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The impact of children's work on schooling: Multi-country evidence

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Much of the recent concern over child labour stems from the belief that it has a detrimental effect on human capital formation. This is reflected in the expanding literature on the subject. Kanbargi and Kulkarni (1991), Psacharopoulos (1997), Patrinos and Psacharopoulos (1997), Jensen and Nielsen (1997), Ravallion and Wodon (2000), Ray (2000a, 2000b, 2002) are indeed part of a large literature that provides evidence on the trade-off between children's work and schooling.[1]

This study attempts to contribute to this literature by answering the following question: Is there a threshold of (weekly) hours of work for 12-14 year olds below which school attendance and performance are not adversely affected? The policy importance of this question stems from Article 7 of the ILO's Minimum Age Convention, 1973 (No. 138), which stipulates that "light work" may be permitted for children from the age of 12 or 13 provided it does not "prejudice their attendance at school … or their capacity to benefit from the instruction received".

The results of the present study support the growing body of evidence on the welfare cost that child labour entails in terms of human capital. Previous investigations include the studies of Patrinos and Psacharopoulos (1995) on Paraguay, Akabayashi and Psacharopoulos (1999) on Tanzania, Singh (1998) on the United States, Heady (2000) on Ghana, Rosati and Rossi (2001) on Pakistan and Nicaragua, and Ray (2000c) on India. Based on an analysis of national surveys of child labour in seven

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[1] For recent surveys of the literature on child labour, see Basu (1999) and Basu and Tzannatos (2003).

countries (Belize, Cambodia, Namibia, Panama, the Philippines, Portugal and Sri Lanka), this article seeks to determine the effect of work on the schooling of children in the age group of 12-14 years. In addition, the study provides evidence on the impact of hours of child work on other measures of learning, such as "time spent on studies at home", "hours of study at school and at home" and "number of failures in school".[2]

The remainder of this article is organized into four sections. The first presents the general research background to the study, its estimation methodology and the chosen data sets, with a discussion of their salient empirical features. The second section presents and discusses the estimation results; and the third, the Sri Lankan evidence on the impact of occupational category on child learning. A final section offers some concluding remarks.

Background, methodology and data

Research background and originality

This study features a number of departures from the above-mentioned recent literature on the impact of child labour on educational outcomes. First, being based on empirical analysis of data sets from seven countries, it is conducted on a more ambitious scale than has been attempted before. Moreover, it represents one of the earliest investigations based on the SIMPOC[3] data sets which – unlike the LSMS[4] data sets on child labour collected by the World Bank – are ideally suited to this type of study. Indeed, child labour investigations of the type attempted here require the individual records of children, whereas the LSMSs provide only household-level records. The seven countries selected for the study span a wide geographical, cultural and political spectrum. The cross-country comparisons allow for an assessment of whether the relationship between child work and learning outcomes varies between countries.

Second, much of the recent literature has used test scores as a measure of "learning achievement". The study departs from this practice for two main reasons: (a) test scores are not available for children in any of the seven data sets considered here, and (b) the reading, language and mathematical skills, which the test scores measure, offer a very limited picture of "learning achievement", especially in the context of a develop-

[2] Because of space constraints, this article reports only a subset of the results yielded by the study. Full details are contained in Ray and Lancaster (2004).

[3] SIMPOC is the acronym for "Statistical Information and Monitoring Programme on Child Labour".

[4] LSMS is the acronym for "Living Standards Measurement Survey".

ing country. Instead, this study uses the "schooling for age" (SAGE) variable that measures schooling attainment relative to age. This is given by

$$\text{SAGE} = \left(\frac{\text{Years of schooling}}{\text{Age} - \text{E}} \right) \times 100 \qquad (1)$$

where E represents the usual school entry age in the given country.[5] Unfortunately, SAGE could not be calculated for Namibia, Portugal and the Philippines because these countries do not report "years of schooling" as a continuous variable. Consequently, the SAGE-based regressions are performed and reported for only four countries (Belize, Cambodia, Panama, and Sri Lanka); for the remaining three countries, the regressions use "years of schooling" as an educational performance measure.

Third, unlike Heady's (2000) study on Ghana for example, the present study attempts to control for the likely endogeneity of child labour hours as an explanatory variable in an equation that estimates its impact on the child's educational outcomes and learning possibilities. Here, "endogeneity" should be understood to mean that child labour hours are determined by the child's schooling variables, and vice versa. For example, a child's labour market status could reflect her school performance as much as the latter could reflect her labour market status. Consequently, the ordinary least squares (OLS) estimates of the impact of child hours on schooling, which ignore such endogeneity, are likely to be biased and inconsistent. That few studies have tried to correct for endogeneity is a limitation of the existing literature that this study attempts to overcome.

Lastly, while the primary focus of this study is on the impact of child labour on child schooling, it also considers "non-child-labour" variables – e.g. age and sex of the child, number of siblings, educational levels of the parents – as explanatory variables in the child schooling regressions. As reported below, some of these variables, especially the adults' educational levels and the household's access to water and electricity, have significant positive effects on the child's educational experience and outcomes. Importantly, these results suggest that controlling a child's labour market activity is not the only way to enhance her schooling experience and learning achievement. In other words, the negative effects of child labour hours on child schooling could be moderated by influencing the non-child-labour variables.

[5] The "years of schooling" variable measures the number of years a child has been in school.

Estimation methodology

The econometric analysis of the data sets is based on the following three-part estimation methodology:[6]

(a) the use of a multinomial logit model to estimate the determinants of the child's participation in schooling and/or employment;

(b) the use of a single equation estimation to examine the impact of child labour hours on child schooling employing an instrumental variable (IV) estimation methodology to control for the potential endogeneity of child labour hours as a regressor, as mentioned above;[7]

(c) the use of a three-stage least squares (3SLS) method of estimation that recognizes the simultaneity in decisions on the child's schooling and labour hours.

The multinomial logit model defines a variable Y as taking on four values, each of which depicts a particular combination of the 12-14 year old child's status in regard to employment and schooling, as follows:

(i) $Y_i = 0$: child i does not work, attends school

(ii) $Y_i = 1$: child i works and attends school

(iii) $Y_i = 2$: child i neither works nor attends school

(iv) $Y_i = 3$: child i works, does not attend school

The estimated equation is given by:

$$Y_i = X_i\beta + \varepsilon_i \qquad (2)$$

where X_i is a matrix of the child's individual, family and community characteristics, β denotes the estimable parameters, and the errors ε_i are assumed to follow a multinomial logistic distribution. Since the probabilities of being in each of the four states above must add up to unity for each child, the multinomial logit strategy involves estimating three equations. In this study, the normalized category is (i), i.e. the state of the child not working but attending school is adopted as the baseline case in the multinomial logit regressions. The sign of the estimated coefficient thus shows the direction of change in the probability of a child aged 12-14 years being in the given category, relative to the normalized category, if the determinant goes up by 1 unit.

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[6] In order to keep the exposition simple, the technical details have been omitted. For a full description, see Ray and Lancaster (2004).

[7] For a lucid discussion of technical terms such as "endogeneity", "instrumental variables", and others used in this article, see Stewart and Gill (1998). In this study, the "instrumental variables" are variables which are highly correlated with the endogenous regressor, namely, child labour hours, but they themselves do not suffer from the reverse causation that gives rise to the endogeneity problem.

The second part of the methodology (b) involves estimating the learning measures (L_i) for child i expressed as a linear function of her labour hours (H_i), the square of her labour hours (H_i^2) and a host of her individual (C_{ik}, k = 1,...m_1) and family (F_{ik}, k = 1,...m_2) characteristics. The estimating equation is given by:

$$L_i = \text{constant} + \delta_1 H_i + \delta_2 (H_i)^2 + \sum_{k=1}^{m_1} \gamma_{1k} C_{ik} + \sum_{k=1}^{m_2} \gamma_{2k} F_{ik} + U_{1i} \quad (3)$$

where U_{1i} is the stochastic error term assumed to have the usual white noise properties.

And the third part (c) estimates (L_i, H_i) jointly as a set of simultaneous equations, consisting of (3) and the child labour hours equation (H_i) expressed as a linear function of the child's individual (C_{ik}) and family (F_{ik}) characteristics and the instrumental variables (I_{ik}) previously used in the IV estimations.

$$H_i = \text{constant} + \sum_{k=1}^{m_1} \psi_{1k} C_{ik} + \sum_{k=1}^{m_2} \psi_{2k} F_{ik} + \sum_{k=1}^{m_3} \psi_{3k} I_{ik} + U_{2i} \quad (4)$$

Data sets and their salient features

The present study is based on an analysis of child labour data from Belize, Cambodia, Namibia, Panama, Philippines, Portugal and Sri Lanka. These data sets were collected under the ILO's Statistical Information and Monitoring Programme on Child Labour (SIMPOC). Launched in 1998 in response to the growing need for more quantitative information on child labour, SIMPOC provides technical assistance to ILO member States to generate reliable, comparable and comprehensive data on all forms of child labour. Table 1 presents a summary of relevant statistics (at sample mean) for the seven data sets considered here, disaggregated by sex. The following features are of particular interest.

First, the current school attendance rates vary a good deal between the seven countries, from the low rates of Namibia to the relatively high rates of Portugal and Sri Lanka. In the Asian countries (Cambodia, the Philippines and Sri Lanka), a much greater percentage of children combine schooling with employment than in the other countries.

Second, out of the four countries for which SAGE is available (Belize, Cambodia, Panama and Sri Lanka), Sri Lanka records the best schooling outcomes. Sri Lanka's performance is indeed quite impressive given its developing country status. It is interesting to note that, on either measure of "school outcome", girls do better than boys in all seven countries.

Table 1. Summary statistics: Means of some key variables

Variable	Belize		Cambodia		Namibia		Panama		Philippines		Portugal		Sri Lanka	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Child age	12.97	12.98	12.98	12.96	13.01	13.01	12.98	12.98	12.99	13.01	13.06	13.05	12.97	12.99
School enrolment rate	91%	88%	89%	85%	83%	89%	88%	90%	89%	92%	98%	98%	94%	95%
Hours of ILO-defined child work[a]	4.85	3.62	18.06	18.15	24.56	20.43	23.87	24.48	16.84	15.70	20.79	27.74	11.80	9.93
Hours of domestic child duties[b]	6.55	9.29	9.89	10.71	—	—	—	—	—	—	7.93	10.04	47.87	67.97
SAGE	74.56	77.09	46.43	47.87	—	—	69.30	72.18	—	—	—	—	86.71	89.26
Number of years of schooling[c]	5.93	6.19	3.26	3.36	1.04[d]	1.09[d]	5.53[d]	5.77[d]	3.57[d]	3.83[d]	2.78	2.86	6.92	7.14
Percentage of children who are:														
(i) In school, but don't work	72.0%	79.7%	30.9%	28.5%	73.3%	79.6%	81.0%	87.9%	70.4%	79.6%	95.2%	96.1%	65.5%	77.3%
(ii) In school and work	18.6%	7.7%	57.7%	56.6%	9.8%	9.4%	6.8%	1.7%	18.4%	12.0%	3.2%	1.9%	28.5%	18.1%
(iii) Neither in school nor in work	3.8%	9.5%	2.4%	2.6%	11.5%	8.8%	5.5%	9.1%	4.3%	5.4%	1.0%	1.4%	2.6%	2.9%
(iv) Not in school but work	5.1%	2.6%	9.0%	12.3%	5.5%	2.3%	6.7%	1.4%	7.0%	2.9%	0.6%	0.6%	3.4%	1.7%

(a) The figures are weekly hours for all countries except Belize for which the figures are daily hours. (b) The figures on domestic hours are weekly for all countries except Sri Lanka where the figures are expressed in "minutes per day". (c) Not comparable between the countries. (d) The figures on the length of schooling received in Namibia, Panama and the Philippines are based on the codes in these data sets. They should not be interpreted literally as "years of schooling" and are thus non-comparable with one another and with the other countries' figures.

Third, the weekly hours of work also vary a good deal between the countries. Working children in the 12-14 age group in Sri Lanka work considerably fewer hours than their counterparts in the other countries. Notwithstanding Portugal's satisfactory school attendance rate, the weekly hours worked by Portuguese working children in the 12-14 age group are surprisingly long.

And fourth, domestic chores constitute a significant share of children's total workload. In the four countries for which information on domestic chores is available, girls generally work longer hours than boys.

By correlating school attendance rates with weekly hours of work, Ray and Lancaster (2004) present evidence suggesting that work hours do adversely affect both school enrolment rates and the school outcome variable, SAGE. Further evidence of the adverse impact of child labour on children's learning possibilities is given in figures 1 and 2. Figure 1 shows the relationship between study time (at mean) and child ages for non-working and working children in Sri Lanka. The mean study time of working children falls below that of non-working children at around the age of 11 years. The decline accelerates over the 12-14 age group considered here, so that by the time children reach school-leaving age a large gap has opened up between the mean study times of non-working and working children. Figure 2 shows, for Cambodia, the percentages of working and non-working children in the various age groups who can read and write. In the target age group of 12-14 years, the cost of child work is once again evident in the lead that non-working children enjoy over working children in regard to reading and writing.

Figure 1. Relationship between mean study time and child ages in Sri Lanka

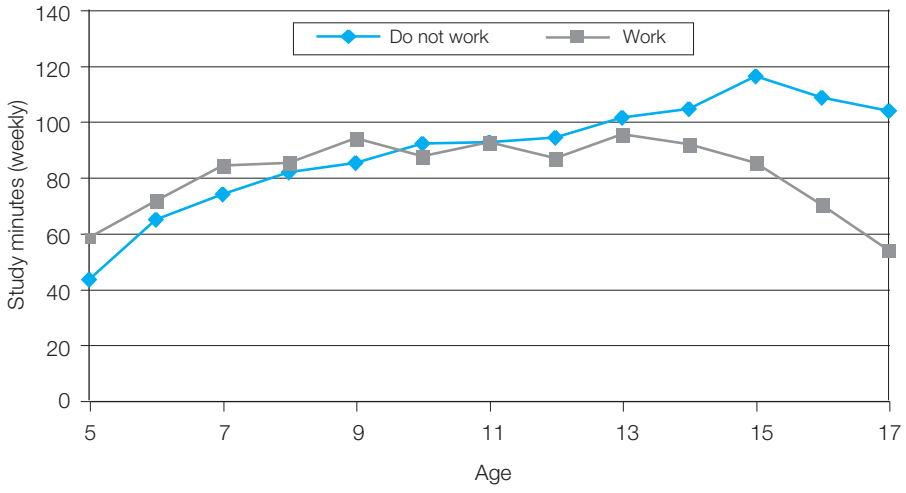
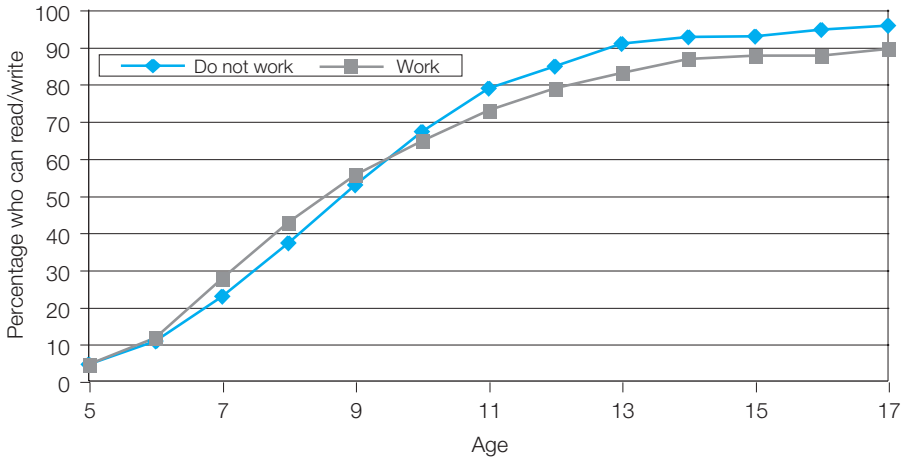


Figure 2. Relation between the percentage of children who can read/write and child ages in Cambodia



Estimation results

Table 2 presents the results of the multinomial logit estimation for Belize (the normalized category being that of children who attend school but do not work). The coefficient estimates of the "years of schooling" variable suggest that school attendance can be "habit forming" in the sense that, *ceteris paribus*, the more schooling experience a child gets the less likely she/he is to drop out of school. An increase in the household's access to water and lighting and its possession of assets such as television and telephone helps to put its children in the "school only" status with no labour market participation.

The marginal probabilities, implied by the multinomial logit parameter estimates for Belize, are reported in table 3. These show that boys in Belize are less likely than girls to be in the "school only" category, and more likely to be in the "work only" category. The marginal probabilities also confirm that access to lighting, water, etc. is associated with households whose children are in the "school only" category. The base probabilities show that a child in Belize is much more likely to be in the "school only" category than in any of the other categories.

The multinomial logit estimation results for Cambodia are presented in table 4. The results are similar in several respects to those reported for Belize (see table 2). Note the powerful positive effects on child schooling of parental educational levels, household possession of assets such as TV, phone, etc., and access to amenities such as lighting and water. The marginal probabilities for Cambodia are presented in table 5.

Table 2. Multinomial logit coefficient estimates:[a] Belize[e], [f], [g]

Variable	Category[b]		
	Both school and work	Neither school nor work	Work only
Age of child	7.93[c]	–2.13	–4.58
	(3.86)	(6.97)	(11.42)
(Age of child)^2	–0.30[c]	0.14	0.25
	(0.15)	(0.26)	(0.43)
No. of children in the household	0.09[c]	0.06	0.00
	(0.04)	(0.06)	(0.08)
Sex of household head (1 = male, 2 = female)	–0.35	–0.49	–0.46
	(0.18)	(0.30)	(0.38)
Sex of child (0 = girl, 1 = boy)	1.08[d]	–0.86[d]	0.78[d]
	(0.16)	(0.22)	(0.27)
Years of schooling	0.06	–0.34[d]	–0.28[d]
	(0.06)	(0.07)	(0.09)
Dummy for lighting	–1.30[e]	0.32	–0.44
	(0.63)	(0.52)	(0.81)
Dummy for water	–0.46[d]	0.98[d]	0.34
	(0.17)	(0.21)	(0.28)
Dummy for TV	–0.95[d]	–0.74[d]	–0.85[d]
	(0.17)	(0.24)	(0.28)
Dummy for radio	–0.39	–0.45	0.44
	(0.22)	(0.28)	(0.45)
Dummy for telephone	–0.39[c]	–1.02[d]	–2.60[d]
	(0.18)	(0.30)	(0.61)

(a) Figures in brackets are standard errors.
(b) The "school only" category is the normalized category.
(c) Statistically significant at the 5 per cent level.
(d) Statistically significant at the 1 per cent level.
(e) Number of observations = 1,894.
(f) Likelihood Ratio Test of Joint Significance: $\chi^2_{33} = 529.13$.
(g) Pseudo $R^2 = 0.1790$.

Table 3. Multinomial logit marginal probabilities for Belize[a]

Variable	School only	Both school and work	Neither school nor work	Work only
Age of child	–0.6983	0.8407	–0.0891	–0.0534
(Age of child)^2	0.0239	–0.0319	0.0052	0.0028
No. of children in the household	–0.0104	0.0090	0.0016	–0.0001
Sex of household head (1 = male, 2 = female)	0.0512	–0.0342	–0.0130	–0.0039
Sex of child (0 = girl, 1 = boy)	–0.0926	0.1161	–0.0300	–0.0065
Years of schooling	0.0054	0.0073	–0.0099	–0.0027
Dummy for lighting	0.0736	–0.0855	0.0149	–0.0030
Dummy for water	0.0069	–0.0487	0.0381	0.0037
Dummy for TV	0.1400	–0.1126	–0.0195	–0.0079
Dummy for radio	0.0540	0.0444	–0.0136	–0.0041
Dummy for telephone	0.0816	–0.0337	–0.0253	–0.0226
Base probability	0.8416	0.1184	0.0301	0.0099

(a) These correspond to the multinomial logit parameter estimates reported in table 2.

Table 4. Multinomial logit coefficient estimates:[a] Cambodia[e], [f], [g]

Variable	Category[b]		
	Both school and work	Neither school nor work	Work only
Age of child	2.53 (1.66)	–8.66 (5.11)	–2.35 (2.93)
(Age of child)^2	–0.090 (0.064)	0.359 (0.197)	0.131 (0.113)
No. of children in the household	0.011 (0.022)	–0.038 (0.061)	0.051 (0.036)
Sex of household head (1 = male, 2 = female)	0.210[c] (0.101)	–0.398 (0.258)	–0.230 (0.169)
Age of household head	–0.003 (0.004)	0.012 (0.010)	0.010 (0.006)
Sex of child (0 = girl, 1 = boy)	–0.028 (0.061)	–0.219 (0.176)	–0.437[d] (0.105)
Years of schooling	–0.015 (0.019)	–0.700[d] (0.064)	–0.608[d] (0.036)
Education level of most educated male adult	–0.031[d] (0.009)	–0.057[c] (0.028)	–0.091[d] (0.017)
Education level of most educated female adult	–0.017 (0.010)	–0.093[d] (0.035)	–0.061[d] (0.020)
Domestic hours	0.037[d] (0.006)	0.034[c] (0.014)	0.054[d] (0.008)
Rural dummy	0.479[d] (0.08)	–0.221 (0.215)	0.324[d] (0.123)
Lighting dummy	–0.797 (0.081)	–0.219 (0.238)	–0.479[d] (0.148)
Water dummy	–0.167 (0.092)	–0.034 (0.369)	–0.017 (0.231)
TV dummy	–0.002 (0.068)	–0.247 (0.208)	–0.368[d] (0.122)
Radio dummy	–0.264[d] (0.078)	–0.114 (0.361)	–0.198 (0.239)
Telephone dummy	0.163[d] (0.054)	–0.032 (0.178)	0.073 (0.091)

(a) Figures in brackets are standard errors.
(b) The "school only" category is the normalized category.
(c) Statistically significant at the 5 per cent level.
(d) Statistically significant at the 1 per cent level.
(e) Number of observations = 6,318.
(f) Likelihood Ratio Test of Joint Significance: $\chi^2_{48} = 1{,}817.86$.
(g) Pseudo $R^2 = 0.1443$.

These show the strong role that adult education plays in pushing children into the "school only" category. A comparison of the base probabilities in tables 3 and 5 shows that Cambodian children are much more likely to combine schooling with employment than children in Belize. This is consistent with the picture presented in table 1.

Table 5. Multinomial logit marginal probabilities for Cambodia[a]

Variable	School only	Both school and work	Neither school nor work	Work only
Age of child	–0.4075	0.7301	–0.1288	–0.1938
(Age of child)^2	0.0136	–0.0280	0.0052	0.0092
No. of children in the household	–0.0028	0.0012	–0.0006	0.0021
Sex of household head (1 = male, 2 = female)	–0.0334	0.0617	–0.0081	–0.0203
Age of household head	0.0004	–0.0012	0.0002	0.0006
Sex of child (0 = girl, 1 = boy)	0.0126	0.0102	–0.0023	–0.0206
Years of schooling	0.0146	0.0226	–0.0083	–0.0289
Education level of most educated male adult	0.0074	–0.0036	–0.0004	–0.0034
Education level of most educated female adult	0.0045	–0.0012	–0.0010	–0.0024
Domestic hours	–0.0080	0.0065	0.00008	0.0014
Dummy for rural	–0.0939	0.1008	–0.0070	0.00009
Dummy for lighting	0.1604	–0.1670	0.0040	0.0026
Dummy for water	0.0324	–0.0381	0.0010	0.0048
Dummy for TV	0.0069	0.0137	–0.0029	–0.0178
Dummy for telephone	0.0529	–0.0529	0.0009	–0.0008
Dummy for radio	–0.0315	0.0351	–0.0018	–0.0018
Base probability	0.2910	0.6440	0.0130	0.0520

(a) These correspond to the multinomial logit parameter estimates reported in table 4.

The econometric evidence on the impact of child labour on schooling is provided in table 6 which presents, for each country, the sex-disaggregated instrumental variable (IV) coefficient estimates of years of schooling/SAGE/current school attendance regressed on a set of determinants. Of particular interest in this study are the estimated coefficients of the "work hours"/"work hours square" variables. Ray and Lancaster (2004) also report the OLS estimates of these regressions and compare them with the IV estimates reported here in order to test the sensitivity of the qualitative results to the estimation method. While the qualitative picture is generally robust between the OLS and IV methods of estimation, there are several instances of differences in quantitative magnitudes. Also, for several countries, we found significant inconsistencies in the OLS estimates, possibly due to the endogeneity of child labour hours as a regressor. This gives us greater confidence in the IV estimates reported here.

It is hazardous to make sweeping generalizations on the basis of these country-specific results. However, one point of concurrence between five of the seven countries – Namibia and Sri Lanka being the exceptions – is the statistical significance and negative magnitude of the estimated coefficient of the "work hours" variable. In other words,

Table 6. Sex-disaggregated IV coefficient estimates[a] of years of schooling, SAGE in the seven countries[b]

Variable	Belize		Cambodia		Namibia		Panama		Philippines		Portugal		Sri Lanka	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Age of child	–0.381 (3.74)	3.279 (3.72)	61.52 (32.44)	67.95 (35.13)	–0.441 (1.06)	–1.609[c] (0.77)	–2.29 (23.41)	32.88 (22.91)	–8.95 (12.42)	–2.12 (11.48)	0.282 (0.60)	–0.033 (0.80)	25.01 (20.16)	–32.52 (18.83)
(Age of child)^2	–0.040 (0.14)	–0.097 (0.14)	–2.20 (1.25)	–2.47 (1.35)	0.021 (0.04)	0.066[c] (0.03)	0.109 (0.90)	–1.19 (0.88)	0.394 (0.49)	0.108 (0.44)	–0.003 (0.02)	0.007 (0.03)	–0.957 (0.78)	1.28 (0.72)
Number of children in the household	–0.003 (0.05)	–0.087[c] (0.04)	–1.47[d] (0.42)	–1.64[d] (0.47)	0.001 (0.01)	–0.005 (0.01)	–1.61[d] (0.22)	–1.99[d] (0.21)	—	—	—	—	–0.47 (0.28)	–0.952[d] (0.25)
Sex of household head (1 = male, 2 = female)	–0.378[c] (0.19)	0.010 (0.17)	–4.20[c] (1.92)	–6.37[d] (2.28)	0.028 (0.04)	0.012 (0.05)	–5.21[d] (1.54)	–1.98 (1.46)	—	—	–0.097[d] (0.04)	–0.066 (0.05)	–1.36 (1.08)	–0.526 (1.07)
Age of household head	—	—	–0.185[d] (0.07)	–0.074 (0.07)	0.006[c] (0.003)	0.003[d] (0.001)	0.034 (0.04)	–0.109[d] (0.04)	—	—	—	—	–0.035 (0.04)	–0.056 (0.03)
Work hours	–2.76[d] (0.66)	–3.97[d] (0.90)	–3.94[d] (0.47)	–4.74[d] (0.55)	–0.152 (0.08)	–0.033 (0.06)	–1.42[d] (0.48)	–3.53[c] (1.71)	–1.134[c] (0.56)	–0.897 (0.59)	–0.154[c] (0.07)	0.415[d] (0.15)	0.898[d] (0.15)	0.382[d] (0.17)
(Work hours)^2	0.316[d] (0.08)	0.44[d] (0.10)	0.069[d] (0.01)	0.084[d] (0.01)	0.002 (0.001)	0.0004 (0.0008)	0.023[d] (0.01)	0.07 (0.04)	0.017[c] (0.01)	0.012 (0.01)	0.003[c] (0.002)	–0.007[d] (0.003)	–0.024[d] (0.003)	–0.014[d] (0.003)
Education level of most educated male adult	—	—	1.43[d] (0.18)	1.08[d] (0.20)	0.048[d] (0.02)	0.06[d] (0.01)	0.152[d] (0.04)	0.176[d] (0.04)	—	—	0.047[d] (0.01)	0.040[d] (0.01)	0.885[d] (0.12)	0.386[d] (0.11)
Education level of most educated female adult	—	—	1.85[d] (0.19)	1.62[d] (0.21)	0.051[d] (0.02)	0.041[d] (0.01)	0.285[d] (0.04)	0.237[d] (0.04)	—	—	0.043[d] (0.01)	0.041[d] (0.01)	1.073[d] (0.11)	0.792[d] (0.10)
Rural dummy	—	—	—	—	0.113 (0.16)	–0.058 (0.10)	—	—	0.187 (0.42)	–0.433 (0.37)	—	—	—	—
Seasonal dummy	—	—	—	—	—	—	—	—	–1.558 (1.02)	–0.73 (0.76)	—	—	—	—

Table 6. Sex-disaggregated IV coefficient estimates[a] of years of schooling, SAGE in the seven countries[b] *(concl.)*

Variable	Belize		Cambodia		Namibia		Panama		Philippines		Portugal		Sri Lanka	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Years of work	—	—	—	—	—	—	—	—	0.151 (0.13)	–0.28 (0.22)	—	—	—	—
Domestic hours	—	—	—	—	—	—	—	—	—	—	–0.004[c] (0.002)	–0.009[d] (0.002)	—	—
Statistics:														
Number of observations	959	935	3 227	3 091	1 465	1 488	2 098	1 939	1 099	611	3 466	3 287	2 403	2 269
F-Tests for joint significance	F(6 952) = 14.10[d]	F(6 928) = 13.22[d]	F(9 3217) = 78.84[d]	F(9 3081) = 63.93[d]	F(10 1454) = 9.25[d]	F(10 1477) = 27.64[d]	F(9 2088) = 49.86[d]	F(9 1929) = 45.25[d]	F(7 1091) = 2.18[c]	F(7 603) = 1.92[d]	F(8 3457) = 52.26[d]	F(8 3278) = 17.89[d]	F(10 2392) = 55.63[d]	F(10 2258) =41.88[d]
Root MSE	2.0475	2.0312	33.023	35.382	0.72315	0.43129	19.14	18.197	5.6903	4.5251	0.63006	0.80585	17.749	16.063

(a) Figures in brackets are standard errors.

(b) The dependent variable is "Years of schooling" in the cases of Belize, Namibia, Philippines and Portugal, and "SAGE" in the cases of Cambodia and Panama; the dependent variable in the case of Sri Lanka is the dummy for "Current school attendance".

(c) Statistically significant at the 5 per cent level.

(d) Statistically significant at the 1 per cent level.

the results support the proposition that work hours adversely affect both school enrolment (i.e. the probability of the child attending school) and the school outcome variables – from the very first hour of work. However, the estimated positive coefficients of the "work hours square" variable for Belize, Cambodia, Panama, Philippines and Portugal suggest that the adverse marginal impact of child labour hours on the schooling variables weakens as the labour hours increase.[8] The tables thus generally point to a U-shaped relationship between schooling and child labour hours. The IV regressions concur that beyond five hours a day (30 hours per week) the marginal impact changes direction, i.e. child labour hours impact positively on school enrolment and the measures of school outcome. In the case of Belize, for example, the turning point is remarkably robust, namely, 4.37 hours a day for boys, 4.51 hours for girls and 4.40 hours for all children.[9] As shown by the means in table 1, however, these turning points – i.e. the theoretical points of equilibrium where the differential impact of work hours on education is zero – will rarely be reached since very few children clock up such long hours of work. The evidence from Belize shows that the disutility to the child from the first labour hour, as she starts working, is quite high. The detailed calculations for Belize reported in Ray and Lancaster (2004) show that the first hour of child labour reduces the probability of school attendance by approximately 50 per cent.

A significant exception to this pattern shows up in the Sri Lankan results, which are partially reported in table 6. Contrary to much of the evidence from the other countries, these results suggest an inverted U-shaped relationship between schooling and labour hours. In other words, a small amount of child work is actually quite beneficial to child learning in Sri Lanka. Table 6 confirms that this holds true for both boys and girls. The SAGE estimates for Sri Lanka (not reported here) imply that the turning point at which child work starts to impact negatively on learning is 18.785 labour hours per week for boys and 14.167 labour hours per week for girls. The fact that a sizeable section of the Sri Lankan child labour force works less than 17.85 hours a week – i.e. the turning point implied by the SAGE regression estimates for all children in Sri Lanka – suggests that child labour is less destructive of children's development in Sri Lanka than in other countries. One possible explanation is that, as table 1 shows, relatively fewer Sri Lankan children are in the "work only" category than

[8] This does not mean that the "average" impact of work hours on educational performance diminishes as well since, unlike the "marginal impact", it does not control for the other characteristics.

[9] These figures are obtained by calculating

$$-\hat{\delta}_1 / 2\hat{\delta}_2$$

where $\hat{\delta}_1, \hat{\delta}_2$ are the estimated coefficients of "work hours" and "work hours square" in the relevant regressions. See equation (3) above.

in the other developing countries. Indeed, a greater percentage of the child population in Sri Lanka combines schooling with employment than in most other developing countries. At moderate levels of work hours, this helps to offset the harmful effects of child labour. This finding merits further investigation because of its significant policy interest. One result on which all the data sets concur is the strong positive role that the level of adult education in the household plays in keeping the child enrolled in school and in improving her learning experience.

The estimates of the school outcome (L_i) and child labour hours (H_i) equations – estimated as a system of equations using three-stage least squares (3SLS) – are reported in Ray and Lancaster (2004). Here, table 7 reports the 3SLS estimates of SAGE for the four countries for which SAGE could be constructed. These results highlight four points that are worth noting.

First, *ceteris paribus*, boys in Cambodia and Sri Lanka complete significantly fewer years of schooling than girls (on the age-corrected measure of schooling). By contrast, no such differential exists in Belize

Table 7. Three-stage least squares (3SLS) coefficient estimates[a] of SAGE on selected SIMPOC data sets

Variable	Belize	Cambodia	Panama	Sri Lanka
Age of child	–10.68 (35.33)	46.39 (26.65)	18.40 (17.64)	–2.03 (13.62)
(Age of child)^2	0.411 (1.358)	–1.58 (1.02)	–0.64 (0.678)	0.098 (0.524)
No. of children in the household	–0.285 (0.396)	–1.18[c] (0.35)	–1.70[c] (0.17)	–0.572[c] (0.184)
Sex of child (0 = girl, 1 = boy)	2.70 (1.51)	–1.94[b] (0.96)	0.554 (0.878)	–1.712[c] (0.525)
Age of household head	—	–0.106 (0.056)	–0.035 (0.029)	–0.029 (0.024)
Education level of most educated male adult	—	1.12[c] (0.15)	0.149[c] (0.03)	0.532[c] (0.083)
Education level of most educated female adult	—	1.53[c] (0.16)	0.240[c] (0.029)	0.818[c] (0.74)
Work hours	–33.43[c] (7.37)	–3.76[c] (0.55)	–2.18[c] (0.63)	0.370[c] (0.091)
(Work hours)^2	3.37[c] (0.84)	0.044[c] (0.010)	0.028[c] (0.011)	–0.014[c] (0.002)
Domestic hours	–0.009 (0.082)	0.416[c] (0.127)	—	–0.017[c] (0.006)
Rural dummy	—	0.88 (1.31)	2.34[c] (0.78)	—
Phone dummy	—	—	1.86[b] (0.85)	—
Number of observations	1 894	6 318	4 037	4 638

(a) Figures in brackets are standard errors. (b) Statistically significant at the 5 per cent level. (c) Statistically significant at the 1 per cent level.

or Panama. Second, the 3SLS estimates confirm that Sri Lanka is the only country where child work hours initially have a positive impact on child learning. Unlike in other countries, the turning point for Sri Lanka (13.55 weekly hours) presents more than mere academic interest since a significant number of child workers work in the range of 0-15 weekly hours. Consequently, a much greater percentage of child workers in Sri Lanka is on the rising segment of the relationship between child learning and labour hours than in the other countries. As reported below, however, Sri Lanka falls in line with the others once we correct for the truncation of child work at zero. Third, in contrast to the figures for economic activity, hours spent by the child on domestic duties impact negatively on learning in Sri Lanka but less significantly elsewhere. And fourth, the results generally confirm that rising levels of adult education promote child welfare by reducing children's hours of work and by increasing the SAGE measure of school outcome. In all four countries reported on in table 7, adult female education levels have a stronger positive impact on child learning than does adult male education.

Further evidence on the adverse impact of child labour on child learning is given in table 8, which presents the instrumental variables

Table 8. Regression coefficient estimates[a] of number of failures experienced by the child: Portugal[d]

Variable	IV[e], [f]	OLS[e], [g]
Age of child	–0.049	–0.426
	(0.665)	(0.569)
(Age of child)^2	0.006	0.021
	(0.026)	(0.022)
Sex of child (1 = boy, 2 = girl)	–0.211[c]	–0.246[c]
	(0.027)	(0.021)
Sex of household head (1 = male, 2 = female)	0.098[c]	0.095[c]
	(0.038)	(0.033)
Education level of most educated male adult	–0.083[c]	–0.093[c]
	(0.009)	(0.008)
Education level of most educated female adult	–0.084[c]	–0.092[c]
	(0.009)	(0.008)
Domestic hours	0.004[b]	0.008[c]
	(0.002)	(0.002)
Work hours	0.334[c]	0.009
	(0.108)	(0.007)
(Work hours)^2	–0.006[c]	–0.0001
	(0.002)	(0.0001)
	Test for H_o: Difference in coefficients is not systematic	
	$\chi^2_1 = 11.98$[c]	

(a) Figures in brackets are standard errors. (b) Statistically significant at the 5 per cent level. (c) Statistically significant at the 1 per cent level. (d) Number of observations = 6,753. (e) F-tests for Joint Significance: IV: F(9,6743) = 78.66[c], OLS: F(9,6743) = 102.38[c]. (f) IV: Root MSE = 0.96397. (g) OLS: $R^2 = 0.1202$, $\bar{R}^2 = 0.1191$, Root MSE = 0.83991.

(IV) and ordinary least squares (OLS) regression estimates of the number of failures in school experienced by children in Portugal. The IV estimates show that a *ceteris paribus* unit increase in child labour hours leads to a worsening of the child's school performance, reflected in a 0.34 increase in the failure rate. Another useful piece of evidence that the Portuguese results provide relates to the impact of hours of domestic work on child learning. The IV and OLS estimates concur that domestic work hours impact negatively on learning by significantly increasing the number of failures that the child experiences in high school.

Let us recall table 7, which shows that in three of the four countries it covers child labour has an adverse impact on children's education (SAGE) from the very first hour of work. In other words, even a limited amount of child work can be detrimental to the child's education. The exception, as already noted, is Sri Lanka. These estimates, however, ignore the truncation of hours of child work at zero. Table 9 presents the corresponding estimates of SAGE based on a Tobit estimation of the child labour hours equation. These estimates strengthen the case for the negative impact of child labour on schooling. And in the case of Sri Lanka, the inverted U-shaped relationship between child schooling and child labour

Table 9. Tobit coefficient estimates[a] of SAGE

Variable	Belize	Cambodia	Sri Lanka
Age of child	–0.115 (19.67)	44.88[c] (15.65)	9.51 (11.93)
(Age of child)^2	0.040 (0.756)	–1.51[b] (0.60)	–0.309 (0.457)
No. of children in the household	–0.181 (0.221)	–1.60[b] (0.206)	–0.755 (0.163)
Sex of child (0 = girl, 1 = boy)	4.37[c] (0.94)	–2.31[c] (0.570)	0.705 (0.820)
Age of household head	—	–0.037 (0.033)	–0.050[b] (0.021)
Education level of most educated male adult	—	1.19[c] (0.09)	0.312[c] (0.091)
Education level of most educated female adult	—	1.74[c] (0.104)	0.660[c] (0.072)
Work hours	–1.57[c] (0.14)	–0.781[c] (0.083)	–0.411[c] (0.083)
(Work hours)^2	0.00007 (0.001)	–0.020[c] (0.006)	–0.001[c] (0.0001)
Domestic hours	–0.00 (0.003)	0.148[c] (0.058)	0.007 (0.007)
Rural dummy	—	–0.967 (0.859)	—
Number of observations	1 894	6 318	4 672

(a) Figures in brackets are standard errors. (b) Statistically significant at the 5 per cent level. (c) Statistically significant at the 1 per cent level.

now gives way to a monotonically decreasing relationship. In other words, the limited support that the Sri Lankan evidence seemed to provide for Article 7 of ILO Convention No. 138 now disappears with the Tobit estimation of child labour hours. Table 9 shows, quite categorically, that if one recognizes the harmful effect of child labour on the child's education, then the appropriate choice for the hours-of-work threshold is zero.

Impact of occupational category on child learning: The Sri Lankan evidence

Since the initial Sri Lankan results contrast sharply with those obtained for the other countries, it would seem worth investigating how the estimated relationships are affected by disaggregation of the employed children by occupational category. Table 10 presents the mean values of school enrolment rates, SAGE and study time for Sri Lankan working children in the age group of 12-14 years, disaggregated into the following four occupational categories: (i) service workers, and shop and market sales workers; (ii) craft and related workers; (iii) sales and services workers in "elementary occupations"; and (iv) agricultural workers. The school enrolment rate shows considerable variation between the four occupational categories, ranging from 39.5 per cent for children employed as sales and services workers in "elementary occupations" to 94.3 per cent among children who work in agriculture. The age-corrected schooling measure (SAGE) varies less than the school enrolment rate though this variable, along with mean study time, also gives a substantially lower value for children employed in "elementary occupations".

For each occupational category, we performed separate ordinary least squares (OLS) estimations of the regressions of SAGE (a measure of learning output) and study time (a measure of learning input). We also performed OLS regressions on the data pooled over the different occupational categories along with the introduction of interaction terms between the four occupational dummies and the "labour hours" and "labour hours square" variables. Although the estimates are not reported here for space reasons, they are available on request. In three of the four occupational categories, neither "work hours" nor "work hours square" has a significant impact on the schooling measure, SAGE. In the case of agricultural workers, however, the impact is significantly positive and, since this category accounts for nearly 20 per cent of all the children in the 12-14 year age group, it explains the positive coefficient estimate of the work hours variable found in the aggregate estimations reported earlier. The negative coefficient estimates of the interaction terms between the "labour hours square" variable and the occupational dummies, which we found from the estimation on the pooled data, show that a heavy workload does eventually have an adverse effect on the schooling

Table 10. Variation of school attendance rates, etc.[a] between occupations in Sri Lanka

Category	Percentage of children aged 12-14 years	School attendance rate	SAGE	Mean study time[b]
1. Service workers, and shop and market sales workers	2.39	0.871 (0.337)	87.65 (21.71)	87.24 (58.86)
2. Craft and related workers	3.48	0.828 (0.378)	85.34 (20.08)	84.44 (61.34)
3. Sales and service workers in "elementary occupations"[c]	0.89	0.395 (0.495)	62.52 (38.57)	35.70 (47.77)
4. Agricultural workers	18.94	0.943 (0.231)	87.75 (18.57)	97.45 (64.4)
5. Non-workers	74.30	0.963 (0.191)	88.48 (17.87)	108.97 (104.2)

(a) Figures in brackets are standard errors. (b) Minutes per week. (c) Includes street vendors, porters, shoe repairers, etc.

of children in all of the occupational categories. The occupationally disaggregated estimates suggest that "light work" defined as child work that does not negatively impact on the child's "capacity to benefit from the instruction received", as stipulated in ILO Convention No. 138, should mean a maximum work load of 10.54 hours per week for service workers, and shop and market sales workers and 10.88 hours per week for agricultural workers. These cut-off points are somewhat lower than those suggested by the IV estimates based on aggregate Sri Lankan data that ignored inter-occupational differences.

Concluding remarks

The existing child labour literature does not provide any definitive conclusion on the extent to which children's work has a negative influence on school attendance and performance in the 12-14 age group. Indeed, much of the literature is concerned with analysing the causes or determinants of child labour rather than its consequences, especially for human capital; and the few published studies that attempt to answer this question do not address the issue of endogeneity of child labour hours in the estimation. The latter follows from the possibility that a child's school performance can determine her labour market status.

By drawing on multi-country SIMPOC data sets and using alternative estimation methods, this study has examined the robustness of the evidence on the impact of child labour hours on the children's school attendance and performance. Its central message is that children's work, even in limited amounts, does adversely affect child learning. This is reflected in reduced school attendance rates and in a shorter duration of schooling. The damage done by children's work to child

learning is also evidenced by the adverse impact of work hours on children's ability to read and write in Cambodia and in Namibia, with the latter result holding true only under simplifying estimation assumptions. Further support for the proposition that child work is detrimental to child learning comes from the finding that work hours significantly increase the rate of failures experienced by children in Portugal.

The finding of a negative impact of child work on learning is remarkably robust to the data set, to the use of weights in the data, to the sex of the child and to the estimation procedure adopted. On the latter point, recognition of the possibility that a child's school performance affects her labour market involvement seems to worsen the estimated impact of child work on human capital formation. The sex-disaggregated estimates generally suggest that the marginal impact of child work is more detrimental to the learning experience of girls than that of boys, though there are some exceptions.

A significant exception to the result that children's work, even in limited amounts, is detrimental to child learning is provided by the Sri Lankan experience. Sri Lanka stands alone in providing evidence that children aged 12-14 years can combine work and school in such a way that school performance does not suffer. The Sri Lankan results suggest that a child in this age group can work up to 12-15 hours a week without suffering a decline in her school attendance rate or in the overall duration of her schooling. Even in Sri Lanka, however, the child's school performance deteriorates sharply beyond that threshold.

Though the focus of this study has been on the impact of children's work on child learning, there are other features of its results that deserve special mention. In general, boys fare worse than girls as to the length of their schooling. Children in female-headed households and in households with low levels of adult education tend to perform worse than other children. The strong positive impact of adult education on the child schooling variables is a result that holds true for all the data sets and which is robust to the estimation method.

There is in fact a clear policy message in the result on the strong and positive role that adult education plays in improving child learning. To the extent that ILO Convention No. 138 permits some "light work" for children as from the ages of 12 or 13 years, it should be accompanied by a campaign to raise adult education levels. Better-educated adults will, by ensuring that their children make more efficient use of their non-labour time for study, help to reduce the damage done to child learning by work hours. Note, also, the potential of other measures for improving child learning outcomes, such as location of schools near places of child work, improved provision of community infrastructure such as water and electricity, better quality schooling, etc.

Lastly, let us note some avenues of further research that follow from this study. First, unlike ILO (2002), this study has not distinguished be-

tween hazardous and non-hazardous child labour, nor between children "in the worst forms of child labour" and other child labourers. The results may be sensitive to these distinctions. Second, child labour can have adverse consequences for a child's health or development in addition to educational attendance. Third, this study has focused on educational *attendance* and not looked into educational *performance* for determining light work. All three are important but complex issues that merit separate investigation.

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