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Contents:



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**Abstract**

This paper presents a dynamic model of child labour supply in a farming household. The model clarifies the roles of land, income and household size, allowing labour and credit market imperfections. If labour markets are imperfect, child labour is increasing in farm size and decreasing in household size. The effect of income is shown to depend upon whether the effective choice is between work and school or whether leisure is involved. Credit market constraints tend to dilute the positive impact of farm size and reinforce the negative effect of income. The model is estimated for rural Ghana and Pakistan. A striking finding of the paper is that the effect of farm size at given levels of household income is significantly positive for girls in both countries, but not for boys. This is consistent with the finding, in other contexts, that females exhibit larger substitution effects in labour supply. Increases in household income have a negative impact on work for boys in Pakistan and for girls in Ghana but there is no income effect for the other two groups of children. We find interesting effects of household size and composition, female headship, and mothers' post-secondary education.

**Keywords:** Child labour, poverty, female education, agricultural households, Ghana, Pakistan.

**JEL Nos.:** J22, O15.



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## Summary

### Objectives, Approach & Definitions

- We investigate child labour on family farms in rural Ghana and Pakistan.
- We propose a two-period model of child labour in a farming household that faces labour market and credit market imperfections and we clarify the expected impact of farm size and household income on child labour.
- Children are defined as 7-14 year-olds in Ghana and 10-14 year-olds in Pakistan.
- The sample is restricted to households that own or operate agricultural land.
- The dependent variable is hours of child labour and we use the tobit estimator.
- The potential endogeneity of household income and farm size is taken into account. For household income the OLS coefficient is shown to carry a significant positive bias.

### Theoretical Results

- Labour market imperfections create a positive effect of farm size on child labour.
- For a given farm size, household size should have a negative impact on child farm labour. This contrasts with the positive effect suggested in existing work.
- Credit market constraints tend to reinforce the negative effect of

income and dilute the positive impact of farm size, controlling for income.

## Descriptive Statistics

- The incidence of child farm labour is greater in Ghana than in Pakistan. Data on hours of work in the reference week show farm work to be a half-time job in both countries.
- It is much more common for farm working children to combine work with school in Ghana than in Pakistan, and in Pakistan it is especially uncommon amongst girls.
- A substantial proportion of children in Pakistan work for wages outside the home in addition to working on the household farm or enterprise but child work in Ghana is exclusively for the household.
- In both countries, a large fraction of children was neither in work nor in school when surveyed.
- The gender differential in school attendance in rural Pakistan is much larger than in rural Ghana. Girls in Pakistan are more heavily engaged in farm and wage work than boys but they are also more likely to be classed as neither in work nor in school.

## Results of Data Analysis

- For a given level of household consumption, farm size has a positive effect on the labour of girls in both countries but does not affect boys' work.

- The mode of operation of land (rent, sharecropping, etc) has effects on child labour for given acreage.
- Increases in household income decrease the work of boys in Pakistan and girls in Ghana but there is no income effect on the work of other children.
- Child labour does not increase with household size for any of the four groups of children. For boys in Pakistan and girls in Ghana household size has a negative impact.
- The age-gender composition of the household has a greater influence on child work in Pakistan than in Ghana. While children of the household head are less likely than other children to be in work in Ghana, the converse is true in Pakistan.
- Female-headship significantly increases the work of all children other than boys in Ghana. The marginal effects are larger in Pakistan, whereas the incidence of female headship is enormously greater in Ghana.
- Mothers' secondary education has a negative impact for boys and girls in Pakistan and for boys in Ghana. In contrast, a negative effect of father's education is observed only for Pakistani girls.
- Controlling for household resources, there are some substantial effects of community variables measuring access to school, rainfall / irrigation and economic infrastructure.
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## 1. Introduction

In Ghana and Pakistan, as in most developing countries, the vast majority of working children are engaged in agricultural work and this is predominantly on farms owned or operated by their families (see ILO, 1996). Since land is the most important store of wealth in agrarian societies and a substantial fraction of households do not own land, this casts doubt on the commonly held presumption that child labour emerges from the poorest households (e.g., US Department of Labor (2000), Basu and Van (1998)). The theoretical literature on child labour has emphasised credit market imperfections (see Ranjan (1999), Lahiri and Jaffrey (1999)) to the relative neglect of labour market imperfections. Indeed, a well-functioning labour market is central to the seminal paper on the economics of child labour by Basu and Van (1998). This paper emphasises that labour market failure may explain the prevalence of child work on household farms and enterprises, and our theoretical model integrates this with credit market failure.

The intuition for why asset ownership may increase child labour is straightforward. The marginal product of the family worker (the child) is greater the greater the stock of productive assets owned by the household. Therefore, if households with relatively large plots of land find it difficult to hire in workers to work on the farm (imperfect labour market), then they have an incentive to employ their children, as long as the wealth effect of land ownership is not so large as to dominate.

To the extent that households smooth their consumption over the lifecycle, we would expect their consumption in any period to reflect their assessment of their lifetime wealth, including the value of their land. Therefore, conditioning on consumption (which may be expected to produce a negative effect on child labour if child leisure and education are normal goods), we expect farm size to mainly capture the (positive) substitution effect on child labour (see Section 4). It is therefore interesting to examine, as is done in this paper, the separate effects of farm size and consumption in a dynamic model estimated on data that isolate the children of farming households. Existing empirical studies tend to include one or the other of farm size and consumption but seldom both, and most aggregate over all types of child work across rural and urban regions of a country. This makes their results difficult to interpret.

Section 4 specifies a two-period model of child labour that shows it to be a function of both assets and income and that clarifies the interpretation of their coefficients under imperfect labour and credit markets. It explicitly allows for the accumulation of both work experience and educational capital. The returns to work experience on the household farm may be particularly high for children that expect to inherit their parent's land.

A difference between Ghana and Pakistan that is of particular relevance in this paper is that the land-labour ratio is greater on average in Ghana than in Pakistan. Other things being equal, households in Ghana may thus be expected to employ more children on the household farm- and this, we find, is indeed the case (Table 1). A related fact is that the wage labour market is better developed in

rural Pakistan than in rural Ghana (e.g. 36% of adult men work for wages in rural Pakistan and only 22% in rural Ghana). If this means that it is easier in Pakistan to hire in workers on large farms instead of using child labour, then it is again consistent with the observed fact that Ghana has a greater fraction of children working on household farms. However, this does not imply that children are better off in Pakistan. While no children in the Ghana sample are in wage employment, 6% of boys and 12% of girls aged 10-14 in Pakistan are, and their school attendance rates are particularly low (see Table 1). Within rural Pakistan, our data show that households that send children in to wage work are poorer on average than households that employ children on the family farm. Therefore the prevalence of child wage work in Pakistan in contrast to Ghana is consistent with the greater incidence of poverty in Pakistan as compared with Ghana (Ray (2000) estimates that 27% of households in Pakistan fall below the median income per adult-equivalent as compared with 14% in Ghana). These descriptive facts motivate the analysis and underline the importance of conditioning simultaneously on income and assets.

The underlying question of interest is whether child work on the farm is a choice determined by, for example, relatively high returns to experience, or whether it is the result of household poverty, poor school access, or the difficulties of hiring in farm labour. We explore large and rich data sets for two countries in a comparative light with a view to furthering our understanding of this question. Unlike most studies on this subject, we instrument income and land. The estimated equations provide estimates of the total impact of land size, land tenure-type, household consumption, household size,

parents' education and other relevant variables on child labour. These permit consideration of the effects on child labour of, for example, land redistribution, income transfers and fertility change.

The paper is organised as follows. Section 2 oulines some of the contributions of this paper in the context of the existing literature. Section 3 presents a descriptive analysis of the extent and nature of child labour in the rural areas of Ghana and Pakistan. The question of whether child labour is a "bad thing" or whether some farm work may just be good exercise and practical training[1] depends upon the hours spent in such work and the extent to which it conflicts with school. This is discussed in Section 3, and compared across the two countries. Section 4 presents a two-period model of child labour in a peasant household that has limited access to the labour market. An empirical specification of the model is discussed in Section 5. Tobit estimates of an equation explaining the variation in hours of child work are presented in Section 6, and Section 7 concludes.

## 2. The Literature and Contributions of this Paper

### ***Modelling the impact of farm size and household income on child labour***

The canonical model of the consuming and producing agricultural household is probably that of Strauss (1986). Benjamin

[1] Cigno, Rosati and Tzannatos (1999), for example, find no difference in the health status of working children and school-going children in India and they find that children that are neither in work nor in school are the least healthy. Bekombo (1981), for instance, emphasises the

(1992) extends this to show that if consumption and production decisions are separable then labour usage on the household farm will be independent of household composition. However, if labour markets are imperfect, then separability is violated and farm labour usage is a function of household composition. In an interesting development of this model, Cockburn (2000) shows that, in the non-separable case, child labour is a function of the stock of land and other assets. He finds that some assets (e.g., livestock, land) increase child labour in Ethiopia while others reduce it (e.g., oxen, ploughs). He does not condition on household income and the asset effects contains both income (wealth) and substitution effects.

We model child farm labour as depending upon both farm size and consumption. The interpretation of these coefficients is clarified using the theoretical framework developed in Section 4, where the role of credit constraints is also explicated. Our model also incorporates returns to experience and education by introducing a second period for when the child has grown up.

## ***Evidence on Effects of Farm Size and Household Income on Child Labour***

Early empirical work on child labour consisted largely of case studies that interviewed working children. Large scale representative

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importance of work experience for children in rural Africa.

household surveys have the advantage of providing information about children who do and do not work, thereby making it possible to investigate the decision to work. Since these large survey data have become widely available in the last decade, economists have estimated reduced form participation equations for child work and schooling for a range of countries (for example, see Canagarajah and Coulombe (1998), Grootaert and Patrinos (1998), Jensen and Nielsen (1997), Jensen (1999), Kassouf (1998), Patrinos and Psacharopoulos (1997), Ray (2000), Blunch and Verner (2000)) and this work has contributed to an increased understanding of the correlates of child labour.

However, this research displays a variety of effects of income and farm-size and the two variables tend not to be included in the same equation. Whether household poverty is measured as household income or consumption, the adult wage rate, or as assets such as land, the existing literature has failed to establish a systematic relation of child work and poverty.

Although a positive relation of child work and poverty is plausible and is often assumed, it is unsurprising, for the reasons that follow, that it is not systematically identified by empirical analysis of child labour. First, when productive assets are used to proxy income, a positive substitution effect will tend to get entangled with the expected negative effect of income. Second, most existing studies do not instrument household income and this would tend to create an upward bias in its coefficient[2]. Third, almost all of this work has

2 See, for example, Psacharopoulos (1997), Patrinos and Psacharopoulos (1997), Kassouf (1998), Canagarajah and Coulombe (1998), Kanbargi and Kulkarni (1995), Grootaert (1998), Blunch and Verner (2000) and Cockburn (2000). Grootaert (1998) acknowledges that income (or

aggregated child work on the household farm or enterprise with work for outside employers and also with domestic work where the relevant data are available. It has also tended to pool data for rural and urban sectors of the economy and for boys and girls. If there are negative income effects in some sub-groups but not others, aggregation will tend to obscure them. Our specification addresses each of these issues

We regress hours of child work on household income, farm size, mode of operation of land, household size, household composition, and other control variables, separating samples by gender. We thus include both household income and farm size as regressors and we instrument both. A comparison of estimates with and without instrumental variables on our data underline the importance of IV. We restrict attention to rural areas and to work on land owned or operated by the child's family. In a departure from much of the literature, we select in to our samples only those households that own or operate land. It is only in such households that working on the family farm is a choice! Neglecting to select out the landless households would bias the coefficient on farm size. Indeed, our investigation of this showed that every other variable in the equation was wiped out by the stunning explanatory power of farm size when the equation was estimated on a sample including landless households. Unlike other studies of child labour, we control

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expenditure) is likely to be endogenous and argues that this is dealt with in his analysis of child labour in the Cote d'Ivoire by replacing income with a dummy for whether or not the household falls into the lowest income quantile. In fact, this dummy is of course endogenous as well- the author does not solve the problem by throwing away information on income. Ray (2000) also uses a dummy for whether the household is above or below a poverty line but he deducts the child's contribution to household income (using certain assumptions to impute a wage to unpaid child workers). This will not solve the endogeneity problem if child and parent labour supply are simultaneously determined.

for the mode of operation of land. Existing work has tended to concentrate on the participation decision. However, the data on hours of work of children exhibit substantial variation, with many children working less than 10 hours a week. From a policy perspective, participation at 10 hours a week is rather different from participation at 40 hous a week. We therefore utilise the information on work hours by estimating tobit models.

## 3. Prevalence and Intensity Of Child Labour

The data are drawn from the Ghana Living Standards Survey (GLSS) for 1991/2 and the Pakistan Integrated Household Survey (PIHS) for 1991. These are large nationally representative surveys collected by the respective national governments in cooperation with the World Bank. The GLSS collects data on employment for persons 7 years or older whereas the cut-off is at the age of 10 in the PIHS. The structure and coverage of the two data sets is sufficiently similar to allow some interesting cross-national comparisons. Table 1 presents a comparative profile of child activities in *rural* areas for 7-14 year olds in Ghana and 10-14 year olds in Pakistan and Table 2 presents hours of work. The following discussion is based upon these Tables. A more detailed discussion of the data on the activities of children grouped into the age ranges 7-9, 10-14 and 15-17 is presented in Bhalotra and Heady (2000).

In Ghana, 41% of boys and 34% of girls undertake work on the household farm. In Pakistan, the corresponding participation rates are 22% and 28%. Farm work is, on average, a half-time job for

children[3]. Notice the wide dispersion in work hours around the mean, which underlines the importance of explaining hours and not just work participation.

Of Ghanaian children who work on the household farm, three in four boys and two in three girls are at the same time in school. In Pakistan, this is true of one in two boys. Girls in Pakistan are in a class apart, as only one in ten of those who work on the farm attends school. It would appear, therefore, that combining farmwork and school is considerably easier in Ghana than in Pakistan and that it is especially difficult (or not preferred) for Pakistani girls.[4] Heady (1999) finds that working affects school performance in Ghana, even though it does not affect school attendance. This is not surprising since the hours of work involved are not trivial. We do not have the relevant data to investigate school performance for Pakistan.

A striking difference between the two countries is that a significant fraction of children in Pakistan are engaged in work outside the household, whereas child participation in wage work in Ghana is close to zero[5]. School attendance in Pakistan shows a remarkable gender differential, much greater than that in Ghana. In both countries, a substantial proportion of children neither work nor

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[3] For all types of work except housework, this refers to the answer to the question : "how many hours per week did you normally work?" Only 5 children reported working at more than one occupation at the same time, so secondary work was ignored in the interests of simplicity. Individuals may be engaged in housework as well as the main occupation.

[4] The correlation of school attendance (a binary variable for the individual) with work-participation and hours of work was examined for 7-17 year olds, holding constant age, household size, current household expenditure per capita, and all cluster-specific effects. The conditional correlation of work participation with school participation in Ghana is (unexpectedly) positive but increasing hours of work did appear to reduce the probability of school attendance. In Pakistan, both participation and hours of child work are negatively correlated with school attendance (results available from the authors).

[5] Wage work in Pakistan is analysed in Bhalotra (1998).

go to school and 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 (Ravallion and Wodon (2000) find support for this for the case of Bangladesh).

## 4. A Two-Period Model of Child Labour

This section develops a model of the peasant household in an economy with ill-functioning labour markets. Allowing two periods, we are able to capture the impact of child work in period 1 on productivity in period 2. This arises through the child gaining work experience and, typically, having lower educational attainment. We analyse the effects of farm size on child labour, distinguishing substitution and income effects. Controlling for income (or consumption) in addition to farm size is of direct interest and also gives the farm size coefficient a clearer interpretation. The model also demonstrates the impact of credit market imperfections, showing that they will tend to dilute the positive substitution effect of farm size and reinforce the negative income effect on child labour.

### ***Model Specification***

Consider a peasant household containing parents and children, which has no access to a labour market. Divide its life span into two

periods. In the first, the parents produce output on the farm using land, their own labour and possibly their children's labour. During this first period, the children may also attend school. In the second period, the children have grown up and may even have left the family home, but the household continues to value their consumption as part of the household's total.

In the first period, superscripted 1, household income is given by a farm production function:

$$Y^1 = F^1(A, L_p^1, L_c^1) \qquad (1)$$

where A is land area and L is labour, with the subscripts p and c differentiating between labour supplied by parents and children. In the second period, since the children might have left home, their contribution to family income is separate from household farm production and household income is given by:

$$Y^2 = F^2(A, L_p^2) + W_c^2(S, L_c^1).L_c^2 \qquad (2)$$

We have allowed the child's wage in the second period to be a function of her first period labour supply ($L_c^1$) and schooling (S). W does not have to be an explicit wage: if the child grows up to work on her own farm, W is her marginal product.

The household has a utility function that is separable between the two periods:

$$U = U^1(X^1, L_p^1, L_c^1, S) + U^2(X^2, L_p^2, L_c^2) \qquad (3)$$

where X is consumption. We assume that children under 15 do not bargain with their parents. Their only fallback option may be to run away from home and this may be thought especially unlikely among land-owning households since children may expect to inherit the land if they remain attached to the household. It may be important to allow the child labour decision to be influenced by the relative bargaining powers of the mother and the father of the child (e.g. Galasso, 1999) but our data do not have variables ("extra environmental parameters"- see McElroy, 1990) that can be used to denote these relative powers in an empirical model. In view of this constraint, the household is specified as maximising a common utility function[6].

The household inherits some (positive or negative) financial wealth from a period zero that is not modelled. Call this $K^0$. Then financial wealth in period 1, $K^1$, is given by:

$$K^1 = K^0 + F^1(A, L_p^1, L_c^1) - X^1 - C(S) \qquad (4)$$

where C(S) is the cost of schooling and the price of consumption is normalised to unity. The financial wealth available to the household in period 2 will depend on that in period 1, but will also depend on the household's access to financial services. Under imperfect capital markets, the interest rate facing the household will depend upon its wealth. For households with negative financial wealth (debt), the interest rate will additionally depend on characteristics that affect

[6] Bhalotra (2000) investigates whether parents who set their children to work are selfish.

their perceived credit-worthiness including personal characteristics (Z) and ownership of land (A). Let us represent this relationship between wealth in the two periods by the function $K^2 = G(K^1, A; Z)$. This implies the following budget constraint for period 2:

$$X^2 = F^2(A, L_p^2) + W_c^2(S, L_c^1).L_c^2 + G(K^1, A; Z) \qquad (5)$$

The household attempts to maximise (3) subject to (4) and (5).

The First-order Conditions

The first-order conditions most relevant to the child labour decision are as follows:

$$\frac{\partial U^1}{\partial X^1} - \lambda^1 = 0 \qquad (6)$$

$$\frac{\partial G}{\partial K^1}.\lambda^2 - \lambda^1 = 0 \qquad (7)$$

$$\frac{\partial U^1}{\partial L_c^1} + \frac{\partial F^1}{\partial L_c^1}.\lambda^1 + \lambda^2.\frac{\partial W_c^2}{\partial L_c^1}.L_c^2 \le 0 \qquad (8)$$

$$\frac{\partial U^1}{\partial S} - \frac{dC}{dS}.\lambda^1 + \lambda^2.\frac{\partial W_c^2}{\partial S}.L_c^2 \le 0 \qquad (9)$$

where $\lambda_1$ and $\lambda_2$ are the Lagrange multipliers on (4) and (5), and the inequalities in (8) and (9) become equalities when child labour and schooling, respectively, are positive. The work-leisure choice is made with reference to equation (8). This states that the value of the

marginal product of child labour in the first period plus the value of the wage increase in the second period (arising from work experience) must be less than or equal to the marginal (dis)utility of work. Equation (9) has a similar interpretation for the choice between leisure and school attendance. Combining (8) and (9) gives:

$$\{\frac{\partial U^1}{\partial L_c^1} - \frac{\partial U^1}{\partial S}\} + \lambda^1.\{\frac{\partial F^1}{\partial L_c^1} + \frac{dC}{dS}\} = \lambda^2.L_c^2.\{\frac{\partial W_c^2}{\partial S} - \frac{\partial W_c^2}{\partial L_c^1}\} \qquad (10)$$

which is the relevant condition if hours of child leisure are fixed and one is interested in the reallocation of an hour of child time from work to school.

***<u>The Estimated Equation</u>***

The choice variables can be expressed as functions of the exogenous variables, land size (A) and initial wealth ($K^0$). Substituting out the terms in condition (8) and solving gives us an expression for the quantity of interest, namely the quantity of child labour supplied in period 1:

$$L_c^1 = H(A, K^0; Z, e) \qquad (11)$$

where Z is a vector of observable household characteristics that affect the objectives and constraints of the optimisation problem. This includes the costs of schooling *(C(S))*, and also access to credit, land productivity, and household size and composition. Unobservable characteristics and optimisation errors are captured by the random

variable, *e*.

Note that child labour supply in period 1 will be zero if (8) is satisfied by an inequality when evaluated at zero hours. This would be equivalent to the implicit wage being below the reservation wage. Thus, a tobit model is used to take account of the fact that the left-hand side variable is constrained to be non-negative.

Equation (11) cannot be estimated directly because initial financial wealth, $K_0$, is unobservable. This difficulty is dealt with by noting that consumption in period 1 is also a choice variable, and therefore a function of all the variables on the right-hand side of (10). This function can be inverted to give:

$$K^0 = K(A, X^1; Z, e) \qquad (12)$$

It is then possible to substitute (12) into (11), to obtain:

$$L_c^1 = H'(A, X^1; Z, e) \qquad (13)$$

It is this equation that we estimate.

***Impact of a Change in Farm Size***

Interpretation of the parameter estimates of (13) requires an understanding of how the estimated coefficients relate to standard

concepts in the theories of labour supply and household decision-making. This is best achieved by analysing the Hicksian supply function for child labour that follows from the household maximisation problem:

$$L_c^1 = L_c^1(w_c^1, r, U; Z, e) \qquad (14)$$

where $w_c^1$ is the implicit wage for child labour in period 1, obtained by partially differentiating the production function, and r is the (marginal) interest rate implied by the function G(.). The second period child wage is not included in (14) because it is completely endogenous. Parents' wages do not appear because we assume that child labour is separable from parent labour or that parents' labour supply has only income effects on child labour supply.

For reasons discussed in the Introductory section, we are particularly interested in the effect of the size of land holdings (A) on child labour. We are now in a position to see that a change in land area (or initial wealth) will produce changes in all five arguments of (14):

$$\delta L_c^1 = \frac{\partial L_c^1}{\partial w_c^1}.\delta w_c^1 + \frac{\partial L_c^1}{\partial r}.\delta r + \frac{\partial L_c}{\partial U}.\delta U \qquad (15)$$

The first term on the right-hand side of (15) is a standard substitution effect, denoting the increased marginal productivity of labour (higher implicit wage) that follows from an increase in the land-labour ratio. The second term is also a substitution effect, reflecting the effect of the

(marginal) interest rate on the balance between current benefits and future costs of child labour. This term would be zero if there were perfect capital markets since interest rates would then be independent of household wealth. However, more generally, one would expect changes in land area and initial wealth to affect the interest rate that the household faces. The final term in (15) is the income effect, expressed in terms of changes in *utility*. This denotes the important fact that the income effect spans both periods and involves changes in consumption as well as leisure. The following section looks more carefully at this.

***The Income Effect***

The preceding section derived the total impact of a change in farm size on child work and showed that it contains income and substitution effects. In this section, we concentrate on analysis of the income effect. Total differentiation of the 2-period utility function, (3), followed by some manipulation using the first-order conditions gives:

$$\delta U = \frac{\partial U^1}{\partial X^1}.\{\delta X^1 - w_p^1.\delta L_p^1 - w_c^1.\delta L_c^1 + \delta C\} + \frac{\partial U^2}{\partial X^2}.\{\delta X^2 - w_p^2.\delta L_p^2 - W_c^2.\delta L_c^2 - \delta W_c^2.L_c^2\} \quad (16)$$

where $\delta C, W_c^2, \delta W_c^2$ represent the change in schooling costs, the second period child wage, and the change in the second period child wage.

Equation (16) shows that a change in utility involves not only changes in consumption in the two periods but also changes in labour supply and schooling. These, in turn, impact upon the second period child wage. Equations (8) and (9) show the following. First, a change

in the optimal level of schooling will result in changed school costs, and these must be added to first period consumption. Second, the altered optimal levels of schooling and child labour supply in the first period will change the second period child wage and this change must be added to second period consumption. Substituting (16) into (15) results in:

$$\delta L_c^1.\{1+\frac{\partial U^1}{\partial X^1}.w_c^1\} = \frac{\partial L_c^1}{\partial w_c^1}.\delta w_c^1 + \frac{\partial L_c^1}{\partial r}.\delta r$$
$$+\frac{\partial L_c^1}{\partial U}.[\frac{\partial U^1}{\partial X^1}\{\delta X^1 - w_p^1.\delta L_p^1 + \delta C\} + \frac{\partial U^2}{\partial X^2}\{\delta X^2 - w_p^2.\delta L_p^2 - W_c^2.\delta L_c^2 - \delta W_c^2.L_c^2\}] \quad (17)$$

The term in paretheses on the left-hand side of (17) is simply a scaling factor that takes account of the fact that some of any extra utility from the additional land or capital is likely to arise through a reduction in child labour. If taken across to the other side of the equation, it will affect the magnitudes of the income and substitution effects proportionally.

The expression in square brackets on the right-hand side of (17) represents the income effect in terms of separate expressions for period 1 and period 2 utilities. In the empirical model, we expect that expenditure in Period 1 ($X^1$) will capture the effects of school costs, ($X^2$)[7], and changes in parent labour supply (because of our assumption of separability of parent and child labour).

***Interpretation of Farm Size and Consumption Coefficients***

[7] This is because consumption in Period 2 depends upon the same set of exogenous variables as consumption in Period 1 and because of consumption smoothing.

The estimated equation, (13), contains land size (A) and first-period consumption ($X^1$). The discussion in the preceding two sub-sections allows us to provide a clear interpretation of their coefficients. Several empirical studies of child labour include one or both of these variables but there has been no attempt to interpret their coefficients in the context of a theoretical model.

An increase in farm size will generate two sorts of substitution effects, one associated with a change in the implicit child wage rate (more land implies higher marginal product of labour) and the other associated with a change in the interest rate that the household faces (land as collateral). The first will tend to increase child labour while the second will tend to decrease it. Given separability of parent and child labour supply, any change in parent labour induced by a change in farm size will translate into an income effect, captured by the consumption variable. An increase in farm size will also have direct wealth effects. For example, it will increase productivity of farm labour holding the labour input constant, or parents may reduce their labour input, enjoying the increased wealth as leisure. To the extent that they reduce the child's labour input, expenditure on education will rise. We expect these effects to be reflected in household consumption. Controlling for consumption, we expect the farm size coefficient to reflect the substitution effects.

***Household Income***

If households have sources of financial wealth other than land, then cross-sectional differences in consumption will reflect differences in total wealth rather than just differences in land

ownership. The influence of income (or financial wealth other than land) in the model comes through the shadow prices, $\lambda^1$ and $\lambda^2$, with a high price being associated with a low level of permanent income. Under perfect capital markets, lower income will create an equal proportionate increase in $\lambda^1$ and $\lambda^2$ (see equation (7)). It follows from (8) that this will result in an increase in child work. It is worth noting that this negative income effect is unambiguous because leisure is normal. In (10), where the effective choice is between work and school with leisure fixed, this depends upon the plausible assumption that work is more unpleasant at the margin than school ($\partial U^1/\partial L_c^1 - \partial U^1/\partial S < 0$).

***Imperfect Capital Markets***

This sub-section isolates from the preceding discussion, the effects of imperfect credit markets. The farm size coefficient, which is expected to be positive when picking up the standard substitution effect, will be less positive if land serves as collateral. Recognition of this may help explain a small or non-positive effect of farm size on child labour in some samples.

Credit constraints will reinforce the negative income effect on child work described above for the perfect capital markets. This is because low-income households are more likely to face credit constraints. A sudden reduction in a household's finances will increase the current period's shadow price, $\lambda^1$, without a corresponding increase in the shadow price for period 2, $\lambda^2$, resulting in an increase child work in the current period. (The vector Z therefore includes variables that capture the economic vulnerability

of the household (see Section 5.).

*To summarise, controlling for current-period consumption in addition to farm size offers the following advantages.* (1) It allows for income effects on child labour arising from sources of wealth other than land. (2) It is of direct interest since household per capita food expenditure is a conventional measure of *household poverty*. (3) It allows us to interpret the farm size coefficient as a substitution effect, whereas without consumption held constant, this coefficient would combine income and substitution effects. The distinction is of policy interest. For example, we may face a choice between land reform and income transfers and the relative efficacy of these interventions in reducing child labour will depend upon the relative size of these effects. Our model shows that this will hinge not only on preferences and the long run net returns to work experience and education, but also on whether the effective choice is between work and school or between one of these activities and leisure, as well as upon the extent of labour market failure relative to credit market failure.

## 5. An Empirical Model and Estimation Issues

The *dependent variable* in the estimated equations is the hours of child work on farms owned or operated by the household. Since not all children have the option to work on the family farm, we use the *sub-sample* of households that operate land. In rural Pakistan, 36% of households own land and 51% operate land. Ownership, at 49%, is not dissimilar in rural Ghana but there are more ways of sharing land and 90% of households operate some land. Since many children do not participate in farm work, we use the tobit estimator. All reported

standard errors are robust (e.g. White, 1980), and adjusted to permit observations within clusters (primary sampling units) to be correlated (e.g. Deaton, 1997).

***Potential Endogeneity of Income and Land***

The main estimation issue arises from the fact that child labour contributes to household income, making the income variable endogenous. Since children working on the family farm are not paid a wage, their contribution cannot be deducted from total income. Even if we could observe child income the endogeneity problem would not be resolved by subtracting it from the total if the labour supply of different household members is jointly determined. We therefore instrument income using the following procedure which gives consistent estimates when the dependent variable is censored (see Smith and Blundell, 1986). Suppressing individual subscripts, let the main equation, for hours of work (H), be written as:

$$H^{*} = X\beta + Y\gamma + e \qquad (19)$$

where hours (H) is a censored endogenous variable, X is a vector of exogenous variables and Y is a measure of household living standards, which is endogenous. The auxiliary equation describing Y in terms of exogenous variables Z (Z includes X) is:

$$Y = Z\pi + u \qquad (20)$$

The error terms e and u are assumed to be jointly normally distributed. Let $e = u\alpha + \varepsilon$. Substituting for e in (19) gives the conditional model,

$$H^{*} = X\beta + Y\gamma + u\alpha + \varepsilon \qquad (21)$$

where u is an estimate obtained by OLS estimation of (20), and (21) can be estimated by the standard tobit procedure. It can be very difficult to find appropriate instruments for income, but the availability of community-level variables in our household surveys offers instruments that are not only valid but fairly efficient. We find that the estimates change significantly upon instrumenting income and that the OLS estimates carry a bias in the expected direction.

It is reasonable to assume that land owned is exogenous because it is typically inherited rather than purchased. This, however, may not be a valid assumption for land rented or sharecropped. To take account of this, land operated was instrumented with land owned. Since there was no significant difference in the estimates and the Smith-Blundell test rejected exogeneity, we have dropped the land-size residual in the interests of efficiency.

***Variables***

The equations include a quadratic in *child age*. Since the incentive to put a child to work on the farm depends upon the size of the farm relative to the size of the available pool of family labour, we include not only farm size but also household size and composition as regressors. Given farm size, we expect household size to have a negative impact on child work. Unlike many other studies focused on rural farm labour, we include indicators for the *mode of operation of land* (*sharecropping*, *rent* in both countries and, additionally, whether

*free* or *village land* in Ghana)[8]. For Ghana, we have a further variable which records the *number of plots of land.* This is less relevant in Pakistan where family land holdings tend to be consolidated and jointly operated in contrast to regions of sub-Saharan Africa where men and women often have their own plots.

Household income is proxied by *food expenditure per capita*[9], which includes the imputed value of home-produced consumption. This is expected to be smoother than actual income (see Altonji, 1983). Even though rural economies are characterised by imperfect capital markets, there is some evidence that poor households achieve a degree of consumption smoothing (see Townsend (1994) for example). As a measure of household insecurity, we include an indicator for whether the household has a *female head.*

*Province dummies* are included to capture variation in productivity or labour demand. Parents' wages are proxied by *mothers' and fathers' age and educational level.* To the extent that womens' education reflects their bargaining power (by virtue of being an asset that they can take away with them if they leave the household), inclusion of mothers' education as distinct from fathers' education relaxes the unitary modelling assumption implicit in (1). These variables may also have direct effects if children with better educated parents derive more from their education, or are likely to be better informed in job-search (this will affect the dynamic returns to

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8 One rationalisation of the benefits to the landlord from pursuing sharecropping instead of renting the land out or hiring wage labour in, is that it improves the landlord's access to labour by making available the labour of the tenant's family in addition to the labour of the tenant (see Basu, 1997, for example).

9 There is no need to assume a equivalence scale because size and detailed household composition variables are included in the equations. Food expenditure is preferred to total expenditure because the latter will include expenditures on durables which are not as smooth.

education versus work discussed in Section 4). We further relax the simplicity of the theoretical structure by allowing parents to have preferences over children that depend upon *birth order* (evidence of such effects is, for example, in Das Gupta (1987) and Butcher and Case (1994)) and on the *relation of the child to the household head.* Alternative relations include niece, nephew, grandchild, sibling, and it is not unusual in Ghana to find foster children in the household (see Ainsworth, 1996).

Rather than measure expenditure on schooling, we use dummy variables for whether a *primary, middle and secondary school* are present in the community where the child lives. Access may further be influenced by whether there is *public transport* in the community. We include religion and ethnicity variables in order to capture *attitudinal/cultural differences* in the valuation of school and work. This is expected to be especially relevant when looking at girls, towards whom attitudes tend to incorporate greater heterogeneity. Some other community-level characteristics are included so as to control for work opportunities as well as norms at a finer level of disaggregation than the province.

Means for the sub-samples of working and non-working children are in Appendix Tables 1 and 2. The variables used differ between the countries to some extent because of differences in the questionnaires. A comparison of means across these sub-samples, and a comparison of means across the two countries can be found in Bhalotra and Heady (2000).

***Determinants of Child Work***

We first present estimates of a parsimonious model corresponding to equation (13), in which the only variable in the vector Z is household size (Table 3). Estimates of marginal effects for a model with a larger set of control variables are presented in Tables 4 and 5 for the probability of working and for the hours of work conditional on working respectively. The standard marginal effects are multiplied by 0.1 for per capita food expenditure (Y) because this is in logarithms and for household composition variables because these are proportions and, as a result, the effects of a 10% change in these variable can be directly read off the Table.

***Identification of the Effect of Household Living Standards***

Instruments for household consumption are community-level variables[10]. The first stage regression explains 31% of the variation in per capita food expenditure in Pakistan and 29% in Ghana, and the instruments are jointly significant at 1% and 10% respectively. We find that the results change significantly (and in the expected direction) if we do not instrument (see Tables 3-5 and Sections 6.1, 6.2), underlining the importance of employing IV methods in studying the impact of household income on child work. Since most papers investigating child labour do not instrument household income (see Section 2), their estimates will tend to carry upward biases. The rest of this section presents the results, first for Ghana, and then for Pakistan, where contrasts with Ghana are highlighted.

[10] Instruments in Pakistan are the community-level average of household consumption, the percentage of households that own land, the percentage that sharecrop, and indicator dummies for the presence of a railway line and electricity. In Ghana, we simply use dummies for a market and for piped water since other available characteristics (road, post office, grating machine) had no explanatory power in the first-stage regression.

Further analysis and a summary are presented in the concluding section.

### ***6.1. Results for Ghana***

Consider the parsimonious model in Table 3. Farm size has a highly significant positive effect for both boys and girls, the effect for girls being 50% larger than that for boys. Household per capita consumption has an unexpectedly positive effect on child work, and we are unable to reject its exogeneity. Boys from larger households work significantly more while girls' farm labour is independent of household size.

Adding a range of control variables (Tables 4 and 5) makes a dramatic difference to these results. The effects of farm size, consumption and household size all become insignificant for boys. For girls, a significant positive effect of farm size persists, and household p.c. consumption and size both become negative and significant. For girls, therefore, each of the three main variables takes the sign predicted by theory once appropriate conditioning variables are included. In the extended model, as in the parsimonious model, we are unable to reject exogeneity of the consumption variable for boys. However, the null of exogeneity is now clearly rejected for girls.

The rest of this section summarises the effects of the additional variables in Tables 4 and 5. Child characteristics have broadly similar effects for boys and girls. Child work increases with *age* at a decreasing rate. A complete set of *birth-order* dummies was included but their coefficients were poorly determined. They were therefore replaced by a single indicator variable for whether the child in

question was the oldest child in the household. This too was insignificant for both genders and since it is closely related to age, it was dropped. The dummy indicating whether the child was the *child of the household head* (as opposed to nephew, sibling, foster child, etc) is negative for both genders and significant for boys.

Households in Ghana often own several plots of land, with ownership often divided between men and women in a household (e.g. Iversen, 2000). We find a strong positive effect of the *number of farms* operated on hours of work, of similar magnitude for boys and girls. Since this result obtains when controlling for acres of land operated by the household, it suggests not a size effect but an effect associated with the subdivision of land. This merits further micro-level research. The *mode of operation of land* (sharecrop, rent etc) matters.

Girls, but not boys exhibit significantly more hours of farm work in *female-headed households.* Indeed, there are no effects of *household composition* on boys' work. A further significant effect, restricted to girls, is that they work less in households with male or female children under 7 years of age, that is, younger than themselves.

The only significant effect of the parent education variables is that the sons of *mothers with secondary-level education* work less. Since this is at given levels of household living standards, it would appear to reflect preferences rather than resources.

Dummies for *the presence of primary, middle and secondary schools* in the cluster take the expected negative signs and the latter two are

significant for both genders[11]. *Public transport* in the village has a negative effect that is restricted to girls. This is consistent with the hypothesis that distance to school may deter the attendance of girls more than it does that of boys. *Electricity* in the village reduces child work significantly. The use of fertilizers increases child work, significantly in the case of girls. Community leader's responses to whether rain in the year of the survey was heavier than in the preceding year suggest a negative effect of *rainfall* on child labour, significant for boys. *Irrigation* and *tractors* do not have significant effects on child work, nor does the presence of a village *bank*. To avoid clutter, these variables are not shown in the Table. The set of community variables is jointly significant for both boys ($\chi^2_{17}$=34, p>$\chi^2$=0.01) and girls ($\chi^2_{17}$=27.6, p>$\chi^2$=0.05).

The *region dummies* are jointly very significant and have larger effects for girls ($\chi^2_6$=58 for boys and $\chi^2_6$=48 for girls, p>$\chi^2$=0 for both). *Religion* has no systematic effect on boys' work ($\chi^2_2$=2, p>$\chi^2$=0.37) but Christian girls work significantly fewer hours on average than Animist girls who work less than Muslim girls ($\chi^2_2$=5.3, p>$\chi^2$=0.07). The dummies for ethnicity are insignificant for girls ($\chi^2_5$=3.2, p>$\chi^2$=0.67). Boys of Ewe *ethnicity* are significantly less likely to work ($\chi^2_5$=11.9, p>$\chi^2$=0.04).

### ***6.2. Results for Pakistan***

The parsimonious equations in Table 3 show a positive effect of

[11] The significance of cluster-specific (or community) variables in determining child work in Ghana is substantially altered once standard errors are robust and cluster-adjusted. All equations report the correct (adjusted) standard errors.

farm size on girls' work but the positive coefficient estimated for boys is insignificant. Household consumption has the expected negative effect on child work but this is only significant for boys. For both boys and girls, hours of work fall significantly with household size. Weak exogeneity of the consumption variable is rejected for both genders in Pakistan. Replacing IV with standard tobit estimation results in consumption being completely insignificant for both boys and girls. This is consistent with the expected sign of the simultaneity bias.

When additional regressors are included (Tables 4 and 5), all of these effects persist except for the effect of household size on girls' work, which becomes insignificant. Across both genders, the significant coefficients take signs consistent with our theoretical framework. Further consideration of the gender difference in the results is deferred to Section 7. The rest of this section considers the effects of the additional variables.

Child *age* has a positive effect on hours worked, which is much larger for boys than for girls. There are no *birth order* effects. In contrast to Ghana, *children of the household head* in Pakistan are more likely than other children in the household to be at work on the farm. As in Ghana, the *mode of operation* of land impacts on child labour for a given size of farm.

The children of *female-headed households* in Pakistan work significantly more and the effect is bigger for boys than for girls. In Ghana this effect was restricted to girls. These results suggest that there are aspects of illbeing or insecurity in female headed households that household consumption and farm size do not pick up. Controlling for household size, there are some fairly complex

effects of the *age-gender composition of the household* on child work in Pakistan, in contrast with Ghana where these effects were limited. Both boys and girls in Pakistan work less if they have young siblings. We found a similar effect for Ghanaian girls. This contradicts evidence from other regions which finds that children - and especially girls - with more siblings work longer hours on average (see Lloyd (1993) and Jomo (1992)). In addition, girls in Pakistan work significantly less in households with a relatively high fraction of adult men and elderly women. Boys work less in households with a high fraction of 15-19 year-old girls.

There is a significant negative effect of *fathers'secondary education* that is restricted to girls. *Mothers' education* to the level of middle or secondary school has a huge negative effect on child work for both genders, in contrast to Ghana where mothers education reduces the work of boys but not girls.

The presence in the cluster of a *primary school* for girls reduces the farm labour of girls and, possibly because of sibling competition for resources, the presence of a primary school for boys increases girls' farm labour. These school-access variables have no effect on boys' work. The presence of a bus route (public transport) has a negative effect on girls' work, just as in Ghana. Cluster specific variables which have a significant effect on boys' work include positive effects from a *market* and negative effects from a *telephone* and a *canal.* For girls, community-level variables are altogether less significant than for boys. The cluster-level variables are jointly significant at the 10% level for boys ($\chi^2_{11}$=18.2, p>$\chi^2$=0.08) and insignificant for girls ($\chi^2_{11}$=15.3, p>$\chi^2$=0.18).

*Province dummies* ($\chi^2_3$=11.7, p>$\chi^2$=0.0) and *religion* dummies ($\chi^2_2$=17.9, p>$\chi^2$=0.0) are jointly significant for girls though not for boys ($\chi^2_3$=4.5 $\chi^2_2$=2.9, respectively). Amongst girls, Christians work significantly less than Muslims who work significantly less than other Non-Muslims. The tendency for Christian girls to work relatively less was also seen for Ghana. Christians constitute 1.5% of the population and other non-Muslims (mostly Hindus) account for another 3.6%; the vast majority are Muslim.

## 6. Conclusions and Policy Implications

Comparative work is useful in investigating whether there are behavioural patterns relating to child work. While South Asia has the largest number of working children, Sub-Saharan Africa has the highest incidence of child labour. Even though it claims the majority of child workers, the agricultural work of children is severely understudied as compared with the more visible forms of work in Latin America and Asia which involve children in labour-intensive manufacturing. The results of the paper are interesting not only with regard to similarities and differences between Pakistan and Ghana but also with regard to gender differences. These are briefly summarised in this section.

Controlling for household consumption, we identify a positive effect of farm size on girls' work in both countries, and no significant association for boys. This suggests that the substitution effect is larger for girls than for boys, which is consistent with the finding in a range of developed country data sets that female labour supply is more

elastic than male labour supply. It also coincides with the finding that the substitution effect is larger for girls than for boys in the supply of *wage* labour in Pakistan (see Bhalotra, 1998).

There are significant effects of land tenure type (mode of operation) on child labour at given acreage. No other study of child labour has considered this factor at either the theoretical or the empirical level.

We observe a negative relation of child work and household food consumption per capita (our proxy for income) for boys in Pakistan and girls in Ghana, the marginal effect being much larger in the former case. In Pakistan, an increase in per capita food expenditure of 10% is estimated to reduce the probability of boys' work by 5 percentage points (so that, at the mean, the observed participation rate of 32% would fall to 26%) and, conditional on working, the same change in expenditure is expected to reduce hours of work by 1.28 per week. The corresponding effects for girls in Ghana are 2 percentage points and 0.31 hours per week. For comparison with existing empirical work on child labour, it is worth emphasising that we would find weaker income effects if we did not account for simultaneity bias. Section 2 listed reasons why the existing literature may not have identified a positive relation of household poverty and child work, and the potential problems noted there were avoided by careful specification. We nevertheless find no income effect for the other two of the four groups of children in our sample.

Consider possible reasons for the country and gender pattern of the income elasticity. The absence of a negative income effect on the

work of boys in Ghana may be related to the fact that 75% of these boys combine work and school (Table 1). In Pakistan, the absence of an income effect on girls' work is consistent with parents valuing a son's education over that of their daughters. The demand for girls' schooling may be low because of low returns rather than because of household income[12]. It may also be relevant that boys work considerably longer hours than girls on average (Table 2).

It is useful to affirm the plausibility of our results by looking back to the raw data organised by income group. Table 6 presents activity rates and average work hours for children by income quartile. It is only for Pakistani boys that participation rates in farm work decline monotonically with household living standards. The descriptive data are therefore consistent with the tobit estimates of the income effect[13]. Note also that a stronger negative relation of expenditure and child work is observed in the case of wage work (Panel 2, Table 6). School attendance increases steadily with income in Pakistan but does not exhibit a clear income effect in Ghana (Panel 3).

The results obtain upon holding constant region, religion and ethnicity of the household as well as a variety of community characteristics which, amongst other things, are expected to control for demand effects. There is some evidence that access to school affects child labour, especially in Ghana. An interesing finding is that the presence of public transport in the village has a negative effect that is restricted to girls. The negative effect of the presence of a canal

12 Bhalotra (2000) finds higher returns to school for men than for women in rural Pakistan and, in contrast, Glewwe (2000) finds that the return to school for women in Ghana is no lower than the return for men.

13 The negative income effect for girls in Ghana did not appear in the parsimonious model in Table 3, showing that its identification relies upon introducing the set of controls in Tables 4-5

on boys' work in Pakistan and the negative effect of increased rainfall on boys' work in Ghana may indicate the power of interventions that minimise income fluctuations in reducing child labour.

We find that children from larger households are not more likely to work or to work harder. Female headship significantly increases child labour in every case except for that of boys in Ghana. The size of this effect is much larger in Pakistan than in Ghana, where the proportion of female-headed households is enormously larger (30% as compared with less than 3%). There are some interesting and large effects of the age-gender composition of the household in Pakistan, though the corresponding effects in Ghana are weak. Father's secondary education significantly reduces girls' work in Pakistan but has no effect on the labour of the other three groups. Mother's secondary education tends to reduce child hours of work in both countries. In Ghana this effect is restricted to boys but in Pakistan it is significant for boys and girls, and of similar magnitude. These findings reinforce a growing literature on the importance of female education in achieving positive outcomes for children across a range of countries. The magnitude of the effects we find is so large that policy aimed at eliminating child work is best targeted here.

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**Table 1**

**Child Activities**

| | ***Pakistan boys*** | ***Pakistan Girls*** | ***Ghana Boys*** | ***Ghana Girls*** |
|---|---|---|---|---|
| ***Total participation rates*** | | | | |
| *Household Farm work* | 22.1% | 28.1% | 40.5% | 34.4% |
| *Household Enterprise work* | 2.3% | 1.6% | 1.8% | 2.5% |
| *Wage work* | 6.2% | 11.9% | 0% | 0% |
| *School* | 72.8% | 30.5% | 76.5% | 68.9% |
| *None of the above activities* | 14.0% | 42.4% | 12.7% | 20.1% |
| *Domestic work* | n.a. | 99.4% | 89.8% | 96.2% |
| Participation in one activity | | | | |
| *Farm work only* | 8.6% | 21.1% | 10.6% | 9.8% |
| *Enterprise work only* | 0.64% | 1.2% | 0.3% | 1.2% |
| *Wage work only* | 3.2% | 6.8% | 0% | 0% |
| *School only* | 61.3% | 27.6% | 45.0% | 43.3% |
| ***Combinations of types of work*** | | | | |
| *Farm & enterprise work* | 0.91% | 0.09% | 0% | 0% |
| *Hh farm & wage work* | 2.1% | 4.1% | 0% | 0% |
| *Hh enterprise & wage work* | 0.25% | 0.27% | 0% | 0% |
| ***Combination of work & school*** | | | | |
| *Farm work & school* | 10.5% | 2.7% | 29.9% | 24.6% |
| *Enterprise work & school* | 0.50% | 0% | 1.5% | 1.3% |
| *Wage work & school* | 0.74% | 0.73% | 0% | 0% |
| *Number of children* | 1209 | 1096 | 1718 | 1542 |

***Notes**: Rural areas. Ghana: 7-14 year-olds, Pakistan: 10-14 year-olds.*

**Table 2**

**Weekly Hours of Child Farm Work**

| | Household farm | Wage work |
|---|---|---|
| ***Ghana boys*** | 15.5 (13.3) | |
| | N=696 | |
| ***Ghana girls*** | 15.4 (12.9) | |
| | N=531 | |
| ***Pakistan boys*** | 22.5 (18.5) | 44.9 (22.3) |
| | N=267 | N=61 |
| ***Pakistan girls*** | 13.3 (13.8) | 30.9 (15.6) |
| | N=308 | N=73 |

**Notes**: Hours are values reported for the reference week, conditional on participation in the activity in the reference week. Girls' participation has a large seasonal component and so not all participating girls participate in the week before the survey. Figures in parentheses are standard deviations around the means. N is the number of observations (or the number of working children). For Ghana the data refer to 7-14 year olds and for Pakistan to 10-14 year olds.

**Table 3**

**Child Work on the Household Farm: Parsimonious Model**

**Marginal Effects**

| | ***Pakistan boys*** | Pakistan girls | ***Ghana boys*** | ***Ghana girls*** |
|---|---|---|---|---|
| Participation Probabilities | | | | |
| Log p.c. food expend (0.1) | -0.026*** | -0.010 | 0.012*** | 0.0095** |
| Acres (1 acre) x $10^2$ | 0.026 | 0.15** | 0.41*** | 0.60*** |
| Acres$^2$ (1 acre) x $10^4$ | | | -0.31* | -0.30 |
| Household size (1 person) | -0.021*** | -0.013*** | 0.0098*** | -0.0069 |
| *Residual (lpcfdexp)* | 0.022*** | 0.017** | -0.006 | -0.000053 |
| ***Hours Conditional on Work*** | | | | |
| Log p.c. food expend (0.1) | -0.68*** | -0.18 | 0.22*** | 0.16** |
| Acres (1 acre) x $10^2$ | 0.68 | 2.70** | 7.40*** | 10.20*** |
| Acres$^2$ (1 acre) x $10^4$ | | | -5.50* | -5.10 |
| Household size (1 person) | -0.54*** | -0.25*** | 0.18*** | -0.12 |
| *Residual (lpcfdexp)* | 0.59*** | 0.030** | -0.11 | -0.0009 |
| ***N*** | 513 | 473 | 1272 | 1127 |
| *Log likelihood* | -969.82 | -901.27 | -2895.3 | -2278.3 |

**Notes**: Figures are marginal effects at sample means for the change indicated in parentheses in column 1. Based on tobit estimates with *Dependent variable*: hours worked by children on the household farm. Sample: Rural households that operate some land. ***, ** and * denote significance at the 5%, 10% and 12% levels respectively. The regressions included region, religion and ethnicity dummies. Since some regions for Ghana coincided with ethnic groups, they had to be dropped. Variables that were insignificant in all four samples are not shown.

**Table 4**
**Child Participation on the Household Farm**
**Marginal Effects**

| | ***Pakistan boys*** | Pakistan girls | ***Ghana boys*** | ***Ghana girls*** |
|---|---|---|---|---|
| ***Child characteristics*** | | | | |
| Age (1 year) | 0.081*** | 0.033*** | 0.15*** | 0.15*** |
| Age-squared (1 year) | | | -0.0041 | -0.0047* |
| Child of head (0/1) | 0.12* | 0.15** | -0.066** | -0.006 |
| ***Household resources*** | | | | |
| Ln p.c. food expend (0.1) | -0.051*** | -0.017 | 0.0048 | -0.021*** |
| Acres (1 acre) x $10^2$ | 0.069 | 0.20* | -0.071 | 0.36*** |
| Acres$^2$ (1 acre) x $10^4$ | | | -0.00015 | -0.014** |
| ***Farm organisation*** | | | | |
| Number of farms (by 1) | | | 0.046*** | 0.048*** |
| Rent? (0/1) | -0.031 | 0.12** | 0.14*** | 0.14*** |
| Sharecrop? (0/1) | 0.11*** | 0.06 | -0.040 | 0.011 |
| Free farm (0/1) | | | 0.14*** | 0.16*** |
| Village farm (0/1) | | | 0.031 | 0.20*** |
| ***Household structure*** | | | | |
| Household size (1 person) | -0.024*** | -0.011 | -0.0055 | -0.020*** |
| Female head? (0/1) | 0.39*** | 0.22** | 0.036 | 0.080* |
| Males<5(7) yrs (0.1) | -0.079*** | -0.031 | -0.0041 | -0.038*** |
| Males 5-9 yrs (0.1) | -0.059* | -0.090*** | | |
| Males 15-19 yrs(0.1) | -0.049 | -0.051 | -0.0065 | -0.016 |
| Males 20-59 yrs(0.1) | 0.0043 | -0.077** | -0.0057 | 0.024 |
| Males >60 years (0.1) | -0.014 | 0.062 | 0.026 | 0.030 |
| Females<5(7) yrs (0.1) | -0.037 | 0.011 | 0.022 | -0.029** |
| Females 5-9 yrs (0.1) | 0.015 | -0.014 | | |
| Females 15-19 yrs(0.1) | -0.13*** | -0.054 | -0.013 | -0.0084 |
| Females 20-59 yrs(0.1) | 0.019 | 0.003 | 0.00014 | 0.0006 |
| Females >60 years (0.1) | -0.079 | -0.25*** | 0.0086 | 0.17 |
| ***Parents' education*** | | | | |
| Mother mid/sec (0/1) | -1.55*** | -2.17*** | -0.093*** | -0.028 |
| Father secondary (0/1) | 0.12 | -0.52*** | -0.039 | 0.029 |
| ***Community variables*** | | | | |
| Primary school girls (0/1) | 0.11 | -0.17 | -0.043 | -0.064 |
| Primary school, boys(0/1) | 0.040 | 0.39*** | | |
| Middle school(0/1) | | | -0.093*** | -0.067* |
| Secondary school (0/1) | | | -0.099** | -0.128*** |
| Public transport(0/1) | -0.048 | -0.095** | -0.030 | -0.12*** |
| Canal (0/1) | -0.11** | 0.070 | | |
| Market(0/1) | 0.36*** | -0.059 | | |
| Telephone (0/1) | -0.10*** | -0.017 | | |
| Increased rain this year(0/1) | | | -0.11*** | -0.017 |
| Electricity(0/1) | | | -0.12*** | -0.11*** |
| Cooperative in village (0/1) | | | -0.014 | 0.10*** |
| Fertiliser (0/1) | | | 0.031 | 0.093*** |
| *Residual (lpcfdexp)* | 0.041*** | 0.028* | 0.0017 | 0.034*** |
| *N (#censored obs)* | 471 (323) | 436 (284) | 1263 (720) | 1122 (702) |
| *Log likelihood* | -847.78 | -776.32 | -2694.92 | -2129.33 |

**Notes**: See Table 3. These regressions included region, religion and ethnicity dummies. Since some regions for Ghana coincided with ethnic groups, they had to be dropped.

**Table 5**
**Hours of Child Farm Work Conditional on Participation**
*Marginal Effects*

| | ***Pakistan Boys*** | ***Pakistan Girls*** | ***Ghana Boys*** | ***Ghana Girls*** |
|---|---|---|---|---|
| ***Child characteristics*** | | | | |
| Age (1 year) | 1.86*** | 0.46*** | 2.33*** | 2.25*** |
| Age-squared (1 year) | | | -0.063 | -0.069* |
| Child of head (0/1) | 2.70* | 2.09** | -1.02** | -0.083 |
| ***Household resources*** | | | | |
| Ln p.c. food expend (0.1) | -1.16*** | -0.24 | 0.073 | -0.31** |
| Acres (1 acre) x $10^2$ | 1.60 | 2.90* | 1.10 | 5.40*** |
| Acres$^2$ (1 acre) x $10^4$ | | | -0.0024 | -0.20** |
| ***Farm organisation*** | | | | |
| Number of farms (by 1) | | | 0.71*** | 0.70*** |
| Rent (0/1) | -0.70 | 1.74** | 2.09*** | 2.14*** |
| Sharecrop (0/1) | 2.62*** | 0.78 | -0.62 | 0.15 |
| Free farm (0/1) | | | 2.22*** | 2.32*** |
| Village farm(0/1) | | | 0.47 | 2.96*** |
| ***Household structure*** | | | | |
| Household size (by 1) | -0.54*** | -0.16 | -0.085 | -0.30*** |
| Female head? (0/1) | 9.02*** | 3.06** | 0.55 | 1.18* |
| Males <5(7) years (0.1) | -1.8*** | -0.44 | 0.063 | -0.56*** |
| Males 5-9 years(0.1) | -1.35* | -1.27*** | | |
| Males 15-19 years(0.1) | -1.11 | -0.71 | -0.10 | -0.24 |
| Males 20-59 years(0.1) | -0.098 | -1.09** | 0.088 | 0.36 |
| Males >60 years (0.1) | -0.32 | 0.88 | 0.39 | 0.44 |
| Females<5(7) yrs (0.1) | -0.86 | 0.16 | 0.34 | -0.43** |
| Females 5-9 yrs (0.1) | 0.35 | -0.20 | | |
| Females 15-19 yrs(0.1) | -2.86*** | -0.76 | -0.20 | -0.12 |
| Females 20-59 yrs(0.1) | 0.43 | 0.045 | 0.0021 | 0.0096 |
| Females over 60 yrs(0.1) | -1.81 | -3.53*** | 0.13 | 0.25 |
| ***Parents' education***(0/1) | | | | |
| Mother mid/sec (0/1) | -35.45*** | -30.58*** | -1.43*** | -0.41 |
| Father secondary (0/1) | 2.75 | -7.26*** | -0.6 | 0.43 |
| ***Community variables*** | | | | |
| Primary school girls (0/1) | 2.43 | -2.41 | -0.67 | -0.94 |
| Primary school, boys(0/1) | 0.90 | 5.43*** | | |
| Middle school(0/1) | | | -1.43*** | -0.98* |
| Secondary school (0/1) | | | -1.53** | -1.88*** |
| Public transport(0/1) | -1.11 | -1.34** | -0.46 | -1.72*** |
| Canal (0/1) | -2.45** | 0.97 | | |
| Market(0/1) | 8.14*** | -0.82 | | |
| Telephone (0/1) | -2.32*** | -0.24 | | |
| Increased rain this year(0/1) | | | -1.69*** | -0.24 |
| Electricity(0/1) | | | -1.86*** | -1.54*** |
| Cooperative in village (0/1) | | | -0.21 | 1.51*** |
| Fertiliser (0/1) | | | 0.48 | 1.37*** |
| | | | | |
| *Residual (lpcfdexp)* | 0.95*** | 0.40* | 0.027 | 0.49*** |
| *N (#censored obs)* | 471(323) | 436(284) | 1263(720) | 1122(702) |
| *Log likelihood* | -847.78 | -776.32 | -2694.92 | -2129.33 |

**Notes:** See Notes to Table 3.

**Table 6**
**Child Activities By Quartile of Per Capita Food Expenditure**

| | ***Pakistan boys*** | ***Pakistan girls*** | ***Ghana boys*** | ***Ghana girls*** |
|---|---|---|---|---|
| ***Hh Farm Work*** | | | | |
| ***Full sample*** | 22.1<br>(23.3) | 28.1<br>(13.3) | 40.5<br>(15.5) | 34.4<br>(15.4) |
| *Quartile 1* | 24.3<br>(20.6) | 25.4<br>(11.5) | 36.7<br>(18) | 30.4<br>(13) |
| *Quartile 2* | 23.0<br>(23.2) | 26.8<br>(15.3) | 37.7<br>(14) | 29.3<br>(14) |
| *Quartile 3* | 21.1<br>(25.2) | 29.7<br>(13.9) | 44.1<br>(15) | 39.3<br>(17) |
| *Quartile 4* | 19.8<br>(25.1) | 30.8<br>(12.6) | 43.8<br>(15) | 38.6<br>(17) |
| ***Wage Work*** | | | | |
| ***Full sample*** | 6.2<br>(31) | 11.9<br>(45) | | |
| *Quartile 1* | 8.2<br>(44.6) | 18.8<br>(31.7) | | |
| *Quartile 2* | 6.9<br>(51.8) | 11.5<br>(33.6) | | |
| *Quartile 3* | 4.7<br>(40.7) | 8.0<br>(35.5) | | |
| *Quartile 4* | 5.0<br>(36.4) | 9.4<br>(24.7) | | |
| ***School Attendance*** | | | | |
| ***Full sample*** | 72.8 | 30.5 | 76.5 | 68.9 |
| *Quartile 1* | 65.4 | 26.3 | 70.0 | 61.3 |
| *Quartile 2* | 69.3 | 26.8 | 79.6 | 74.7 |
| *Quartile 3* | 77.0 | 33.5 | 75.6 | 69.2 |
| *Quartile 4* | 79.1 | 36.0 | 81.4 | 69.4 |

**Notes**: See Notes to Tables 1-3. Hh=household. All figures are percentages except figures in parentheses which are weekly hours of work in the reference week, conditional on participation.

**Appendix Table 1**
**Variable Means for Workers and Non-Workers by Gender**
**Rural Ghana**

| | Boys in Ghana | | Girls in Ghana | |
|---|---|---|---|---|
| | Workers | Non-workers | Workers | Non-workers |
| ***#Observations*** | 687 | 884 | 523 | 884 |
| ***Dependent variable*** | | | | |
| hours worked on farm | 15.5 | 0 | 15.5 | 0 |
| ***Child characteristics*** | | | | |
| age | 10.9 | 9.8 | 10.9 | 9.7 |
| first child | 0.61 | 0.47 | 0.64 | 0.48 |
| child of head of hh | 0.77 | 0.84 | 0.72 | 0.81 |
| ***Household resources*** | | | | |
| ln pc food expenditure | -0.33 | -0.40 | -0.27 | -0.39 |
| acres of land | 9.34 | 8.23 | 9.77 | 7.57 |
| ***Size of farm*** | | | | |
| number of farms | 2.0 | 1.94 | 2.1 | 1.92 |
| rent land? | 0.086 | 0.055 | 0.071 | 0.083 |
| sharecrop land? | 0.070 | 0.067 | 0.067 | 0.066 |
| freely available land? | 0.23 | 0.15 | 0.21 | 0.15 |
| village-owned land? | 0.23 | 0.26 | 0.24 | 0.28 |
| ***Household structure*** | | | | |
| household size | 7.3 | 7.2 | 6.9 | 7.3 |
| female head? | 0.27 | 0.20 | 0.34 | 0.22 |
| males under 7 years | 0.10 | 0.11 | 0.091 | 0.11 |
| males 7-14 years | 0.28 | 0.28 | 0.10 | 0.095 |
| males 15-19 years | 0.059 | 0.049 | 0.059 | 0.049 |
| males 20-59 years | 0.10 | 0.11 | 0.11 | 0.11 |
| males over 60 years | 0.033 | 0.032 | 0.032 | 0.028 |
| females under 7 yrs | 0.098 | 0.097 | 0.097 | 0.103 |
| females 7-14 years | 0.085 | 0.088 | 0.27 | 0.26 |
| females 15-19 years | 0.041 | 0.034 | 0.037 | 0.039 |
| females 20-59 years | 0.16 | 0.18 | 0.18 | 0.18 |
| females over 60 years | 0.033 | 0.020 | 0.037 | 0.019 |
| ***Parents' education*** | | | | |
| mother none | 0.68 | 0.66 | 0.66 | 0.69 |
| mother primary | 0.15 | 0.11 | 0.13 | 0.14 |
| mother secondary | 0.17 | 0.23 | 0.21 | 0.17 |
| father none | 0.51 | 0.49 | 0.46 | 0.53 |
| father primary | 0.086 | 0.088 | 0.079 | 0.085 |
| father secondary | 0.40 | 0.42 | 0.46 | 0.38 |
| ***Community variables*** | | | | |
| ***Access to school*** | | | | |
| local primary school | 0.85 | 0.89 | 0.87 | 0.88 |
| local middle school | 0.61 | 0.64 | 0.70 | 0.63 |
| local secondary school | 0.14 | 0.11 | 0.11 | 0.10 |
| local public transport | 0.52 | 0.50 | 0.52 | 0.47 |
| ***Quality of school*** | | | | |
| age of primary school | 33.5 | 32.1 | 35.1 | 32.6 |
| age of middle school | 15.1 | 10.1 | 15.1 | 11.6 |

| | | | | |
|---|---|---|---|---|
| age of sec/tech sch | 16.1 | 17.1 | 15.9 | 18.0 |
| ***Farming technology*** | | | | |
| co-operative society | 0.29 | 0.31 | 0.36 | 0.27 |
| mutual aid for workers | 0.87 | 0.88 | 0.86 | 0.88 |
| irrigation | 0.038 | 0.041 | 0.026 | 0.039 |
| increased rain this year | 0.64 | 0.77 | 0.60 | 0.75 |
| husking machine | 0.074 | 0.060 | 0.072 | 0.058 |
| fertilizer | 0.56 | 0.58 | 0.57 | 0.54 |
| ***Economic infrastructure*** | | | | |
| electricity | 0.12 | 0.14 | 0.15 | 0.17 |
| bank | 0.094 | 0.084 | 0.14 | 0.076 |
| ***Dynamism*** | | | | |
| life better than 1981 | 0.27 | 0.23 | 0.32 | 0.26 |
| easier to find work | 0.27 | 0.31 | 0.32 | 0.29 |
| ***Regions*** | | | | |
| Central Region | 0.14 | 0.083 | 0.15 | 0.10 |
| Eastern Region | 0.028 | 0.25 | 0.027 | 0.21 |
| West | 0.096 | 0.11 | 0.12 | 0.11 |
| Volta Region | 0.14 | 0.088 | 0.14 | 0.081 |
| Ashanti Region | 0.24 | 0.078 | 0.26 | 0.078 |
| Brong Ahafo Region | 0.13 | 0.13 | 0.15 | 0.14 |
| North | 0.08 | 0.11 | 0.05 | 0.12 |
| Upper West | 0.04 | 0.04 | 0.03 | 0.05 |
| Upper East | 0.08 | 0.10 | 0.08 | 0.11 |
| ***Ethnic groups*** | | | | |
| Akan | 0.57 | 0.48 | 0.61 | 0.46 |
| Ewe | 0.038 | 0.058 | 0.056 | 0.059 |
| Ga-adangbe | 0.038 | 0.11 | 0.024 | 0.089 |
| Dagbani | 0.054 | 0.041 | 0.028 | 0.049 |
| Nzema | 0.013 | 0.013 | 0.015 | 0.017 |
| Other | 0.29 | 0.30 | 0.26 | 0.32 |
| ***Religion*** | | | | |
| Christian | 0.61 | 0.60 | 0.65 | 0.58 |
| Animist/traditional | 0.19 | 0.25 | 0.16 | 0.25 |
| Muslim | 0.20 | 0.15 | 0.19 | 0.17 |

**Notes**: See Notes to Table 3. Not all community variables shown here are used in the analysis. Per capi expenditure for Ghana is expressed as a ratio to its mean, not so for Pakistan. This makes no effective differen to the tobit estimates since the variable is in logarithms and there is an equation constant.

**Appendix Table 2**
**Variable Means for Workers and Non-Workers by Gender**
**Rural Pakistan**

| | Boys in Pakistan | | Girls in Pakistan | |
|---|---|---|---|---|
| | Workers | Non-workers | Workers | Non-workers |
| ***# Observations*** | 191 | 427 | 200 | 365 |
| ***Dependent variable*** | | | | |
| hours worked on farm | 25.6 | 0 | 14.9 | 0 |
| ***Child characteristics*** | | | | |
| age | 12.2 | 11.6 | 12.0 | 11.8 |
| first child | 0.69 | 0.50 | 0.63 | 0.60 |
| child of head of hh | 0.85 | 0.78 | 0.87 | 0.79 |
| ***Household resources*** | | | | |
| ln pc food expenditure | 5.28 | 5.36 | 5.36 | 5.34 |
| acres of land | 11.8 | 11.3 | 12.0 | 9.82 |
| ***Size of farm*** | | | | |
| rent land? | 0.13 | 0.15 | 0.16 | 0.16 |
| sharecrop land? | 0.48 | 0.33 | 0.43 | 0.30 |
| ***Household structure*** | | | | |
| household size | 9.6 | 11.2 | 9.8 | 10.9 |
| female head? | 0.03 | 0.01 | 0.045 | 0.014 |
| males under 5 years | 0.051 | 0.056 | 0.062 | 0.060 |
| males 5-9 years | 0.10 | 0.196 | 0.095 | 0.089 |
| males 10-14 years | 0.18 | 0.16 | 0.072 | 0.052 |
| males 15-19 years | 0.052 | 0.068 | 0.060 | 0.061 |
| males 20-59 years | 0.16 | 0.16 | 0.15 | 0.17 |
| males over 60 years | 0.027 | 0.028 | 0.033 | 0.026 |
| females under 5 yrs | 0.059 | 0.064 | 0.070 | 0.063 |
| females 5-9 years | 0.10 | 0.084 | 0.090 | 0.086 |
| females 10-14 years | 0.060 | 0.051 | 0.16 | 0.17 |
| females 15-19 years | 0.039 | 0.051 | 0.044 | 0.049 |
| females 20-59 years | 0.16 | 0.16 | 0.15 | 0.16 |
| females over 60 years | 0.014 | 0.021 | 0.0094 | 0.025 |
| ***Parents' education*** | | | | |
| mother none | 0.98 | 0.97 | 0.99 | 0.94 |
| mother primary or less | 0.023 | 0.021 | 0.011 | 0.046 |
| mother mid/secondary | 0.00 | 0.008 | 0.00 | 0.012 |
| father none | 0.66 | 0.63 | 0.71 | 0.61 |
| father primary or less | 0.22 | 0.21 | 0.20 | 0.19 |
| father middle | 0.067 | 0.064 | 0.066 | 0.082 |
| father secondary | 0.056 | 0.092 | 0.020 | 0.12 |
| ***Community variables*** | | | | |
| ***Access to school*** | | | | |
| boy's primary school | 0.88 | 0.91 | 0.93 | 0.90 |
| boy's middle school | 0.44 | 0.44 | 0.38 | 0.41 |
| girl's primary school | 0.85 | 0.86 | 0.87 | 0.82 |
| girl's middle school | 0.28 | 0.28 | 0.25 | 0.26 |
| local public transport[1] | 0.66 | 0.62 | 0.60 | 0.62 |
| ***Farming technology*** | | | | |
| canal | 0.69 | 0.53 | 0.63 | 0.61 |

| | | | | |
|---|---|---|---|---|
| rent for a tractor | 77.5 | 78.7 | 78.9 | 80.3 |
| ***Economic infrastructure*** | | | | |
| shop | 0.95 | 0.94 | 0.93 | 0.93 |
| market | 0.021 | 0.026 | 0.015 | 0.036 |
| post office | 0.63 | 0.60 | 0.63 | 0.61 |
| telephone | 0.37 | 0.39 | 0.41 | 0.38 |
| ***Regions*** | | | | |
| Punjab | 0.50 | 0.47 | 0.42 | 0.47 |
| Baluchistan | 0.031 | 0.054 | 0.020 | 0.082 |
| Sindh | 0.31 | 0.26 | 0.39 | 0.21 |
| Northwest Frontier | 0.16 | 0.22 | 0.17 | 0.24 |
| ***Religion*** | | | | |
| Muslim | 0.91 | 0.96 | 0.89 | 0.98 |
| Christian | 0.031 | 0.007 | 0.030 | 0.008 |
| Non-Muslim | 0.058 | 0.033 | 0.080 | 0.017 |

**Notes**: See Notes to Appendix Table 1. [1]:Corresponds to the presence of a bus route through the cluster.