheless, it is useful to compare the stability of the overall results towards such specification issues.

As expected, the linear univariate models of Tables 9 and 10 yield overall somewhat less significant results than the trivariate probit specifications

[24] This result is in line with some other studies on the role of local labor demand (see Duryea and Arends Kuenning 2003 on Brazil) although there is also contrasting evidence finding that the income effects of local wages outweigh substitution effects (see Kambhampati and Rajan 2006 on India or Wahba 2006 on Egypt).

[25] Although ability of the children is not measured, idleness can also be expected to crucially depend on individual abilities. As demonstrated by Bacolod and Ranjan (2008) for the Philippines, in a family the least able children are the ones to stay idle, especially among the relatively richer families.

Table 9 Robustness: univariate OLS estimates of work/schooling of girls

Dependent var.	Market work		Domestic work		Schooling	
	Coeff.	SE	Coeff.	SE	Coeff.	SE
Middle wealth	−0.002	(0.026)	−0.056	(0.040)	0.122**	(0.035)
Larger wealth	−0.024	(0.030)	−0.163**	(0.057)	0.280**	(0.047)
Large land	0.040	(0.054)	0.104†	(0.058)	−0.019	(0.045)
Animals owned	0.011*	(0.005)	0.011	(0.008)	−0.009†	(0.005)
Father literate	0.014	(0.041)	−0.083†	(0.045)	0.129**	(0.041)
Father sec. ed.	−0.025	(0.032)	−0.120**	(0.044)	0.220**	(0.044)
No father	−0.033	(0.066)	−0.039	(0.077)	0.157*	(0.062)
Mother literate	−0.047	(0.032)	−0.152*	(0.059)	0.161**	(0.057)
Mother sec. ed.	−0.044	(0.030)	−0.201**	(0.054)	0.176**	(0.052)
No mother	−0.090	(0.066)	0.092	(0.076)	−0.125*	(0.061)
Female head	0.187*	(0.089)	0.024	(0.096)	−0.047	(0.073)
No. infants	0.005	(0.009)	0.024	(0.015)	−0.026†	(0.015)
No. small children	0.008	(0.010)	0.018	(0.018)	−0.027†	(0.016)
No. boys	−0.020	(0.013)	0.009	(0.017)	−0.015	(0.016)
No. girls	−0.012	(0.012)	−0.006	(0.020)	−0.009	(0.019)
No. adult males	−0.016	(0.015)	0.024	(0.022)	0.002	(0.020)
No. adult females	−0.002	(0.015)	−0.019	(0.023)	0.023	(0.021)
No. elderly	−0.003	(0.016)	−0.059**	(0.022)	0.060**	(0.022)
Married	0.025	(0.051)	0.131†	(0.074)	−0.168**	(0.053)
Birth order	0.011	(0.010)	−0.017	(0.018)	0.030†	(0.016)
Lower caste	0.079**	(0.025)	0.127*	(0.050)	−0.161**	(0.050)
Scheduled caste	0.158**	(0.035)	0.074	(0.058)	−0.139*	(0.058)
Muslim	0.034	(0.032)	0.165**	(0.062)	−0.134*	(0.065)
Time to school	0.007	(0.009)	0.028	(0.032)	−0.021	(0.023)
School costs	0.077	(0.046)	0.029	(0.067)	−0.122†	(0.066)
Real wages	0.094**	(0.037)	0.053	(0.054)	−0.022	(0.062)
Female work high	0.070**	(0.029)	−0.099*	(0.033)	0.068†	(0.039)
R^2	0.142		0.200		0.360	

The results show three separate linear probability models, estimated by OLS. The models also include age dummies and a constant. The number of observations is 1,067. Standard errors are clustered at village level. **, *, † Significance at the 1, 5, and 10 % level

(in Tables 5, 6), although many of the linear coefficients are relatively close to the estimated average partial effects. One of the major differences between the two sets of results is the role of caste and religion for explaining the gender unspecific activities. Here the multivariate specifications yield both considerably larger and significant estimates, while univariate OLS results stay mainly smaller and insignificant. In a similar vein, maternal education and presence or school costs become insignificant for girls' market work, and the presence of elderly, real wages or female workforce participation lose of their explanatory power in boys'

Table 10 Robustness: univariate OLS estimates of work/schooling of boys

Dependent var.	Market work		Domestic work		Schooling	
	Coeff.	SE	Coeff.	SE	Coeff.	SE
Middle wealth	−0.064**	(0.025)	−0.036*	(0.014)	0.134**	(0.028)
Larger wealth	−0.125**	(0.031)	−0.045**	(0.012)	0.164**	(0.033)
Large land	−0.006	(0.048)	0.017	(0.020)	0.034	(0.043)
Animals owned	−0.003	(0.004)	0.002	(0.002)	0.007†	(0.004)
Father literate	−0.069*	(0.035)	−0.007	(0.019)	0.126**	(0.038)
Father sec. ed.	−0.064*	(0.033)	−0.036**	(0.012)	0.182**	(0.037)
No father	0.012	(0.065)	0.082*	(0.039)	0.021	(0.066)
Mother literate	−0.049	(0.034)	−0.024*	(0.012)	0.131**	(0.030)
Mother sec. ed.	−0.095**	(0.032)	−0.021	(0.013)	0.108**	(0.029)
No mother	0.020	(0.059)	0.034	(0.033)	−0.089	(0.060)
Female head	0.036*	(0.065)	−0.065*	(0.031)	−0.122	(0.097)
No. infants	0.000	(0.011)	−0.005	(0.006)	−0.005	(0.013)
No. small children	0.010	(0.014)	−0.012†	(0.007)	0.000	(0.014)
No. boys	0.017	(0.018)	0.013†	(0.007)	−0.028	(0.020)
No. girls	−0.008	(0.014)	−0.007	(0.006)	0.014	(0.014)
No. adult males	−0.023†	(0.013)	0.011	(0.008)	0.009	(0.016)
No. adult females	−0.001	(0.018)	−0.007	(0.008)	0.002	(0.016)
No. elderly	−0.023	(0.016)	−0.009	(0.007)	0.040*	(0.016)
Married	0.112	(0.100)	0.019	(0.041)	−0.145†	(0.084)
Birth order	0.004	(0.013)	0.010†	(0.006)	−0.004	(0.012)
Lower caste	0.039	(0.029)	−0.038	(0.024)	−0.063*	(0.031)
Scheduled caste	0.052	(0.036)	−0.021	(0.029)	−0.080†	(0.041)
Muslim	0.076	(0.046)	−0.031	(0.030)	−0.150**	(0.049)
Time to school	0.013	(0.009)	0.002	(0.003)	−0.017*	(0.009)
School costs	0.054	(0.042)	0.003	(0.027)	−0.117†	(0.066)
Real wages	0.033	(0.042)	0.015	(0.025)	−0.065	(0.049)
Female work high	−0.007	(0.027)	0.019	(0.014)	0.010	(0.030)
R^2	0.220		0.061		0.258	

The results show three separate linear probability models, estimated by OLS. The models also include age dummies and a constant. The number of observations is 1,345. Standard errors are clustered at village level. **, *, † Significance at the 1, 5, and 10 % level

regressions. Nevertheless, most of the major patterns can be traced even within the univariate framework.

Since the presented trivariate results are always estimated separately for boys and girls, they yield themselves less directly to gender comparisons of the various effects. In order to see whether the apparent differences between boys and girls are also significant in statistical terms, Table 11 shows results from univariate linear probability models estimated for the pooled sample of boys and girls, where every explanatory variable of interest has been interacted with a male dummy. For space economy, the table only presents the coefficients of these interaction terms which

Table 11 Robustness: interaction terms in pooled univariate OLS estimates

Dependent var.	Market work			Domestic work			Schooling		
	B	Coeff.	SE	B	Coeff.	SE	B	Coeff.	SE
Middle wealth		−0.058†	(0.035)	−	0.009	(0.043)	+	0.019	(0.028)
Larger wealth		−0.088*	(0.042)	−	0.106†	(0.058)	+	−0.114†	(0.033)
Large land		−0.046	(0.071)	+	−0.092	(0.059)		0.057	(0.043)
Animals owned	+	−0.012*	(0.006)		−0.010	(0.008)		0.015**	(0.004)
Father literate		−0.077	(0.048)	−	0.068	(0.048)	+	0.000	(0.038)
Father sec. ed.		−0.043	(0.041)	−	0.088†	(0.045)	+	−0.039	(0.037)
No father		0.074	(0.098)		0.085	(0.086)	+	−0.127	(0.066)
Mother literate		−0.003	(0.047)	−	0.128*	(0.062)	+	−0.028	(0.030)
Mother sec. ed.		−0.061	(0.037)	−	0.195**	(0.055)	+	−0.071	(0.029)
No mother	−	0.130	(0.083)		−0.065	(0.083)	−	0.028	(0.060)
Female head	+	−0.173	(0.120)		−0.061	(0.095)		−0.081	(0.097)
No. infants		−0.015	(0.013)	+	−0.016	(0.016)		0.018	(0.013)
No. small children		−0.015	(0.017)		−0.009	(0.020)		0.021	(0.014)
No. boys	−	0.035†	(0.018)		0.002	(0.018)		−0.009	(0.020)
No. girls		0.006	(0.018)		−0.003	(0.021)		0.024	(0.014)
No. adult males		0.000	(0.018)		−0.020	(0.022)		0.008	(0.016)
No. adult females		0.010	(0.021)		0.004	(0.025)		−0.020	(0.016)
No. elderly		−0.014	(0.020)	−	0.038	(0.024)	+	−0.015	(0.016)
Married		0.188†	(0.111)	+	−0.196**	(0.072)	−	0.018	(0.084)
Birth order		0.007	(0.016)		0.009	(0.019)	+	−0.029	(0.012)
Lower caste	+	−0.038	(0.035)	+	−0.165*	(0.059)	−	0.097†	(0.031)
Scheduled caste	+	−0.105*	(0.051)		−0.092	(0.068)	−	0.057	(0.041)
Muslim		0.043	(0.055)	+	−0.196**	(0.071)	−	−0.015	(0.049)
Time to school		0.004	(0.010)		−0.026	(0.032)		0.007	(0.018)
School costs		−0.016	(0.061)		−0.032	(0.069)	−	0.003	(0.066)
Real wages	+	−0.068	(0.055)		−0.033	(0.057)		−0.045	(0.049)
Female work high	+	−0.083*	(0.039)	−	0.121**	(0.033)	+	−0.055	(0.030)
R^2		0.349			0.336			0.399	

The results show three separate linear probability models, estimated by OLS. The models are jointly estimated for 2,412 boys and girls, and include a constant, age dummies, and all the above variables and their interactions with a male dummy. In the table only the coefficients and standard errors of the male interactions are presented; the signs of the significant baseline results for girls are presented in the first column of each model respectively (marked B). Standard errors are clustered at village level. **, *, † Significance at the 1, 5, and 10 % level

show whether any explanatory factor affects time use decisions of boys significantly differently from that of girls. Additionally, the table also indicates the sign of the significant baseline coefficients for girls. The usual limitations of univariate analysis apply to these results as well.

As can be seen in Table 11, even in the univariate setting, some clear-cut gender differences emerge. Wealth effects are indeed more pronounced for the gender

specific work activities, and are larger for girls' schooling. Animal ownership does only affect girls' market work as they are the ones mostly expected to care for animals, while it is also more beneficial to boys' schooling. Parental education reduces girls' domestic work by considerably more, although of course also starting from much higher base levels. Caste and religion seem to affect boys' and girls' market and domestic work differently, which is also more in line with the trivariate results. Finally, high workforce participation of females, capturing potentially also cultural norms about the economic role of females, does affect girls' and boys' work very differently, increasing participation in market work and decreasing participation in domestic work only for girls.

A remaining limitation of the analysis lies in the cross sectional nature of the applied household data. Although a wide range of control variables is used in order to address issues of sample heterogeneity, the approach cannot completely deal with concerns of endogeneity as some of the explanatory factors might be jointly determined with the time use decisions of children. The relatively crude wealth proxies, divided in three categories only, try to limit the scope for direct reverse causality between child labor and the ownership of durable goods. However, for some other variables endogeneity concerns might still remain. Family composition is only given in the short run, and the number of children in a family and investment into human capital of any of the children is jointly determined from a long run perspective; this is the classical argument for a quantity-quality trade-off (Becker and Lewis 1973). This is an issue, which is largely unresolved in the child labor literature and has to be kept in mind when interpreting the results. The endogeneity of real wages in the general equilibrium has also been discussed in the text and might bias the estimated incentive effects downwards. Although these limitations have to be acknowledged, the overall findings on the gender differences in work and schooling of this study are unlikely to be driven by these endogeneity issues in any major way, and are robust to the exclusion of the above controls.

6 Conclusion

Joint estimation of participation equations in market work, domestic work, and schooling can help to shed some additional light on the work-school trade-off of children in rural North India. The inclusion of domestic work in the choice set is especially important for capturing the gender differences in the trade-offs faced by girls and boys. Since the major work activities are different for the two sexes, the trade-offs between work and school differ as well: schooling mostly conflicts with household work for girls, and market work for boys. This gender difference could be due to a gender gap in the relative returns to formal education, differences in relative productivities in specific activities as well as cultural norms with respect to the females' role.

Interestingly, several of the usual explanatory factors, like wealth proxies, tastes for education (proxied by parental education), or the presence of elderly family members (or of the mother for girls), mainly shift children away from the gender-specific work activity towards schooling. By contrast, cultural norms influence

participation in the less typical work activity to a larger extent: caste variables are more strongly related to girls' market and boys' domestic work. Moreover, high female workforce participation in the village shifts girls' activities from domestic towards market work, while making it also more likely that boys perform domestic duties. Studies that concentrate on market work only, are bound to neglect the determinants of these decisions, especially for girls.

The results also emphasize the incentive effects arising from the ownership of productive assets which turn out to be especially important for girls: animal ownership increases the likelihood that girls are involved in market work, possibly also because it enables them to contribute to the family income without leaving the household. The effects of school costs are considerably less gender specific: the direct costs of primary schooling increase participation in market work of children of both sexes, making school attendance also less likely; in a similar vein, opportunity costs of schooling (captured by village wages) increase market work of both boys and girls.

References

Bacolod, M. P., & Ranjan, P. (2008). Why children work, attend school, or stay idle: The roles of ability and household wealth. *Economic Development and Cultural Change, 56*(4), 791–828.

Baland, J.-M., & Robinson, J. A. (2000). Is child labor inefficient? *Journal of Political Economy, 108*(4), 663–679.

Basu, K., Das, S., & Dutta, B. (2009). Child labor and household wealth: Theory and empirical evidence of an inverted-U. *Journal of Development Economics, 91*(1), 8–14.

Basu, K., & Van, P.H. (1998). The economics of child labor. *American Economic Review, 88* (3), 412–427.

Becker, G. S., & Lewis, H. G. (1973). On the interaction between the quantity and quality of children. *Journal of Political Economy, 81*(2), 279–288.

Beegle, K., Dehejia, R. H., & Gatti, R. (2006). Child labor and agricultural shocks. *Journal of Development Economics, 81*(1), 80–96.

Beegle, K., Dehejia, R., & Gatti, R. (2012). Why should we care about child labor?: The education, labor market, and health consequences of child labor. *Journal of Human Resources, 47*(2), 364–396.

Behrman, J. (1988). Intrahousehold allocation of nutrients in rural India: Are boys favored? Do parents exhibit inequality aversion? *Oxford Economic Papers, 40*(1), 32–54.

Bhalotra, S., Heady, C. (2003). Child farm labor: The wealth paradox. *World Bank Economic Review, 17*(2), 197–227.

Canagarajah, S., & Coulombe, H. (1997). *Child labor and schooling in Ghana, policy research working paper series 1844*. Washington DC: The World Bank.

Cappellari, L., & Jenkins, S. P. (2003). Multivariate probit regression using simulated maximum likelihood. *The Stata Journal, 3*(3), 278–294.

Cappellari, L., Jenkins, S. P. (2006). Calculation of multivariate normal probabilities by simulation, with applications to maximum simulated likelihood estimation. *The Stata Journal, 6*(2), 156–189.

Cartwright, K. (1998). Child labor in Colombia. In: C. Grootaert & H. A. Patrinos (Eds.), *The policy analysis of child labor: A Comparative Study, Chap. 4*. London: St Martin's Press.

Chamarbagwala, R., & Tchernis, R. (2010). Exploring the spatial determinants of childrens activities: Evidence from India. *Empirical Economics, 39*(2),593–617.

Cigno, A., & Rosati, F. C. (2005). *The economics of child labour, Chap. 5*. Oxford University Press, Oxford, pp. 83–103.

Drèze, J., & Kingdon, G. G. (2001). School participation in rural India. *Review of Development Economics, 5*(1),1–24.

Duraisamy, M. (2000). *Child schooling and child work in India, Econometric society world congress 2000 contributed papers 0837*. Econometric Society.

Duryea, S., & Arends Kuenning, M. (2003). School attendance, child labor and local labor market fluctuations in urban Brazil. *World Development, 31*(7), 1165–1178.

Edmonds, E. V. (2006). Understanding sibling differences in child labor. *Journal of Population Economics, 19*(4), 795–821.

Edmonds, E. V. (2007). Child labor. In: T. P. Schultz & J. A. Strauss (Eds.), *Handbook of development economics, Vol. 4 of North Holland handbooks in economics* (Chap. 57, pp. 3607–3709). Amsterdam: Elsevier.

Edmonds, E. V., & Pavcnik, N. (2005). Child labor in a global economy. *Journal of Economic Perspectives, 8*(1), 199–220.

Edmonds, E. V., Pavcnik, N., & Topalova, P. (2010). Trade adjustment and human capital investments: Evidence from Indian tariff reform. *American Economic Journal: Applied Economics, 2*(4), 42–75.

Emerson, P. M., & Souza, A. P. (2008). Birth order, child labor, and school attendance in Brazil. *World Development, 36*(9), 1647–1664.

Ersado L. (2005). Child labor and schooling decisions in urban and rural areas: Comparative evidence from Nepal, Peru, and Zimbabwe. *World Development, 33*(3), 455–480.

Foster, A. D., & Rosenzweig, M. R. (2004) Technological change and the distribution of schooling: Evidence from green-revolution India. *Journal of Development Economics, 74*(1), 87–111.

Foster, A., & Rosenzweig, M. (1996). Technical change and human-capital returns and investments: Evidence from the green revolution. *American Economic Review, 86*(4), 931–953.

Greene, W. H. (2003). *Econometric analysis* (5th ed.). Prentice Hall, Upper Saddle River, New Jersey.

Grootaert, C. (1998). Child labour in Cote d'Ivoire. In: C. Grootaert & H. A. Patrinos (Eds.), *The policy analysis of child labor: A Comparative Study, chapter 3*. London: St Martin's Press.

Heady, C. (2003). The effect of child labor on learning achievement. *World Development, 31*(2), 385–398.

Jacoby, H. G., & Skoufias, E. (1997). Risk, financial markets, and human capital in a developing country. *Review of Economic Studies, 64*(3), 311–335.

Kambhampati, U. S., & Rajan, R. (2006). Economic growth: A Panacea for child labor? *World Development, 34*(3), 426–445.

Kambhampati, U. S., & Rajan, R. (2008). The 'nowhere' children: Patriarchy and the role of girls in India's rural economy. *Journal of Development Studies, 44*(9), 1309–1341.

Kochar, A. (2004). Urban influences on rural schooling in India. *Journal of Development Economics, 74*(1), 113–136.

Levison, D., Moe, K., & Knaul, F. (2001). Youth education and work in Mexico. *World Development, 29*(1), 167–188.

Maitra, P., & Ray, R. (2002). The joint estimation of child participation in schooling and employment: Comparative evidence from three continents. *Oxford Development Studies, 30*(1), 41–62.

Meyerhoefer, C., & Chen, C. (2011). The effect of parental labor migration on children's educational progress in rural China. *Review of Economics of the Household, 9*(3), 379–396.

Morduch, J. (2000). Sibling rivalry in Africa. *American Economic Review, 90*(2), 405–409.

Nielsen, H. S. (1998). *Child labor and school attendance: Two joint decisions*, CLS Working Paper 98–015, University of Aarhus.

Pal, S. (2004). How much of the gender difference in child school enrolment can be explained? Evidence from rural India. *Bulletin of Economic Research, 56*(2), 133–158.

Parish, W. L., & Willis, R. J. (1993). Daughters, education and family budgets: Taiwan experiences. *Journal of Human Resources, 28*(4), 863–898.

Psacharopoulos, G., & Patrinos, H. A. (1997). Family size, schooling and child labor in Peru—An empirical analysis. *Journal of Population Economics, 10*(4), 387–405.

Ravallion, M., & Wodon, Q. (2000). Does child labour displace schooling? Evidence on behavioural responses to an enrollment subsidy. *Economic Journal, 110*(462), C158–C175.

Rosati, F., & Straub, R. (2007). Does work during childhood affect the health of Guatemalan adults? *Review of Economics of the Household, 5*(1), 83–94.

Rose, E. (1999). Consumption smoothing and excess female mortality in rural India. *Review of Economics and Statistics, 81*(1), 41–49.

Rosenzweig, M. R., & Schultz, T. P. (1982). Market opportunities, genetic endowments, and intrafamily resource distribution: Child survival in rural India. *American Economic Review, 72*(4), 803–815.

Sen, A. K. (1992). Missing women. *British Medical Journal, 304*(6827), 1–17.

Wahba, J. (2006). The influence of market wages and parental history on child labour and schooling in Egypt. *Journal of Population Economics, 19*(4), 823–852.