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WHAT IS THE EFFECT OF CHILD LABOUR ON LEARNING ACHIEVEMENT? EVIDENCE FROM GHANA

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Abstract

The purpose of this paper is to analyse the effect of children's economic activity on their level of learning achievement. Its particular significance is that it goes further than the fairly common analysis of the effect of child work on school enrolment or attendance by using measures of the skills that children have learned in reading and mathematics. This is made possible by the administration of tests to measure reading achievement and mathematical achievement to about half of the individuals surveyed as part of the second wave of the Ghana Living Standards Survey. The new insights obtained from this approach demonstrate its value, and suggest that similar analyses should be carried out for other countries, once the necessary data have been gathered.

There is a strong case for measuring the effects of child work directly on what children are able to do, because the use of school attendance as a measure of educational achievement is not ideal for estimating the harm caused by child labour. On the one hand, it might over-estimate the harm of child work, overlooking the impact of the poor quality of many schools in developing countries or the fact that a child may learn informally. On the other hand, it might under-estimate the harm of child work, because children that work as well as going to school may find themselves less able to learn, as a result of exhaustion or insufficient time to complete homework.

The results show that work has a substantial effect on learning achievement in the key areas of reading and mathematics. Although these results confirm the accepted wisdom of the negative effects of work on education, they introduce a new view of how these effects arise. They are, to a large extent, direct effects rather than on school attendance. The direct links could be because of exhaustion or because of a diversion of interest away from academic concerns. Alternatively, the empirical results could arise because those children who work are innately less interested in academic achievement. This latter possibility needs further investigation, as it would imply that it is not work that harms educational achievement, but a lack of motivation that affects both work and learning.

1. Introduction

The purpose of this paper is to analyse the effect of children's economic activity on their level of learning achievement. Its particular significance is that it goes further than the fairly common analysis of the effect of child work on school enrolment or attendance[1] by using measures of the skills that children have learned in reading and mathematics. This is made possible by the administration

[1] Examples of this approach are: Kanbargi and Kulkarni (1991), who show that working children in Karnataka (India) are less likely to attend school; and Akabayashi and Psacharopoulos (1999), who show that factors which increase schooling are also factors that reduce child work. As discussed below, the latter study also looks at the effects of work and schooling on educational achievement.

of tests to measure reading achievement and mathematical achievement to about half of the individuals surveyed as part of the second wave of the Ghana Living Standards Survey (GLSS2), conducted in 1988/9.[2] The insights obtained from this approach demonstrate its value, and suggest that similar analyses should be carried out for other countries, once the necessary data have been gathered.

This analysis also has implications for the literature on the effects of schooling on learning achievement, much of it inspired by Knight and Sabot (1990). This literature attempts to explain test scores in terms of school attendance, natural ability and other variables. However, it typically does not include child work as a possible explanation.[3] This paper, therefore, provides an indication of whether child work variables should be included in such studies.

The possible importance of reduced learning achievement is well recognized as one of the major harmful effects of child work, and this has been reflected in a number of projects around the world that are designed to mitigate this effect. Although child work has a number of other possible harmful effects, including damage to health and psychological development, particular attention has been paid to its educational impact for two reasons. First, education is seen as fundamental to improving the quality of life in developing countries, by lifting the people who are educated out of poverty and by improving the quality of human resources that are available for national economic development. Second, the impact of child work on education is both easily believable (a child that is working cannot be at school or doing homework at the same time) and has been readily quantifiable from household survey data, at least as measured by school attendance.

However, the use of school attendance as a measure of learning achievement is not ideal for estimating the harm that child work causes. On the one hand, it might over-estimate the harm of child work, neglecting the part played by poor quality education in many schools in developing countries and the fact that some children may receive an informal education (from work or just daily experiences). On the other hand, it might under-estimate the harm of child work, because children that work as well as go to school may find themselves less able to learn, as a result of exhaustion or insufficient time to complete homework. Therefore, there is a strong case for measuring the effects of child work directly on what children are able to do, instead of simply on how long they spend in school.

These problems have led researchers to look for indicators of school achievement that go beyond simple attendance. Thus, Patrinos and Psacharopoulos (1995) found that several factors that contribute to child labour (age, gender, lan-

[2] I am grateful to the Living Standards Measurement Survey unit at the World Bank for supplying the data from the special educational module in GLSS2. I am also grateful to Paul Glewwe, of the World Bank, for help in interpreting the data. Other work based on the educational data used here is presented in Glewwe (1999).

[3] One exception to this is Appleton (1995) who finds that some child work variables affect examination performance in Kenyan Primary Schools.

guage and number of siblings) reduce school attendance and increase the chances of grade repetition in Paraguay. This was followed, in Patrinos and Psacharopoulos (1997), by the inclusion of a child work variable in equations that were used to estimate the chances of age-grade distortion in Peru. While the estimated coefficient on this variable was positive, indicating that it increased the chances of the child being too old for his/her grade, it was statistically insignificant.

However, grade repetition and age-grade distortion are not perfect indicators of learning achievement, as schools may not apply uniform standards in enforcing grade repetition. What is needed is some measure of actual competence. Akabayashi and Psacharopoulos (1999) use measures of reading ability (being able to read a newspaper) and mathematics (being able to do written calculations) in Tanzania. They find that predicted[4] hours of work reduce ability, while predicted school attendance and hours of study increase ability. However, the coefficients were often insignificant, perhaps because of the small sample size and the poor fit of the predicting equations. More seriously, the authors recognized the possible unreliability of the ability measures, as they were based on parental judgement. The present paper avoids that difficulty by using 'objective' tests of reading and mathematical competence. It also uses a measure of innate ability as a control in estimating the effects of work and school on learning achievement. This is similar to the approach taken by Dustmann *et al*. (1996) for looking at the effect of part-time work on examination performance in the United Kingdom.

Measurement of the effects of child work on learning achievement can make several contributions. First, it will help in an understanding of the decisions that households make as to whether or not their children should work. Second, it will provide an idea of the educational interventions (perhaps through schooling at more convenient times or less formal education) that might be desirable to mitigate the effects of work on education. Third, it will provide a better idea of one of the benefits of policies and projects to reduce child work, and so lead to the better design of such interventions.

As this is a study of just one country, the estimates reported in this paper cannot be seen as applicable everywhere. However, the paper does provide a new view of how to measure the effects of child work on education, and presents a methodology that can both be refined in the future and applied to other countries as and when data become available.

Section 2 surveys recent work on the relationship between child work and educational attendance in a range of developing countries, as a background to the main study. Section 3 presents a picture of the pattern of child work and school attendance revealed by the GLSS2 survey. Section 4 presents a description of the educational test results that were obtained by children between the ages of 9 and 18. Section 5 reports on the results of using simple statistical

[4] The predictions are obtained from separately estimated equations.

methods to model these results in terms of the effects of work on educational achievement. Section 6 concludes with a summary of the results.

2. The Literature on Child Labour and School Attendance

The purpose of this section is to provide a background to the main analysis of the test scores from Ghana. It presents an overview of results that have been obtained on the relationship between child work and school attendance, and discusses methodological issues that have arisen and which are relevant to any study of the effects of child labour on education.

The main results discussed here are taken from research, conducted at the University of Bath, into the relationship between child work and school attendance in Ghana, Pakistan and Bangladesh. The results for Ghana and Pakistan are based on the quantitative analysis of large scale survey data: the third wave of the Ghana Living Standards Survey (GLSS3) for 1991/2 and the Pakistan 1991 Integrated Household Survey (PIHS).[5] The results for Bangladesh are based on the quantitative analysis of a survey and the qualitative analysis of detailed interviews with urban slum dwellers.[6] This is followed by a discussion of the extent to which these results are consistent with those found for other countries. The discussion of these results raises methodological issues of the definition of child work and schooling, and of the nature of the statistical relation between them. These issues are briefly discussed at the end of the section.

▪ 2.1 *Ghana*

The Ghana Survey contains 4,552 households, with an average household size of 4.5 members, giving a total of 20,403 individuals. Table 1 shows the rate of participation in schooling[7] and labour force participation by type of employment for girls and boys. It is clear from looking at the numbers of children involved, that employment on the household farm is by far the most important form of child work, according to the ILO definition, which excludes housework. However housework is also clearly important: this would typically include such tasks as fetching firewood or water, cooking, cleaning, laundry, shopping and child care. By contrast, employment outside the household unit is uncommon, involving only 9 males and 7 females aged under 15 in our sample. The tables show some differences between the sexes, with proportionately more boys attending school and employed on the household farm, and proportionately more girls working for a household enterprise, or engaged in housework.

[5] The results are described in detail in Addison *et al.* (1997a) and Bhalotra and Heady (1999). Note that GLSS3 is used here, instead of the GLSS2 used in the rest of this paper, so that the data from Ghana and Pakistan relate to the same time period.

[6] The results are described in detail in Delap (1998).

[7] For both Ghana and Pakistan, the schooling variable is the answer to the question: "are you currently in school?"

Table 1: *Ghana: Participation in School & Work (per cent)*

Age in years:	7-9		10-14		15-19	
Sex:	Girls	Boys	Girls	Boys	Girls	Boys
School attendance	62.4	78.0	74.4	81.4	39.9	55.1
1. Non-agricultural employment	0.0	0.0	0.4	0.2	1.1	1.5
2. Agricultural employment	0.0	0.1	0.1	0.3	0.4	0.2
3. Total non-household employment	0.0	0.1	0.4	0.5	1.5	1.7
4. Work in household enterprise	1.6	1.0	5.1	2.7	15.4	7.3
5. Work on household farm	15.8	19.9	28.3	35.6	35.4	44.6
6. Housework	82.8	76.8	96.2	89.8	94.2	85.3
7. Total household work	83.4	78.5	96.5	93.5	95.9	94.0

Notes: Participation in 3 is defined as participation in 1 or 2 and similarly an individual is deemed to participate in 7 if (s)he participates in 4, 5 or 6. The figures in 7 are not sums of the figures in 4, 5 and 6 because a child may be active in more than one type of work.

We would expect schooling to be negatively related to both labour force participation and hours of work. However the data that we have show a more complex picture. As reported in Addison *et al.* (1997b), for some groups of children there is a simple positive correlation between labour force participation and school attendance. This is a surprising result and could be the result of a failure to control for other relevant variables. It is possible that the location of the household could affect both work and schooling opportunities, thus producing a spurious correlation. Also, the child's age and both the size and income of the household to which they belong could affect the schooling decision. Finally, it makes sense to look at the hours of work at the same time as participation in work.

These extra factors can be incorporated by using regression analysis, and Table 2 shows the results of an ordinary least squares regression of schooling on age, household size, per capita food consumption (as a measure of household income), participation and hours for males and females respectively. Dummy variables for the sampling cluster were also used in the regression to control for location effects, but are not shown in the tables.

For boys, there is a significant positive relationship between schooling and participation in all three types of household employment. Not surprisingly, given the small numbers involved, no significant relationship between non-household employment and schooling can be detected. The coefficients on the hours of work are all negative (apart from the very small positive coefficient for housework), as expected. Thus, boys who work a small amount (less than about ten hours per week, for work on the family farm or in the family enterprise) are more likely to attend school than those who do no work at all, while those who work longer hours are less likely to attend school. As expected, household income (as measured by food consumption) increases the chances of attending school, but household size has no appreciable effect.

Table 2: *Ghana Living Standards Survey 3: Ordinary Least Square Regression of INSCHOOL on Labour Force Participation and Hours*

	GIRLS		BOYS	
Variables in the Equation	Coefficient	T – Statistic	Coefficient	T - Statistic
Age in years	0.1717	13.0**	0.1612	14.6**
Age squared	-0.0079	-15.0**	-0.0072	- 16.1**
Household size	-0.0016	-0.6	0.0004	0.2
Per capita food consumption	0.0344	2.4*	0.0453	3.3**
Participation				
Non-agricultural employment	0.0047	0.0	-0.3573	-1.6
Agricultural employment	-1.5623	-1.4	0.2781	0.9
Work in household enterprise	-0.1186	-2.2*	0.1452	2.4*
Work on household farm	0.1534	4.6**	0.1062	4.0**
Housework	0.0381	1.5	0.0358	1.7*
Hours				
Non-agricultural employment	-0.0089	-1.7*	-0.0002	-0.0
Agricultural employment	0.0499	1.8*	-0.0171	-2.0*
Work in household enterprise	-0.0036	-2.7**	-0.0109	-6.1**
Work on household farm	-0.0118	-8.9**	-0.0098	-11.0**
Housework	-0.0017	-2.3*	0.0001	-0.2
R square	0.388		0.384	
Standard error	0.401		0.378	

Note: The equation also contained "cluster dummies" to capture the effects of the area in which the children live. These are not reported for lack of space. * indicates significance at 10% or less. ** indicates significance at 1% or less.

For girls, the picture is more complex: there is a significant positive relationship between schooling and work on the household farm, and a significant negative effect of working for the household enterprise, while the other participation variables are insignificant. The coefficients for the hours variables are all negative, except for the anomalous result for agricultural employment (which has a large, though insignificant, participation effect).[8] As with the boys, working for less than about ten hours on the family farm increased educational attendance, while working more than that reduced it. However, in contrast to the males, participation in household enterprises by females unambiguously reduces their schooling. This is particularly interesting as Table 1 shows that girls are more likely to participate in household enterprises than boys. As with the boys, household income increases the chances of a female attending school and household size has no appreciable effect.

These results show that controlling for other factors does not eliminate the unexpected positive relationship between labour force participation and schooling, although it does limit it to housework, to those working less than

[8] It should be remembered that only 5 females in our sample actually engage in agricultural work outside the household, so these estimates clearly need to be regarded with caution.

about ten hours per week on the family farm and males working a similar length of time in the family enterprise. This result could be due to the more ambitious children, or children who are pushed by more ambitious parents, deciding to both work and attend school. It could also be that the income from work is necessary to afford the costs of going to school. There is clearly more research needed to investigate these, and other, possibilities.

The results in Table 2 show that children can both work and go to school. Table 3 shows this in a more explicit way for children in rural areas, which is where most child work takes place. Of Ghanaian children who work on the household farm, almost three in four boys and girls are at the same time in school. Similarly, virtually all boys and almost half the girls combine working on the household enterprise with going to school.

On the other hand, Table 3 shows that a substantial proportion of children neither work nor go to school: 14 per cent of girls and 8 per cent of boys. This fraction is especially large among girls. Therefore, if the main concern is with low educational attainment (and the gender gap therein), then policies designed to discourage child labour may be rather less important than policies that directly promote school attendance.

Table 3: *Rural Ghana: 7-14 Year-Olds. How Often Are Activities Combined?*

	Boys	Girls
Total participation rates		
Farm work	48.9%	44.1%
Enterprise work	2.5%	3.6%
School	78.7%	71.6%
None of the above activities	8.0%	13.7%
Participation restricted to one activity		
Farm work only	13.1%	12.7%
Enterprise work only	0.2%	2.1%
School only	40.6%	38.7%
Combinations of types of work		
Farm and enterprise work	0.0%	0.0%
Combination of work and school		
Farm work and school	35.8%	31.4%
Enterprise work and school	2.3%	1.5%
Number of children	1010	869

▪ 2.2 *Pakistan*

The Pakistan Integrated Household Survey 1991 contains 4,795 households, similar in size to the Ghana Survey. However, due to a much larger mean household size of 7.5 members, this leads to a sample of 36,109 individuals. Unfortunately questions about employment were not routinely asked of children under the age of ten in the PIHS.

School attendence and labour force participation by sex and age group are shown in Table 4. Comparisons with Table 1 show that the proportions currently in school are substantially smaller than in Ghana for all age groups, and particularly for girls. Also, while total employment of children aged 10 to 14 is lower than in Ghana, employment outside the household unit is more common in Pakistan. However, work on the household farm is still the most common form of employment, apart from housework for girls. Unfortunately, questions about housework, or home working for sales were not asked of boys.

Table 4: *Pakistan: Participation in School & Work (per cent)*

Age in years:	5-9		10-14		15-19	
Sex:	Girls	Boys	Girls	Boys	Girls	Boys
School attendance	31.0	53.3	30.6	72.9	11.5	41.5
1. Permanent agricultural employment			0.1	0.6	0.1	0.5
2. Seasonal agricultural employment			11.1	2.6	13.0	5.6
3. Non-agricultural employment			0.6	3.5	1.5	17.9
4. Total non-household employment			11.9	6.2	14.4	22.7
5. Work on household farm			30.0	22.1	35.5	33.4
6. Work in household enterprise			1.6	2.3	2.2	8.8
7. Home work for sales			1.4		3.5	
8. Housework			99.4		97.8	
9. Total household work			99.5	23.5	98.2	40.0

Note: Children under 10 are not asked about work. Boys are not asked about home work for sales or domestic work. Participation in 4 is defined as participation in 1, 2 or 3 and, similarly, an individual is deemed to participate in 9 if (s)he participates in 5, 6, 7 or 8. The figures in 4 are not sums of the figures in 1, 2 and 3 because a child may be active in more than one type of work, and similarly for 9.

In order to look at the effect of child labour on education, as in the analysis of Ghana, Table 5 shows the results of regressing school attendance on labour force participation and hours, for various types of employment. For boys, there is a consistent pattern of negative relationships between schooling and both participation and hours[9] variables, with the only positive coefficients being statistically insignificant. For girls, the same applies, except for participation in housework. It does appear therefore that there may be some real differences in the relationship between schooling and labour force participation between Ghana and Pakistan.

[9] For permanent and seasonal agricultural, and non-agricultural employment, this refers to normal hours per week worked in the last 12 months. For work on the household farm, for the household enterprise, and housework it refers to hours worked in the last week.

Table 5: *Pakistan Integrated Household Survey: Ordinary Least Square Regression of INSCHOOL on Labour Force Participation and Hours*

	GIRLS		BOYS	
Variables in the Equation	Coefficient	T - Statistic	Coefficient	T - Statistic
Age in years	0.0715	2.6**	0.0792	3.4**
Age squared	-0.0037	- 3.9**	-0.0035	- 4.3**
Participation				
Non-agricultural employment	-0.0683	- 0.8	-0.5861	-14.2**
Perm. agricultural employment	0.6355	0.1	-0.6424	-2.1*
Seasonal agricultural employment	-0.2275	-6.0**	-0.2263	-4.7**
Work in household enterprise	-0.1007	-1.5	-0.2178	-4.7**
Work on household farm	-0.2393	-10.0**	0.0360	1.5
Home work for sales	-0.0824	-1.5		
Housework	0.3308	5.5**		
Hours				
Non-agricultural employment	-0.0052	-2.0*	-0.0016	-2.0*
Perm. agricultural employment	-0.0335	- 0.2	0.0004	0.1
Seasonal agricultural employment	-0.0017	-1.3	-0.0046	-2.6**
Work in household enterprise	-0.0018	-0.8	-0.0065	-6.8**
Work on household farm	-0.0006	- 0.5	-0.0128	-17.5**
Home work for sales	-0.0003	-0.5		
Housework	-0.0042	-13.5**		
Multiple R	0.218	0.634		
Standard error	0.426	0.379		

Note: The equation also contained "cluster dummies" to capture the effects of the area in which the children live. These are not reported for lack of space. * indicates significance at 10% or less. ** indicates significance at 1% or less.

Table 6 shows that, in comparison with Table 3 for Ghana, combining farm work and school would appear to be less easily done in Pakistan: almost half the boys but only one in ten farm-working girls manage it. Similarly, combining working on the household enterprise with going to school, in Pakistan, is rare among the boys and unknown amongst girls. Child wage work is virtually absent in Ghana but in Pakistan, where it occupies about 6 per cent of boys and 12 per cent of girls, it clearly interferes with schooling: less than 1 per cent of children combine wage work and school. Overall, in all its forms, child work in Pakistan is much more evidently in competition with school attendance than is the case in Ghana.

In comparison to Ghana, an even higher proportion of children in Pakistan neither work nor go to school: 35 per cent of girls and 10 per cent of boys. This only serves to reinforce the conclusion that policies designed to discourage child labour may be rather less important than policies that directly promote school attendance.

Table 6: *Rural Pakistan: 10-14 Year-Olds: How Often Are Activities Combined?*

	Boys	Girls
Total participation rates		
Household farm work	22.1%	28.1%
Household enterprise work	2.3%	1.6%
Wage work	6.2%	11.9%
School	71.5%	30.5%
None of the above activities	10.5%	35.3%
Participation restricted to one activity		
Household farm work only	9.2%	21.4%
Household enterprise work only	1.0%	1.2%
Wage work only	2.9%	7.0%
School only	60.3%	27.3%
Combinations of types of work		
Household farm and enterprise work	0.58%	0.09%
Household farm and wage work	1.7%	3.8%
Household enterprise and wage work	0.16%	0.27%
Combinations of work and school		
Household farm work and school	10.0%	2.5%
Household enterprise work and school	0.25%	0.0%
Wage work and school	0.50%	0.0%
Number of observations	1208	1095

▪ 2.3 *Bangladesh*

In contrast to the nationally representative sample surveys for Ghana and Pakistan, with a resultant emphasis on rural child work, the quantitative survey for Bangladesh was focused on the slum population of Dhaka city. It covered over 700 households and was conducted from 1995 to 1997 as part of the Urban Livelihoods Study, a joint research project of Proshika, the London School of Hygiene and Tropical Medicine, and the University of Bath. The qualitative analysis was based on detailed interviews, conducted with 14 of the households that had taken part in the quantitative survey. The analysis uses the ILO definition of work and, in this urban setting, this typically involved working for people outside the household.

Table 7 presents the pattern of school attendance and work from the quantitative survey. In the younger age group, 8-11, school attendance for boys and girls is very similar at just over 60 per cent with boys being more likely to combine school with work. Girls and boys are also similar in the proportion that neither work nor go to school. However, boys are more likely to work than girls.

Turning to the older age group, 12-16 years of age, both boys and girls are much less likely to attend school, but the reduction for girls is greater. This reduction in schooling is accompanied by an increase in work, with boys again more likely to work. The number of girls doing neither is the same as in the younger age group, but the proportion of idle boys is substantially lower.

Table 7: *Work and School for Slum Children in Bangladesh*

Age in years:	8-11		12-16	
Sex:	Girls	Boys	Girls	Boys
Only work	13.4%	16.2%	55.3%	56.3%
Work and school	1.8%	6.6%	1.4%	6.4%
Only school	61.2%	54.8%	20.0%	24.7%
Neither	23.6%	22.4%	23.3%	12.6%

There are interesting comparisons with Ghana and Pakistan, although the fact that the age groups do not correspond makes precise comparisons difficult. The school attendance is substantially lower than in Ghana but not generally lower than in Pakistan. However, the difference between boys' and girls' school attendance is much smaller than in Pakistan. The work participation rates are not markedly different from either Ghana or Pakistan, but there is a major difference in the ability of children to combine work and schooling: it is even less common to see schooling combined with work than it is in Pakistan. A large part of this difference is probably due to the fact that the children work outside the household.

Although it was not possible to use regression analysis on the Bangladesh data to look more closely at the relationship between school and work, families were asked why their children were not attending school. The most common explanation was that the children were too busy working. However, it is worth noting that other commonly expressed reasons were "no suitable school facilities" (mostly meaning that available schools are too expensive), "busy with housework" (almost entirely applied to girls) and "child does not want to go" (mainly applied to boys). The effect of housework on girls is consistent with the higher proportion of girls neither working nor attending school, and reflects the same strong views on gender roles that are evident from the Pakistan data and, to a smaller extent, the Ghana data.

These reasons for not attending school were followed up in more detail in the qualitative analysis. This revealed that parents did attach considerable value to education but often found that school fees were too expensive or felt that work experience was more useful to future employment prospects than education. To some extent, these two factors were combined, with parents saying that education would help their child get a good job if they stayed at school for many years, but they could not afford that. Another interesting insight from the qualitative analysis was the investigation of the boys who did not want to go to school. This situation sometimes arose because the boy was beaten or humiliated at school, and refused to return. Parents were then inclined to get their child to work rather than let him remain idle. Thus, it was not a case of work reducing schooling, but poor schooling encouraging work.

Although the data show that the situation of children in urban slums in Bangladesh is different from both Ghana and Pakistan, there is still a clear policy

implication that improvements in schooling and reductions in fees may be a better way of encouraging school attendance than trying to curb child labour directly.

▪ 2.4 *Other studies*

The data from Ghana, Pakistan and Bangladesh provide an interesting pattern of results. It appears to be hardest to combine school and work in Bangladesh, and least difficult in Ghana. To some extent, this is due to the differences between the countries in the proportion of child work that is done outside the household. However, there are also differences between countries in the ability of children to combine household work with schooling. Another important point is that it is generally harder for girls to combine work with schooling, the effect being strongest in Pakistan and weakest in Ghana. Girls are also more likely to be neither working nor attending school. It is interesting to see whether these patterns extend to other countries.

A number of other recent studies have looked at the relationship between child work and schooling, some of them producing information in a similar format to Tables 3, 6 and 7: Kanbargi and Kulkarni (1991), Grootaert and Patrinos (1998), and Nielsen (1998). However, of these, only Kanbargi and Kulkarni draw any inferences about the effect of work on schooling, concluding that children in Karnataka who work are less likely to attend school than those who do not work. The other studies simply report them as data that they use to estimate models of the simultaneous decisions about work and schooling, a methodology that is also used by Akabayashi and Psacharopoulos (1999).[10] Such studies tend to show that factors encouraging work generally discourage schooling, which is consistent with a conflict between work and school attendance. The reasons for this approach are discussed below, together with other methodological issues.

Despite their different approach, it is still possible to describe the basic features of the data they use. Nielsen's (1998) study of Zambia reports a rate of school attendance that is similar to that for Ghana, but a substantially lower rate of child work. However, this low rate of child work is probably due to the design of the survey, which only records a child's work if the child spends more time working than attending school. It is therefore not surprising that few children are shown to combine work and schooling.

Grootaert and Patrinos (1998) report the patterns of child work and school attendance for Côte d'Ivoire, Colombia, urban Bolivia and Philippines. In each case, the surveys are similar to those reported above for Ghana and Pakistan and report child work even if it is not the child's main activity. In Côte d'Ivoire, about 25 per cent of the children attend school without working, about 35 per cent combine work with school, and about 20 per cent concentrated on work. This leaves just over 20 per cent who neither work nor attend

[10] The latter do not provide simple tables relating work to school attendance, but do provide interesting graphs of the negative relationship between hours of work and hours of study at home.

school. Children in urban areas are more likely to concentrate on schooling, and slightly more likely to combine work and schooling, with the consequence that many fewer concentrate on work. Girls are less likely to concentrate on schooling and more likely to devote themselves to housework. In Colombia, about 80 per cent of urban children concentrate on schooling, 5 per cent combine schooling with work, 5 per cent concentrate on work and 10 per cent do neither. Education in rural areas is substantially lower, and this is matched by increases in work participation and in those doing neither. Girls are more likely to attend school and less likely to work. They are also more likely to do neither. In urban Bolivia, full-time school attendance is over 90 per cent until the age of 13 years. After that, child work becomes significant, with somewhat more children working full-time than combining work with school. Only about 3 per cent neither work nor attend school, and this is more common for girls. There is little difference between girls and boys in their labour force participation.

These results confirm the gender aspects of the results from Ghana, Pakistan and Bangladesh. However, they also reinforce the extent of diversity in the patterns of work and school attendance across countries. Côte d'Ivoire appears fairly similar to Ghana in having a substantial number of children combining work and schooling, although it is surprising that urban children (who are, presumably, more likely to work outside the household) are slightly more likely to combine work and schooling. However, Latin America has a higher school enrolment rate and lower work participation than either the African or the Asian countries. This is probably partly due to higher levels of income and partly greater urbanization, with fewer opportunities to work within the household. Nonetheless, a fair proportion of those who work are also able to attend school.

▪ 2.5 *Methodological issues*

This review of the literature on the relationship between child work and school attendance raises a number of methodological issues. Perhaps the most obvious is how work is defined, in terms both of its nature and of its duration. Less obviously, but also important is the issue of how school attendance is defined. Whether it is compatible with working depends not only on the characteristics of the work but also on the characteristics of the schooling, especially its timing. Another important point is the "endogeneity" of some of the variables of interest. For example, should child work be seen as a pre-determined factor that affects a child's ability to go to school, or are the decisions on schooling and work taken simultaneously? The first view is implicit in some writing on child labour, but the previous section showed that the latter view is taken by much of the current literature. These issues are discussed in the remainder of this section.

Perhaps the most controversial aspect of the definition of child work used in most of the studies surveyed here is that it excludes housework, but includes unpaid work in a family farm or enterprise as well as paid work. This follows the ILO definition, which is based on the concept of "economic activity", but clear-

ly has important gender implications as girls are more likely to undertake substantial housework duties than boys and these are just as likely to interfere with schooling as part-time work on a family farm. This probably accounts for the higher proportion of girls who are reported as being neither in work nor in school. The difficulty is recognised by many researchers, and some of the studies attempt to look at housework as well as other forms of child work, but the surveys rarely attempt to measure housework as thoroughly as other sorts of work.

Another important aspect of the definition of child work is that, even within the concept of economic activity, it covers a range of very different activities with different implications for schooling. This is revealed in the studies surveyed here, which show that children who work on family farms or for short hours find it easier to attend school than those who work for outside employers or for long hours. The implications of restricting attention to work that is particularly time consuming is illustrated by Nielsen's (1998) study of Zambia, which looks only at work that takes up more time than schooling. It is not surprising that, with this definition, very few children can combine work with school.

The final aspect of the work definition is whether you define a child as working if they worked in the last week or if they worked in the last year (most surveys ask both questions). The second definition will count more children as working, including those that only work during school holidays and for whom there is little conflict between work and school. On the other hand, limiting the analysis to those who worked last week will not count some children who have worked earlier in the year, possibly at a time that has seriously affected their schooling. There are, therefore, disadvantages with both definitions and any choice will involve compromise. In this situation, it is important to be clear about the definition and understand its implications.

The issues of defining school attendance are not so difficult. One important point is that one should look at school attendance rather than school enrolment, as many children are enroled but never attend. This is often a problem with aggregate official statistics, and household surveys generally concentrate on attendance. However, there is still the issue of the time period of attendance. Asking a child whether they are currently in school or went to school in the last week can fail to include children who are on holiday or ill. On the other hand, asking whether they attended school in the last year can count children who have left school or only attend school infrequently. As with the work definition, there is no perfect answer. However, in studying the relationship between work and school attendance, it makes sense to use the same time period for both definitions, realizing that the "last week" definition will make it harder for children to combine work and school than the "last year" definition.

The issue of endogeneity is both important and difficult to deal with. It can be illustrated in terms of the regression results in tables 2 and 5. These demonstrate a correlation between different types of work and school attendance, controlling for some other factors. However, there are two difficulties in

simply interpreting these results as showing that work reduces school attendance. These are "identification" and "bias", and are discussed in turn.

The problem of identification is straightforward to understand, but not so easy to solve. The essence of the problem is that we cannot tell whether it is work that is determining school attendance or school attendance that is determining work. In reality, it is probably sensible to think that the household makes the two decisions (on work and on school participation) at the same time, and that the decisions will depend on a variety of community, household and child characteristics. This leads to the statistical approach of several studies, mentioned in section 2.4, in which work and schooling are each explained in terms of a number of (exogenous) factors. This has shown that, typically, factors which encourage child work also discourage school attendance. However, it does not answer the question of the extent to which new actions to reduce child labour will encourage school attendance, unless those actions can be accurately represented by changes in the variables used in the school attendance equation. As special programmes against child labour are not included in estimated school attendance equations, this approach does not give us any idea of the likely effects of such programmes on school attendance. In this situation, regressions such as those reported in Tables 2 and 5 are useful, provided that their limitations are recognized.

The problem of bias is more technical. It could arise in the regression results presented in Tables 2 and 5 for the following reason. A positive random error for a particular observation would lead to a higher than expected school attendance, which in turn would be likely to lead the child concerned to have a lower level of work. This effect would lead to a negative correlation between the error term in the equation and the work variables on the right hand side, and so to the coefficients on the work variables picking up an effect that is really due to the error term. Thus, there is a bias in the estimated coefficients. In this case, because the correlation is negative, it makes the coefficients on the work variables more negative (or less positive) than they should be. In some cases, this bias can be eliminated by using exogenous "instrumental variables" to eliminate the correlation between the work variables and the error term.[11] If these variables are available, they also solve the problem of identification, because the possible reverse relationship from schooling to work has been removed by the instruments. However, frequently it is difficult to find suitable instruments and it is necessary to accept the possibility of bias, and take account of it in interpreting the estimated coefficients.

3. Child Work and School Attendance in the GLSS2

GLSS2 is a representative sample survey of the household population in Ghana for 1988/89. It records considerable detail about the income and expenditure of each household, and of the education, health and economic activities of each

[11] This is done by regressing the endogenous right hand variables on the instrumental variables and using the fitted values from those auxiliary regressions instead of the actual values.

person in the household aged more than 7 years. It is a fairly typical example of the Living Standard Measurement Study (LSMS) household surveys that have been undertaken in a number of developing and transitional economies with the encouragement and technical assistance of the World Bank. It is better than some LSMS surveys for studying the effects of child labour because it asks questions about economic activity from children of an early age.

The educational tests discussed below were only administered to people aged 9 years or more, and only to those who lived in half of the sampling clusters. As we are concerned with people who can be regarded as children, and who might reasonably be expected to attend school, the analysis is confined to those aged 18 years or less. Thus, the analysis in this paper relates to people aged between 9 and 18. The analysis in this section covers children who were not tested, as well as those who were.

The definition of work used here is the standard ILO definition, including work provided on the labour market and work for household farms and enterprises, even if it is unpaid. However, it excludes housework in the family home (such as cleaning, cooking or washing). There are several reasons for this. First, the debates surrounding the potentially damaging effects of child labour do not include housework. Second, the information in the survey on housework is less detailed than on ILO-defined work. Third, almost all children in Ghana claim to do some housework, and so the analysis of participation in housework would not be revealing. Nonetheless, it is important to note that girls in Ghana report almost twice as many hours of housework as boys (16 hours per week, compared to 9 hours per week). The neglect of housework would therefore ignore an important gender dimension to educational achievement. For this reason, the reported hours of housework are used as a possible explanatory variable in the analysis of section 5.

As far as practicable, the children themselves provided the information on their schooling and economic activities. For the purpose of this paper, the important schooling question was whether the child had attended school in the past twelve months. This was used in preference to the question on whether they had attended school in the last seven days, because the answer to this question could be affected by school holidays or illness. Similarly, the important question on economic activities was whether the child had worked in the past twelve months. Children who worked were asked a range of questions about their work, including how many weeks they had worked in the last twelve months and how many hours per week they had usually worked in the last twelve months. The answers to these questions will be used as measures of work intensity in this paper. However, the reliability of the answers to these work intensity questions is likely to be lower than for the participation questions, as much of the work is informal and many children are poor judges of time.

The survey reveals the extent of informal working, with 96 per cent of working children undertaking work for the family farm or enterprise and 89

per cent reporting the same occupation as one of their parents. It is therefore not surprising that the industrial composition of this work is highly concentrated in agriculture (83 per cent), retailing (7 per cent) and food manufacture (3 per cent).

Table 8 reports the proportion of children who only work, who only go to school, who do both, and who do neither. Figure 1 displays the same information in graphical form. The first point to note about the data is that working and school attendance are not straight alternatives. Until the age of 18, most working children attend school. Also, in the younger age range, increases in working mainly consist of children working while still at school. It is only at age 17 that there is a clear movement out of school and into work. The second point to note is that there is a small group of children who neither work nor go to school. The third point to note is that the difference in behaviour between boys and girls is not large compared to other developing countries, as discussed in section 2. However, girls are more likely to be neither at work nor in school, less likely to combine work and schooling, and slightly more likely to only work. This could be because they also have greater housework duties.

Figure 1: *Work and School Attendance*

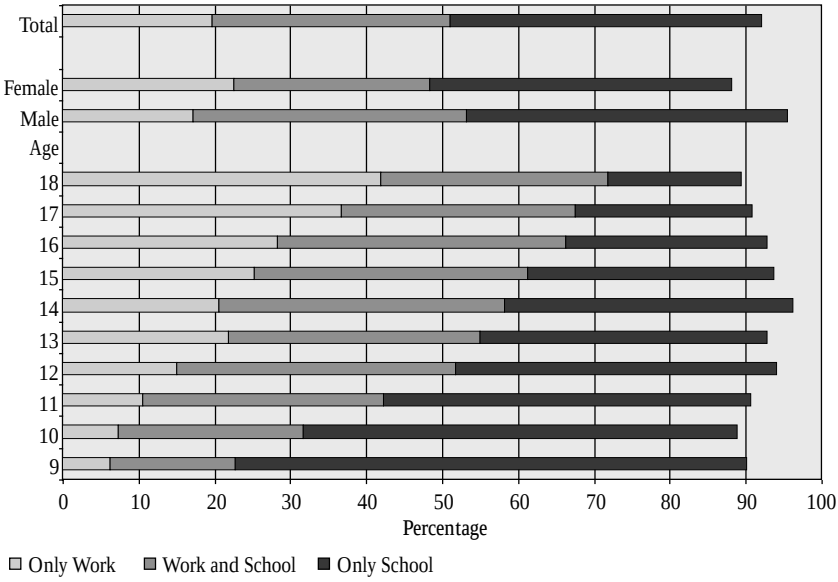


Table 8: *Work and School Attendance*

	Number %	% Only Work	% Only School	% Work and School	Neither
Age					
9	211	6.2	67.3	16.6	10.0
10	217	7.4	57.1	24.4	11.0
11	161	10.6	48.4	31.7	9.1
12	234	15.0	42.3	36.8	6.0
13	169	21.9	37.9	33.1	7.1
14	189	20.6	38.1	37.6	3.7
15	197	25.3	32.5	36.0	6.1
16	169	28.4	26.6	37.9	7.1
17	120	36.7	23.3	30.8	9.2
18	131	42.0	17.6	29.8	10.7
Sex					
Male	961	17.2	42.2	36.1	4.5
Female	837	22.6	39.8	25.8	11.8
Total	1798	19.7	41.1	31.3	7.9

Note: Row percentages do not total 100 because of rounding.

These points suggest that the effect of child work on school attendance is fairly small, partly because most children can combine work and school and partly because some of those who only work may do so as an alternative to doing nothing, rather than as an alternative to going to school. One reason why it appears to be easy to combine work with schooling is that most of the children do not work very much: the mean hours worked per week are 15.5 (with a standard deviation of 16.3) and the mean weeks per year are 14.6 (with a standard deviation of 17.0). In both cases, the median is below the mean. So, this gives a picture of most children only working a little and a much smaller number working an amount that could plausibly interfere with schooling.

It is also worth noting that the effect of working on school hours is very small, although highly statistically significant. The mean school hours per week for working children who attended school was 21.1, only slightly less than the mean of 22.2 hours for non-working children who attended school. Also, for children attending school, there was no relationship between hours of schooling and hours of work.

In summary, this analysis suggests that child work in Ghana has relatively little effect on school attendance. This could be due to the fairly small amount of work that most working children do.[12] However, as argued in section 1, the effect of child work on educational achievement may not be accu-

[12] But note that most of the literature surveyed in section 2, from a range of countries, shows that many children combine work with school.

rately reflected by its impact on school attendance. The rest of this paper, therefore, proceeds to an analysis of educational test results.

4. Educational Test Results

In half the sampling clusters of GLSS2, individuals between the ages of 9 and 55 were asked to take educational tests. These included a test of 'innate ability' (Raven Test), an easy reading test, an easy mathematics test, an advanced reading test, and an advanced mathematics test. Children only took the advanced tests if they achieved above a minimum score (4 out of 8) in the corresponding easy test. The Raven test is a coloured progressive matrices test (Raven (1956) and Raven, Court and Raven (1977)), which was used by Knight and Sabot (1990) and much of the subsequent literature. The advanced reading and mathematics tests are also the same as those used by Knight and Sabot (1990, appendix C). The easy reading and mathematics tests were devised for the GLSS2 and are presented in Glewwe (1999, appendix 4.1).

There were 1,848 children between the ages of 9 and 18 in the sampling clusters where the tests were administered. Of these, 1,563 took the Raven Test, 1,024 took the easy mathematics test and 585 took the easy reading test. Children did not take the Raven Test for a variety of reasons, including illness, travelling and outright refusal. They did not take any of the other tests. A large part of the reduction in numbers from the Raven test to the easy mathematics test was due to the fact that the latter test was only supposed to be administered to those who had completed three years of schooling.[13] The much reduced participation in the easy reading test was probably due to the fact that the test was in English, and some schools do not introduce English language instruction until the fourth year.[14]

Less than half (269) of those taking the easy reading test did well enough to qualify for the advanced reading test and 253 actually took it. A similar pattern applied with mathematics: 500 scored more than 4 in the easy test and 453 took the advanced test.

The results of these tests are given in Table 9. Each test has its own grading scheme and no significance can be attached to comparisons of scores between tests. The relevant comparisons are those between entries in the same column. The first two lines of Table 9 compare the mean scores in each test of all working children and all non-working children. The scores for Raven, Easy Maths and Advanced Reading are higher for non-workers. The scores for Advanced Maths are the same for workers and non-workers, while the workers obtained a higher mean score for Easy Reading. The results for Easy Maths and Advanced Reading support the view that child work harms educational achievement, but the results for Advanced Maths and Easy Reading do not.

[13] In fact, a few children with less than three years of schooling did take the test.

[14] This is supported by the much greater difference between the numbers taking the easy reading and easy mathematics tests amongst younger children and those with few years of schooling.

However, the comparison in the first two lines is distorted by the difference in age composition between the working and non-working children: working children are older and older children do better in the tests, thus making working children appear to do better. This distortion can be removed by comparing the scores of working and non-working children at each age, as is done in the main body of the table. The scores for the reading and mathematics tests are shown graphically in Figures 2 to 5. Comparisons here show that, with few exceptions (7 out of the 40 comparisons, none of which were statistically significant), working children did worse in the reading and mathematics tests than non-working children. This provides strong support for the view that child work harms educational achievement.

Table 9: *Mean Test Scores by Work Status, Sex and Age*

Group	Work	Raven	Easy Reading	Easy Maths	Advanced Reading	Advanced Maths
All	Yes	**17.2**	3.9	4.3	11.9	7.5
	No	**18.2**	3.8	4.5	12.7	7.5
Sex						
Male	Both	**18.6**	**4.1**	**4.6**	**12.8**	**8.1**
Female	Both	**16.7**	**3.5**	**4.1**	**11.5**	**6.6**
Age						
9	Yes	**14.6**	0.0	**2.6**	None	None
	No	**15.6**	3.3	**3.6**	9.6	4.3
10	Yes	15.3	1.0	3.3	10.0	6.5
	No	15.8	1.9	3.4	11.0	4.7
11	Yes	**15.2**	**0.7**	**3.2**	4.0	5.2
	No	**17.0**	**3.0**	**4.4**	9.4	6.4
12	Yes	**16.3**	**1.9**	**3.8**	10.6	6.1
	No	**18.0**	**3.3**	**4.6**	12.5	6.8
13	Yes	**16.1**	3.3	4.1	**9.5**	**5.7**
	No	**19.2**	4.8	4.8	**14.3**	**9.0**
14	Yes	17.3	3.6	4.4	9.6	7.0
	No	17.7	2.7	4.4	10.2	6.7
15	Yes	**17.7**	4.6	**4.3**	12.1	6.4
	No	**21.2**	4.0	**5.1**	11.8	7.4
16	Yes	**18.5**	4.7	5.0	**11.7**	8.4
	No	**21.7**	4.4	5.2	**14.6**	9.4
17	Yes	**19.3**	4.6	5.2	12.3	8.7
	No	**24.3**	5.6	5.3	14.4	9.3
18	Yes	**20.1**	5.2	5.4	14.3	9.4
	No	**23.5**	5.6	5.6	14.4	10.9

Note: Numbers in bold are significantly different from each other at the 10% level.
It is interesting to note that non-working children also do better than working children in the Raven Test. This test is designed to measure innate ability and should therefore not be influenced by educational experience or whether a child is working. Instead, the simplest interpretation of this observation is that households protect more able children from working in order to allow them to develop their abilities to the full. A more complex variant of this type of explanation is to hypothesise that more able children have more able parents, and therefore come from richer households that are less likely to have to put their children to work.

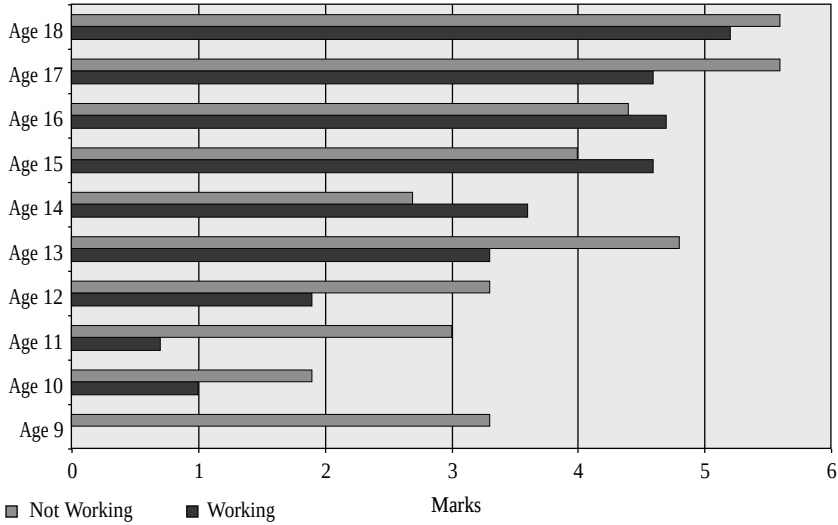
The fact that working children have lower Raven scores raises the possibility that their lower scores for reading and mathematics are due to their lower innate ability, rather than to their work. This possibility is examined in section 5, together with other factors that might affect test results.

Finally, Table 9 shows surprising results for the difference in test scores between girls and boys: girls score substantially lower in all tests, including the Raven Test. This is particularly surprising for the Raven Test, as it is designed to be gender neutral and there is no reason to expect girls to have less innate ability than boys. However, it is unlikely to be due to differences in work and school experience[15] (quite apart from the fact that the Raven Test is supposed to be unaffected by such experience) because, as shown in Table 8, there is little difference between boys and girls in this respect. Even larger gender differences were found by Alderman, Behrman, Ross and Sabot (1996) for Pakistan, but they were unable to provide a complete explanation. There is clearly scope for more research on this issue.

5. Modelling the Determinants of Test Scores

Section 4 showed that working children obtained lower test scores for reading and mathematics than non-working children of the same age, but raised the possibility that this was due to differences in innate ability. At the same time,

Figure 2: *Mean Easy Reading Scores*



[15] In fact, a simple regression that included work and schooling variables could not explain the differences between boys and girls.

Figure 3: *Mean Easy Maths Scores*

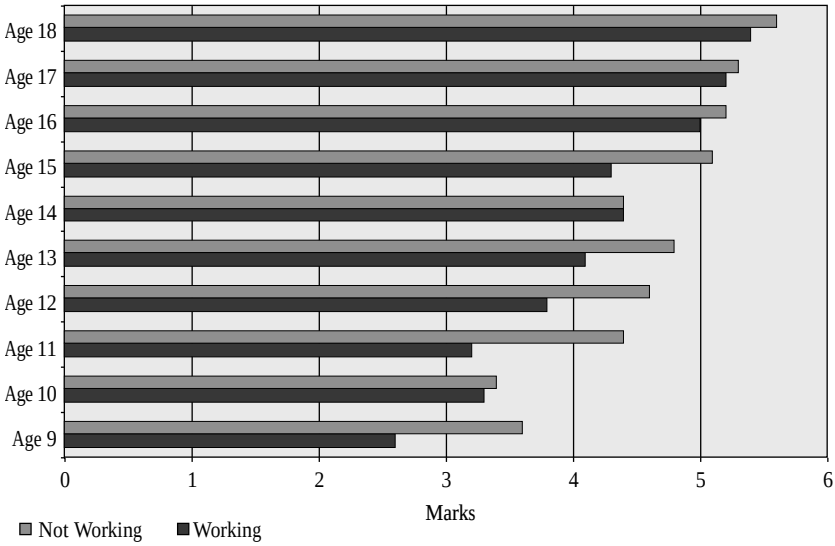


Figure 4: *Mean Advanced Reading Scores*

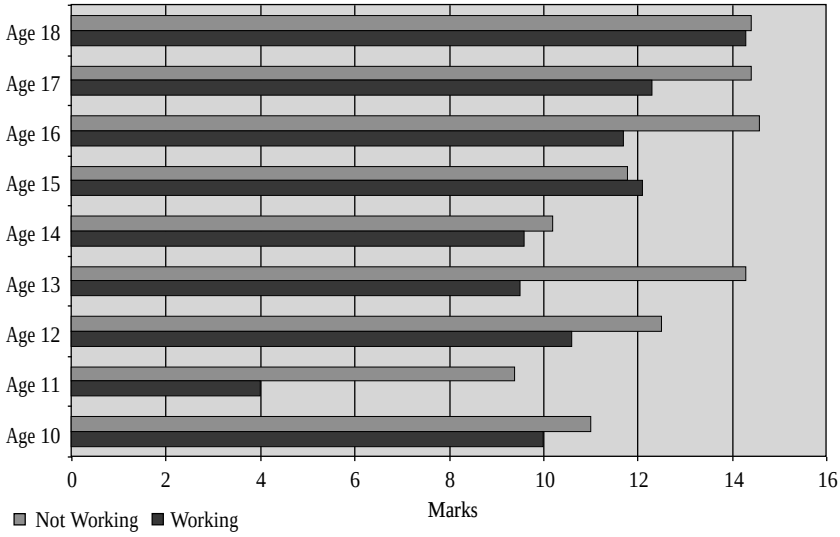
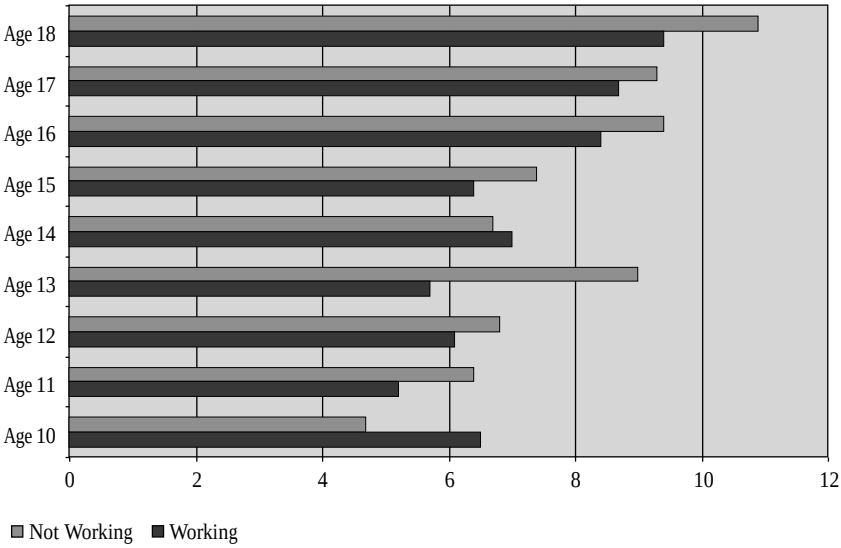


Figure 5: *Mean Advanced Maths Scores*



it is likely that test scores are influenced by other factors apart from innate ability, age, sex and work status. The purpose of this section is to deal with both of these points by using multiple regression to estimate models of what determines test scores for reading and mathematics.

The analysis has to take account of the fact that the effect of work on educational achievement operates both directly and indirectly. The direct effect is that which applies when the amount of schooling is kept constant, and results from such factors as tiredness and lack of time to complete homework. The indirect effect is via schooling: the effect that work has on schooling, and thus on educational achievement.

In order to estimate the total effect, direct plus indirect, it is necessary to exclude the schooling variables themselves from the estimated equation. However, it is necessary to include as many other variables as possible that might affect the level of schooling, in order to prevent the work variables picking up the effects of other influences. In this case, the coefficients on the work variables will capture the effect of work on schooling, and thus on educational achievement (the indirect effect), in addition to the direct effect. This is reported in column (1) of each of Tables 10-13.

In order to estimate the direct effect alone, it is necessary to include the schooling variables, so that the coefficients on the work variables are only picking up the effect of work, given the level of schooling. In Tables 10-13, the addition of schooling variables is given in two steps: in column (2), the addition of the child's years of schooling, and in column (3) the addition of current school attendance and other measures of current school inputs (including

school hours and school charges). This two step approach is used as years of schooling is less likely to be influenced by current work activity than current schooling variables.

Finally, column (4) of Tables 10-13 reports the results of excluding the work variables. This indicates the results that would be obtained from the standard educational achievement literature, in which child work is ignored. It allows us to judge whether the omission of child work variables biases the estimates of the returns to education.

The variables used in the estimation of the results in column (1) are: age[16], whether the child is currently working, the child's Raven Test score, whether the child is female, the number of weeks the child works per year, the number of hours the child works per week, the number of years for which the child has worked, the number of hours per week the child spends doing housework, the number of years of education of the father, the number of years of education of the mother[17], and a set of dummy variables for each sampling cluster to pick up differences in availability and quality of schooling as well as local attitudes to education. The dummy coefficients and constant are not reported for reasons of space. The reported results are obtained by progressively removing most variables with a significance level of greater than 10 per cent. The variables that are retained regardless of significance are: all the cluster dummies, work (a dummy variable indicating work in the past year), female (a dummy variable indicating that the child is a girl) and one measure of work intensity (hours of work, weeks of work or years of work).

The results in column (2) were obtained by adding the child's years at school (child's schooling) to the final set of variables in column (1). The results in column (3) were obtained by adding the following variables to those used in column (2): whether the child is in school, the number of hours per week at school, the amount paid in school fees and the amount paid for school books. These extra variables were dropped progressively if their significance level was greater than 10 per cent, except for the school attendance variable. Finally, the results in column (4) were obtained by dropping the work variables from the equation reported in column (3).

[16] Age was also introduced in a quadratic term and interacted with school attendance and work participation. However, none of these produced statistically significant effects. Thus, the data confirm that a simple linear term is the best way of representing the effect of age on test scores.

[17] The education level of the parents represents both attitudes to education and level of income, which are heavily dependent on education. Income itself is not included because of measurement problems and because it partly depends on the child work that is the main focus of this study. This means that the estimated effect of child work on test scores includes any (positive) effect that there might be of the additional income from the work on education.

Table 10: *Estimation Results for Easy Reading Test*

Variable	(1)	(2)	(3)	(4)
Age	0.248**	-0.045	0.002	-0.011
	(4.36)	(0.63)	(0.02)	(0.13)
Work	-0.968*	-0.979*	-0.918*	
	(1.94)	(2.00)	(1.81)	
Raven	0.187**	0.153**	0.141**	0.140**
	(7.51)	(6.50)	(5.57)	(5.51)
Female	-0.159	-0.265	-0.250	-0.252
	(0.80)	(1.40)	(1.24)	(1.29)
Weeks of work	0.017	0.019	0.017	
	(1.31)	(1.46)	(1.28)	
Father's schooling	0.066**	0.051**	0.045*	0.044*
	(3.75)	(2.97)	(2.31)	(2.26)
Child's schooling	0.397**	0.369**	0.370**	
	(5.45)	(4.01)	(3.96)	
Attend school		0.218	0.229	
		(0.46)	(0.50)	
School fees			0.000088**	0.000091**
			(2.13)	(2.22)
Number of observations	578	578	506	506
R-Squared	0.589	0.622	0.641	0.638
F-Statistics	5.62**	10.09**	13.04**	17.15**
Root mean square error	2.18	2.09	2.06	2.06

Notes: Numbers in parentheses are absolute t-ratios.
* indicates significance at 10% or less.
** indicates significance at 1% or less.

▪ 5.1 *Estimation issues*

One problem in estimating equations of this sort is that, as discussed in section 2, variables such as work status and school attendance cannot be regarded as pre-determined: they are the result of household choices. In principle, this problem can be dealt with by using instrumental variables that are not already included in the equation. However, all variables in the dataset that might influence household choice on work and education, as identified by Bhalotra and Heady (1999), are also variables that should be included in the test score equation. Thus, there are no available instruments, and the only option was to use ordinary least squares.

This would produce biased estimates if any of the work or education variables were correlated with the random error in the equation. This would occur

if those children with higher than expected test scores had systematically different levels of work or schooling than those with lower than expected test scores. This might seem likely, as the results of section 4 suggest that more able children are less likely to work, and it is natural to suppose that they are more likely to go to school. However, as innate ability (measured by the Raven Test) is included in all the regressions, the problem only arises if children with, for example, higher easy maths scores than expected from their ability are less likely to work and more likely to go to school. This seems much less likely. However, it is worth noting that, if it were true, this would lead to an over-estimate of any negative relationship between work and test scores, and an over-estimate of any positive effect of schooling.

▪ 5.2 *Results for the easy reading test*

Table 10 presents the results for the easy reading tests. Column (1) reports the results without the school attendance variables. Columns (2) and (3) report the results with the schooling variables. Column (4) reports the results without the work variables. The numbers recorded in parentheses are the absolute t-ratios of the coefficients, based on robust standard errors that have been adjusted for cluster effects. Coefficients are marked * if they are significant at 10 per cent or less, and ** if significant at 1 per cent or less.

Column (1) of Table 10 shows that age, work innate ability (Raven) and father's schooling are the significant determinants of the easy reading score, and each has the expected sign. It is interesting that girls do slightly worse than boys, even after allowing for their lower Raven scores, although it is statistically insignificant. It is also interesting that no measures of work intensity have a significant impact. This could be because of errors in people's estimates of the time they spend working. Finally, note that hours of housework has been dropped because of its statistical insignificance.

The introduction of the child's years of schooling in column (2) has hardly any effect on any of the existing coefficients, apart from age and father's schooling. The coefficient on age becomes insignificant as years of schooling is highly correlated with age amongst children. The reduction in the coefficient on father's schooling indicates the fact that some of the effect of father's schooling on educational achievement operates via its effect of keeping the child in school for more years. The child's years of schooling are highly significant, but it is interesting that the magnitude of the coefficient is less than half that of the coefficient of work. Thus, participation in work has so much effect on reading scores as to offset two years of schooling.

The introduction of the other schooling variables in column (3) also has little effect on the existing coefficients, apart from a slight reduction in the coefficients on work and father's schooling. This indicates that some, but con-

siderably less than half, of the effect of these variables on schooling achievement is indirect, via their effect on schooling. It is interesting that current school attendance has no significant effect, while school fees do. This suggests either that private schools are more effective than state schools or that parents who pay more for schooling make their children study harder.

Finally, column (4) shows that dropping the work variables has little effect on the coefficients on the schooling variables. This indicates that, despite the evident effect of work on educational achievement, its omission from the estimated equation does not bias the estimated returns to education.

The important conclusion from Table 10 is that work reduces reading scores. The magnitude of the effect of work can be judged in two ways. First, as stated above, work seems to offset the effect of two years of schooling. This seems to be rather large. Second, the coefficient on work is just under half the root mean square error (an estimate of the standard deviation in reading scores when controlling for the variables in the equation). Thus, a child with an average score would fall to one half of a standard deviation below the mean if they started working. This is significant but not enormous. Thus, we can conclude that the effect of work on reading ability is substantial.

▪ 5.3 *Results for the easy mathematics test*

Table 11 presents the results for the easy mathematics test, in the same format. Column (1) shows that, as with the easy reading test, the significant determinants include age, work, innate ability and father's schooling. However, they now also include work for the family and hours of housework. Work for the family has a positive coefficient that is of a similar magnitude to the (negative) coefficient on work. For a child that works in a family farm or business, this means that the work has no effect on their mathematics score. It is only the children who work for other employers that suffer a reduction in score.

Column (2) shows that, as with the easy reading test, the introduction of the child's years of schooling only affects the coefficients on age and father's schooling. This time, the coefficient on child's years of schooling is about a third of the value of the coefficient on work.

However, the introduction of current schooling variables in column (3) has a strikingly different effect from the case of the easy reading test. The coefficient on current school attendance is highly significant and the coefficient on work is halved in magnitude. Thus, half of the effect of work on educational achievement is indirect, via schooling. This contrast with reading suggests that children lose their mathematical skills soon after leaving school.

Another difference between column (3) in Table 11 and Table 10 is that, for mathematics, expenditures on books are more significant than school fees.

Table 11: *Estimation Results for Easy Mathematics Test*

Variable	(1)	(2)	(3)	(4)
Age	0.150**	-0.035	0.024	-0.001
	(5.10)	(0.88)	(0.53)	(0.02)
Work	-0.771*	-0.799*	-0.355	
	(2.38)	(2.31)	(0.96)	
Raven	0.143**	0.115**	0.110**	0.110**
	(17.40)	(14.65)	(12.84)	(12.76)
Female	-0.056	-0.115	-0.083	-0.142
	(0.56)	(1.16)	(0.80)	(1.44)
Work for family	0.812**	0.752*	0.379	
	(2.68)	(2.53)	(1.15)	
Weeks of work	-0.010	-0.006	-0.010	
	(1.38)	(0.95)	(1.50)	
Hours of housework	-0.016*	-0.016*	-0.015 (1.50)	
	(1.66)	(1.66)		
Father's schooling	0.021*	0.009	0.011 (0.81)	0.011
	(1.68)	(0.70)		(0.77)
Child's schooling		0.255*	0.221** (5.69)	0.221**
		(7.43)		(5.81)
Attend school			0.474**	0.517**
			(2.67)	(2.93)
School books			0.000082*	0.000079**
			(2.46)	(2.55)
Number of observations	1010	1010	933	934
R-Squared	0.423	0.461	0.466	0.458
F-Statistics	5.01**	12.24**	49.04**	69.33**
Root mean square error	1.64	1.58	1.59	1.60

Notes: Numbers in parentheses are absolute t-ratios.
* indicates significance at 10% or less.
** indicates significance at 1% or less.

Finally as with the easy reading test, column (4) shows that the omission of work variables does not bias estimates of returns to schooling.

The most important conclusion from Table 11 is that work has a substantial negative impact on children's mathematical skills, but only if they work outside the home. Using the same method as before, the magnitude of this reduction can be seen as either about three years of schooling or half a standard deviation of the controlled score distribution. However, half of this effect is direct and half indirect, via schooling.

▪ 5.4 *Results for the advanced reading test*

Table 12 presents the results for the advanced reading test. Column (1) shows a different pattern from that in Tables 10 and 11. Age and innate ability are still significant factors, but hours of work, rather than the simple fact of working, is now the other significant factor. In fact, the work variable has an unexpectedly positive, but insignificant effect. This suggests that hours of work become more important in their effect at higher levels of academic achievement.[18] The magnitude of this effect can be gauged by noting that the average working child works approximately 15 hours per week. The effect of that level of work would be to reduce the score by 1.26 (=15x0.084).

Table 12: *Estimation Results for Advanced Reading Test*

Variable	(1)	(2)	(3)	(4)
Age	0.499**	-0.285	-0.365	-0.392
	(3.16)	(1.08)	(1.34)	(1.50)
Work	1.134	1.182	1.692	
	(0.98)	(0.94)	(1.33)	
Raven	0.159*	0.090	0.089	0.098
	(2.35)	(1.34)	(1.32)	(1.52)
Female	-1.423	-1.761*	-1.900*	-1.709*
	(1.43)	(1.74)	(1.93)	(1.77)
Hours of work	-0.084**	-0.073**	-0.101**	
	(3.33)	(2.54)	(3.27)	
Child's schooling		0.967**	0.917** (3.57)	0.980**
		(3.99)		(3.98)
Attend school			-3.235*	-1.594
			(1.94)	(1.03)
School hours			0.100* (1.81)	0.077 (1.42)
Number of observations	248	248	245	245
R-Squared	0.502	0.564	0.570	0.551
F-Statistics	5.87**	6.87**	6.62**	7.93**
Root mean square error	4.49	4.22	4.18	4.25

Notes: Numbers in parentheses are absolute t-ratios.
* indicates significance at 10% or less.
** indicates significance at 1% or less.

Another difference is that father's education is no longer significant, presumably because the levels of achievement are now likely to be higher than those achieved by the parents.

[18] It may also reflect the greater ability of older children to judge time.

As before, the introduction of child's schooling in column (2) mainly affects the coefficient on age. However, it is interesting that it also makes the coefficient on female become significantly negative. Also, the coefficient on the Raven test score is reduced and becomes insignificant, suggesting that its effect is indirect. The magnitude of the years of schooling coefficient is approximately the same as the (insignificant) coefficient on work, which is now positive. It is also not much less than the effect of hours of work for the average working child. As the coefficient on work has the unexpected negative sign, this suggests that the average working child suffers no loss in the advanced reading score. However, a child who works twice the average amount (and an appreciable number do work that much) will suffer a loss of advanced reading score that is equivalent to one year of schooling.

The addition of the current schooling variables in column (3) has no appreciable effect on the existing coefficients. This suggests that most of the effect of work on educational achievement is direct rather than indirect. It is also worth noting that the coefficient on current school attendance is negative, but that this is substantially offset by the coefficient on hours. The combined effect for the average pupil will be slightly negative, suggesting that current school attendance has no value in terms of advanced reading achievement.

Finally, column (4) shows that dropping the work variables has little effect on the schooling coefficients, except for the contradictory coefficients on current school attendance. So, once again, estimates of return to years of schooling are not substantially affected by omitting child work variables.

The main conclusion from Table 12 is that child work only harms the advanced reading score for children who work substantially more than average. In that case, the effect appears to be much more direct than indirect.

▪ 5.5 *Results for the advanced mathematics test*

Finally, Table 13 presents the results for the advanced mathematics test. Column (1) includes the same significant variables as Table 12. However, now sex and years of work are also significant, although years of work has an unexpected sign. As with reading, the move from the easy to advanced test of mathematics has changed the significant aspect of work from simply whether or not the child works to how much they work. From the coefficient on hours of work, the negative effect of working 15 hours is 0.48 (=15x0.032). If added to the (correctly signed but insignificant) coefficient on work, the total negative effect is about 1.5. Adding in the effect of the (incorrectly signed) coefficient on years of work would only reduce the overall effect of work on the test score to less than one for children who had been working for more than two years. As less than half of the children who took this test had worked for more than one year, this suggests that the typical effect of working on the advanced mathematics score is about 1.1.

Table 13: *Estimation Results for Advanced Mathematics Test*

Variable	(1)	(2)	(3)	(4)
Age	0.636**	0.122	0.149 (0.98)	0.143 (1.04)
	(6.82)	(0.87)		
Work	-1.215	-0.939	-0.750	
	(1.53)	(1.27)	(1.00)	
Raven	0.121**	0.076*	0.102**	0.103**
	(3.11)	(2.23)	(3.17)	(3.08)
Female	-0.718*	-0.862*	-0.861*	-0.907*
	(1.89)	(2.17)	(1.95)	(2.10)
Hours of work	-0.030*	-0.027*	-0.025	
	(1.89)	(1.70)	(1.34)	
Years of work	0.355*	0.303	0.384*	
	(1.69)	(1.51)	(2.24)	
Father's schooling	0.074*	0.043 (1.07)	0.031 (0.78)	0.041
	(1.88)			(1.08)
Child's schooling		0.629**	0.524** (3.60)	0.562**
		(4.93)		(3.89)
Attend school			-0.900	-0.413
			(0.79)	(0.69)
School books			0.00023*	0.00025* (2.25)
			(2.10)	
School hours			0.055* (1.65)	0.050 (1.52)
Number of observations	444	444	407	407
R-Squared	0.438	0.479	0.531	0.518
F-Statistics	12.44**	16.71**	15.62**	21.13**
Root mean square error	3.75	3.62	3.50	3.53

Notes: Numbers in parentheses are absolute t-ratios.
* indicates significance at 10% or less.
** indicates significance at 1% or less.

In contrast to the easy mathematics test, working for the family does not appear to reduce the harmful effect of work on the test score.

As before, the effect of adding the child's years of schooling in column (2) on existing coefficients is concentrated mainly on the age coefficient. However, as with the advanced reading test, it reduces the Raven coefficient and increases the size of the female coefficient. It also reduces the size of the work coefficient, suggesting that some of the effect of work on the test score is indirect. The size of the coefficient on child's schooling is not much more than half the typical effect of working. Thus, working can be expected to reduce the score of the typical child by the equivalent of nearly two years of schooling. Thus, work has a much larger effect on the advanced mathematics score than the advanced reading score.

Column (3) shows that the introduction of the current school variables produces a slight further reduction in the (negative) work coefficients, again suggesting that part of the influence is indirect. However, as with the advanced reading test, the coefficients on the current schooling variables are partly offsetting. Nonetheless, it takes fewer hours of schooling to offset the negative school attendance coefficient in this case than in the case of the advanced reading test. Thus, as with the easy tests, current schooling appears to be more important for mathematics than for reading and, consistent with that, more of the adverse effect of work is indirect.

Finally, column (4) shows, once again, that the bias from leaving child work variables out of the equation has little effect on the estimates of the returns to schooling.

The main conclusion from Table 13 is that work does reduce the advanced mathematics test score, and that a fair proportion of that effect is indirect. In addition, the harmful effect is greater for those that work above average hours.

6. Conclusions

This paper has presented the results of applying a new method of analysing the effects of child work on learning achievement, based on a dataset that is unusually rich in providing information on work, schooling and test results. The findings demonstrate the value of this new analysis, and of collecting data of this sort.

The results show that work has a substantial effect on learning achievement in the key areas of reading and mathematics. It is worth noting that the significance of the work variable is substantially higher than that obtained by either Patrinos and Psacharopoulos (1997) or Akabayashi and Psacharopoulos (1999). This may well be the result of using more accurate measures of achievement, and controlling for innate ability, although there were also differences in sample characteristics and statistical methodology.[19] This suggests that our understanding of this important topic could be furthered by the collection of data of this sort from other countries. Despite the demonstrated importance of work, its omission was not found to substantially bias estimates of returns to schooling.

[19] The sample sizes in this paper are larger than those in Akabayashi and Psacharopoulos (1999) but smaller than those in Patrinos and Psacharopoulos (1997). The use of predicted rather than actual values in Akabayashi and Psacharopoulos may also have contributed to the frequent insignificance of estimated effects. They used predicted values to avoid the bias that could result from using endogenous variables. As argued in section 4, this problem of bias is likely to be much smaller in this paper because of the use of innate ability as a control variable.

Although these results confirm the accepted wisdom of the effects of work on learning achievement, they introduce a new view of how that arises. First, these effects are substantial even though section 3 showed that work had relatively little impact on school attendance. Second, section 5 showed that a substantial proportion of the effect is direct rather than indirect, via schooling. This is important because much of the work on the educational harm of child work has focused on its effects on schooling.

The direct link between work and learning achievement, holding education constant, could be because of exhaustion or because of a diversion of interest away from academic concerns. However, it could also be caused by those children who work being innately less interested in academic achievement. This latter possibility needs further investigation, as it would imply that it is not work that harms educational achievement, but a lack of motivation that affects both work and learning. If it were true, efforts to improve the educational qualifications of children should be aimed at designing school curricula to stimulate children's interest, rather than simply discouraging child work.

As well as these major conclusions, it is interesting to note some of the detail of the results in section 5. Schooling was more important in mathematics than it was in reading. In addition, the advanced tests were less affected by whether a child worked than by the amount of work that they undertook. It is also worth noting the way that working for the family eliminated the harmful effect of work on the easy mathematics score. This has important implications for judging the relative harm of work for the family and work elsewhere. As far as gender is concerned, girls were found to do worse in all the tests, even allowing for their lower Raven scores. Girls also carry out more housework, which was shown to reduce the easy mathematics score.

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WHAT IS THE EFFECT OF CHILD LABOUR ON LEARNING ACHIEVEMENT? EVIDENCE FROM GHANA

This paper analyzes the links between child labour and poor school performance, using data gathered in Ghana in recent years. Author Christopher Heady moves away from conventional studies on child labour and education, which tend to focus on low school enrolment and attendance. He goes further, to examine the day to day impact of child labour on those in school, finding that, as well as leaving children too tired to learn, child labour robs them of their interest in learning. Children who are already contributing economically to their family income may be less interested in academic achievement, resulting in lack of motivation that affects both their learning and their future prospects.

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