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# Schooling Costs and Child Labour in Rural Pakistan

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## Abstract

A conventional argument in the child-labor debate is that improvements in access to schools are an effective way to reduce the labor force participation of children. It is argued that schooling competes with economic activity in the use of children's time, and enhanced access to schools, interpretable as reduction in schooling costs, may raise school attendance at the expense of child labor. In this paper, we draw a distinction between child labor within the household (intra-household) and child work in the labor market (extra-household), and examine the separate effects of schooling costs on the two types of child labor. Consistent, at least in part, with our theoretical framework, we find that extra-household child labor and schooling costs are positively related while intra-household child labor is insensitive to changes in the costs of schooling. Our results suggest that reduction in schooling costs will have limited success in the abatement of child labor in rural Pakistan.



## Kurzfassung

Ein verbreitetes Argument in der Debatte über Kinderarbeit ist, dass verbesserte Zugangsmöglichkeiten zu Schulen ein effektives Mittel sind, um Kinderarbeit zu reduzieren. Es wird angeführt, dass bei der Zeiteinteilung eines Kindes Ausbildung und ökonomische Aktivität miteinander konkurrieren. Eine Verbesserung des Zugangs zu Schulen, im Sinne einer Kostensenkung der Schulausbildung, würde demnach den Schulbesuch auf Kosten der Kinderarbeit steigern. In unserem Beitrag unterscheiden wir zwischen haushaltsinterner Kinderarbeit (intra-household) und haushaltsexterne Kinderarbeit auf dem Arbeitsmarkt (extra-household) und untersuchen die verschiedenen Auswirkungen von Ausbildungskosten auf beide Typen der Kinderarbeit. In relativer Übereinstimmung mit unserem theoretischen Rahmen gelangen wir zu dem Ergebnis, dass haushaltsexterne Kinderarbeit und Schulkosten in positiver Beziehung zueinander stehen, während sich haushaltsinterne Kinderarbeit als unempfindlich auf Änderungen der Schulkosten erweist. Unsere Ergebnisse deuten an, dass bei der Bekämpfung von Kinderarbeit im ländlichen Pakistan eine Kostensenkung der Schulausbildung nur begrenzt erfolgreich sein wird.

# 1 Introduction

The International Labour Organization (ILO) considers child labour to be "simply the single most important source of child exploitation and child abuse in the world today" (ILO, 1998).[1] According to the ILO, child labour places an untenable burden upon children. It is widely held to reduce children's educational attainment and, in its most exacting forms, to be ruinous to children's physical and mental health.

Even though most countries have legislated a minimum working age and many have ratified related ILO Conventions and the 1989 UN Convention on the Rights of the Child, the number of working children remains high. National legislation frequently exempts agricultural and domestic service sectors, and labour laws are often poorly enforced outside the formal sector. The ILO (1998) estimates that there are approximately 250 million 5-14 year old children working in developing countries, of which at least 120 million are full-time workers. It is likely that these figures are underestimates since they do not account for child labour in domestic chores such as cooking, cleaning, and childcare, performed mainly by girls.

This paper's focus upon rural child labour in a South Asian nation is motivated by the facts that the participation rates of children in economic activity are much higher in rural than in urban areas (ILO, 1996), and that the majority (61%) of the world's child workers come from Asia (ILO, 1998). In the Pakistani context, a Child Labour Survey (CLS) conducted in 1996 by the Federal Bureau of Statistics of Pakistan found that 3.3 million (8.3%) of Pakistan's 40 million 5-14 year old children were economically active. The incidence of child labour was 8 times higher in rural than in urban areas, and two-thirds of the working children were engaged in the agricultural sector.

The widespread prevalence of child labour in rural Pakistan, despite the government's ratification of various international conventions and laws prohibiting work by children suggests that additional policy measures to curb child labour are warranted. A view held, among others, by the ILO is that "the single most effective way to stem the flow of school-age children into abusive forms of employment is to extend and improve schooling so that it will attract and retain them" (ILO, 1998). Schooling competes with economic activity in the use of children's time. Therefore, policy interventions such as improvements in access to schools, and/or improvements in the quality of schools, may raise school attendance at the expense of child labour.

[1] We are aware that the two terms child labour and child work may have different connotations. However, in this paper we focus on the distinction between child work/labour inside and outside the household and use the terms child work and child labour synonymously.

While there is a substantial literature on the determinants of child labour[2], empirical evidence on the substitutability of children's schooling and labour, and on the effectiveness of education related policy measures in the reduction of child labour, is limited. One approach at gauging the links between schooling and child labour has been to compare children's educational outcomes across work status. Psacharopoulos (1997) uses data from Bolivia and Venezuela to show that children who work are more likely to fail at school and that child work reduces educational attainment by almost two years. In contrast, Patrinos' and Psacharopoulos' (1997) work on Peru reveals that child labour is not detrimental to schooling. While these papers represent some of the first attempts at gauging the effect of child work on schooling, their inclusion of work status, a choice variable, as an exogenous regressor may not be appropriate.

A second line of research has attempted to assess the links between schooling and child labour by examining the effect of education related policy alternatives such as school concentration, distance to schools, school fees (subsidies) and school quality, on the incidence of child labour. For instance, Grootaert (1999) reports that child labour force participation in rural Côte d'Ivoire is responsive to distance from school. According to his estimates, a US$3 reduction in annual schooling costs (induced by increased school proximity) may lead to a 1 percentage point reduction in the probability of child labour force participation. However, schooling costs are not found to be statistically significant correlates of child labour in urban Côte d'Ivoire. Cartwright and Patrinos (1999) find a strong positive relationship between schooling costs and child labour force participation in urban Bolivia. In contrast, Cartwright's (1999) work on Colombia shows that higher school costs are associated with a lower probability of working. Using data from the Tanga region of mainland Tanzania, Akabayashi and Psacharopoulos (1999) report that children work longer hours per day in localities with a lower school concentration. Their measure of school quality has no influence on child work while, controlling for school concentration, distance from the closest public primary school is negatively related to hours of work.

Grootaert and Patrinos (1999) argue that this empirical ambiguity in the effects of schooling related policy measures on child labour force participation is largely due to data limitations. While the argument has its merits, it is possible that households adjust to changes in school prices (quality) along dimensions other than children's work. In a recent paper, Ravallion and Wodon (2000) argue that a rise in school attendance driven, for instance, by lower schooling costs may occur largely at the expense of children's leisure with little or no reduction in child labour. Their empirical work shows that a school enrolment subsidy in the form of monthly food rations to households in rural Bangladesh reduces the incidence of child labour. However, they emphasize that the decline in the incidence of child labour that may be ascribed to the subsidy accounts for a small proportion of the increase in school enrolment, implying higher school

[2] Early examples include Rosenzweig and Evenson's (1977) work on India and Levy's (1985) work on Egypt. A more recent example is Ray's (2000) paper, partially based upon the same data set as this paper. For a more extensive set of references, see Ray (2000).

attendance comes mainly at the expense of children's leisure. Thus, they conclude that child labour force participation may not be very responsive to education related policy measures.

There may be factors besides adjustment along the leisure dimension responsible for the ambiguous effect of schooling related policy measures on child work. First, the papers discussed above mainly use child labour force participation as their measure of child work. It is possible that the effect of schooling costs on child labour would be less ambiguous if the latter were measured continuously, i.e. as hours worked, rather than as dichotomous labour force participation. Second, some authors (Rodgers and Standing, 1981; Bequelle and Boyden, 1988) argue that it is important to distinguish between child labour within the household (domestic work, work on the family farm or enterprise) and child work in the labour market. Implicit in this argument is the view that the two types of child labour may exhibit differing sensitivities to changes in school costs (quality) and that failure to distinguish between different types of child activities may obscure the link between schooling costs and child labour.

Like the authors of the second set of papers reviewed above, we examine whether school related policy measures are an effective way to combat child labour. Our data, from rural Pakistan, is informative not only of children's participation in work activities but also of the numbers of hours worked per week. Furthermore, we draw a distinction between child work within the household and child work in the labour market and examine whether the two types of child labour react differently to changes in schooling costs.

The following chapter discusses child labour in Pakistan and also provides arguments to justify the distinction that we make between intra-household and extra-household child labour supply. In Chapter 3 we develop an analytical framework, which predicts that intra-household and extra-household child labour supply will respond differently to changes in school costs. Chapter 4 describes the data, Chapter 5 presents the empirical estimates, and the final chapter concludes the paper.

# 2 Child labour in Pakistan and a typology of child work

## 2.1 Child labour in Pakistan

The definition of the activities that constitute labour and the definition of a child itself are contentious issues. A reading of Pakistan's national policy on child labour and current legislative measures on child labour reveals that Pakistan apparently follows international standards by defining a person of age 14 and below as a child (see Hyder, 1998). While the definition of a child appears clear, the definition of work does not. Pakistani law states that no child below 14 should be engaged in any factory or mine or other hazardous employment or in any occupation or employment which prejudices his or her health or education or interferes with his or her physical, mental or moral development. Given the flexibility of this definition, it is no surprise that measurement of the extent of child labour in Pakistan spans a wide range of estimates. Difficulties with measuring the incidence of child labour are exacerbated by data limitations. The Census and the Labour Force Survey (LFS) in Pakistan do not collect labour related information on persons below the age of 10. Various international agencies and local sources have attempted to fill this data gap, providing estimates of between 6 and 10 million child workers in the country (a labour force participation rate of 15-20%). A survey conducted in 1996, under the auspices of the ILO sponsored International Programme on the Elimination of Child Labour (IPEC), indicated that 3.3 million (8.3%) of Pakistan's 40 million 5-14 year old children were economically active.

Our paper is concerned with children in the age group 10-14. Hence, we focus on the labour market activity of this group. The LFS considers a child (age 10-14) to be employed/working if he or she worked at least one hour during the reference week as a paid employee, was self-employed, or worked as an unpaid family member on a family farm or in a family firm. A child who did not have a job but was seeking one is treated as unemployed. Following accepted definitions, the sum of employed and unemployed children constitutes the child labour force. Note that the LFS does not consider child participation in domestic work to be labour.

Estimates based upon LFS data indicate that the labour force participation (LFP) rate of children in the age group 10-14 was 13.65% in 1990-91.[3] The LFP rate in rural areas, at around 17%, was considerably higher than in urban areas (7.87%). The LFP rate among boys at 19.2% was almost three times that among girls (6.95%). While the gender differential in LFP rates is

[3] Although LFS child labor data is available for later years, we choose to present data for 1990-91 to enable comparison with the 1991 data upon which this paper is based.

lower in rural areas, the LFP rate is still considerably higher among boys than girls (22.7 versus 9.2%, see Table 1a). Almost 76% of employed children in rural areas worked in agriculture or agriculture related activities, 11% worked in manufacturing, with the remainder working in the services sector.

**Table 1a: Labour Force Participation Rates (%) of Children age 10-14 in Pakistan, 1990-91.**

| | % Male | % Female | % of Total Labour Force |
|---|---|---|---|
| Rural | 22.68 | 9.21 | 16.76 |
| Urban | 12.20 | 3.13 | 7.87 |
| Total | 19.15 | 6.95 | 13.65 |

Source: Government of Pakistan (1993)

**Table 1b: Labour Force Participation Rates (%) of Children age 10-14 in Pakistan, 1991**

| | % Male | % Female | % of Total Labour Force |
|---|---|---|---|
| Rural [a] | 27.8 | 28.9 | 28.0 |
| Rural [b] | 27.8 | 85.6 | 55.1 |

Notes: These figures are based on our calculations using the Pakistan Integrated Household Survey conducted in 1991. [a] Calculations exclude child participation in domestic chores. [b] Calculations include child participation in domestic chores. There is no change for males as survey designers assumed that males do not spend any time on domestic chores.

This paper's empirical analysis is based upon data from the 1991 Pakistan Integrated Household Survey (PIHS). To compare PIHS and LFS data, we first use a definition of work as similar as possible to that in the LFS, i.e. exclude domestic work. With this definition of work, the PIHS data indicate that the LFP rate in rural Pakistan was approximately 28% in 1990-91. The data also suggest that LFP rates for males and females in rural Pakistan are not particularly different (28 versus 29%). When the definition of child labour is expanded to include domestic work, these figures alter dramatically. The overall LFP rate increases to 55% while the female LFP rate is estimated at 86%. Hence, the PIHS data suggest child labour force participation rates in rural Pakistan were considerably higher in 1990-91 than indicated by the LFS data even with a common definition of work. It is not our aim to resolve this discrepancy but to illustrate that estimates of child labour force participation are very sensitive to the data source and to the definition of child labour.

## 2.2 A typology of child labour

The work activities of children may be taken to consist of three broad types: work in the labour market for a wage, unpaid work on the family farm or enterprise, and unpaid domestic work. There is considerable disagreement about whether all three activities constitute child labour or whether only work in the labour market is truly child labour. Some authors have recast the above trichotomy of child work into a dichotomy consisting of work outside and work within

the household, and holding that work by children is child labour only if it is exploitative, have argued that work within the context of the household does not constitute child labour. It is argued that work on a family farm or in another family enterprise, or in a household domestic capacity, provides on-the-job training, equips a child with essential skills that may not be learned elsewhere, and enhances the self-esteem of the child. Since work within the household is typically executed under the guidance and supervision of parents, it is deemed not to be exploitative and not to harm the healthy development of a child. According to this view, only work that involves an employee-employer relationship and that is remunerated in cash or kind constitutes child labour. Rodgers and Standing (1981), Bequelle and Boyden (1988), and Blanc (1994) present detailed supportive arguments.

While acknowledging that work outside and within the household may be viewed differently by parents and one must be distinguished from the other, the view that work undertaken in the context of the household is *not* child labour has been sharply criticized. Nieuwenhuys (1994) writes that "the assumption that children's work, in the context of the peasant family, is morally neutral is preposterous." On the basis of a detailed anthropological study in Kerala, India, Nieuwenhuys (1994) argues that restricting child labour to remunerated work ignores the contribution that parents solicit from their children. She argues that non-remunerated work does not make work within the household any less demanding or less important for families, and there can be no presumption that poor parents are able to protect their children from excessive drudgery and exploitation. Furthermore, the majority of child work in rural areas consists of household chores and unpaid work on family farms. Hence, accepting the narrow definition of child labour would lead to the conclusion that the problem of child labour in rural areas is marginal.

While disagreeing about the type of work that falls under the rubric of child labour, both views agree that work within the household ought to be distinguished from work outside it. Such a distinction is desirable particularly because parents may view the two types of children's work as different. For instance, parents in dire financial need may turn to extra-household child labour primarily for the augmentation of household resources, whereas children's work in a family farm/business may be driven by multiple motives and viewed as an essential component of upbringing. If the two types of child labour are indeed viewed differently by parents, it is possible that they will exhibit differing sensitivities to policy interventions designed to curb child labour. If extra-household work is motivated primarily by a need to augment household income, it may be responsive to income subsidies or direct reductions in schooling costs. If, on the other hand, work within the household is viewed as essential training that cannot be acquired elsewhere, it may not be as responsive to such economic stimuli. To discuss these issues formally and to motivate our empirical work the following chapter presents an agricultural household model.

# 3 Model and Empirical Specification

The following theoretical framework draws upon the model by Gronau (1977) and agricultural household models (AHM) as reviewed by Singh *et al* (1986). In his formalization of the trichotomy of women's work in the market, work at home, and leisure Gronau (1977) argues that work at home of a woman additionally employed in the labour market ought not to respond to changes in her unearned income. The argument rests upon the logic that, assuming a unit of goods purchased with wage receipts and a unit of goods produced at home are perfect substitutes in consumption, the efficient allocation of time between market and household work in an interior solution calls for equality between the marginal product of work at home and the market wage rate, in which case work at home would depend only upon the market wage rate and the parameters of the household production function. Only in the event that a woman supplied no wage labour, a corner solution wherein the marginal product of her work at home was not constrained to equal but rather exceeded her market wage, would her labour input in household production decrease in her unearned income.

Gronau's (1977) model may also be used to analyze the allocation of child time between work in the labour market, work at home, time at school and leisure, but must first be suitably modified. Gronau's (1977) model, designed to explain the allocation of women's time in developed countries, understandably ignores the possibility of hired labour serving household production. To remedy this omission, we turn to an agricultural household model similar to that of Singh *et al* (1986).

Consider a household comprised of a child and her adult guardians. Assume the adults maximize a twice-differentiable quasi-concave utility function:

$$U = U\left(C, l, S; E\right) \tag{1}$$

where $C$ is a composite consumable representing the household's standard of living, $l$ is the child's leisure, $S$ is the child's school attendance, and $E$ is a vector of exogenous child and household characteristics that parameterize the utility function. The second component of the model is a household production function, also parameterized by variables $E$, $q = f(L;E)$, where $L$ signifies child labour input in household production. $L$ may consist of both household and hired child labour. It is assumed that labour markets are complete and that child labour may be hired in or out at a wage rate denoted by $w$.

The adults allocate the child's total endowment of time, $T$, between school attendance, leisure, work in the labour market (extra-household child labour), $L^M$, and work in household production (intra-household child labour), $L^H$. Hence, utility maximization is subject to the time constraint:

$$T = l + S + L^M + L^H = l + S + L^S \quad (2)$$

where $L^S$, the total labour supplied by the child, is the sum of her extra-household and intra-household labour.

Since $Y$, the adult contribution to household income (assumed exogenous) and the output of child labour in household production must together suffice to meet the costs of hiring child labour, household consumption, and schooling, the budget constraint may be written as:

$$Y + f(L;E) = C + pS + w(L - L^S) \quad (3)$$

where $p$ represents the price of schooling. Constraints (2) and (3) may be combined as:

$$Y + wT + [f(L;E) - wL] = C + (w + p)S + wl \quad (4)$$

The household adults may be assumed to maximize the utility function (1) subject to (4).[4] The Lagrangian function of the optimization problem is:

$$Z = U(C, l, S; E) + \lambda[Y + wT + \{f(L;E) - wL\} - C - (w + p)S - wl] \quad (5)$$

where $\lambda$ denotes the Lagrange multiplier.

Consider the household's demand for child labour input in household production. Optimal labour demand, that which maximizes "profit", i.e. $f(L;E) - wL$, in household production, must satisfy $f'(L;E) = w$, implying that a household's demand for child labour is a function only of $w$ and $E$, and may, thus, be represented as:

$$L^{D*} = L^D(w, E) \quad (6)$$

The separation of the household's production decision (optimal child labour input in household production, $L^{D*}$) from its consumption decisions is a well-known feature of AHM. As long as the labour market is complete, it is predicted that household demand for child labour will be independent of child labour supply. In other words, production decisions will be independent of household preferences, or profit maximization will be independent of utility maximization.

The first order conditions (FOC) for an interior utility maximum are:

$$\frac{\partial Z}{\partial \lambda} = Y + wT + \{f(L^{D*};E) - wL^{D*}\} - C - (w + p)S - wl = 0 \quad (7)$$

[4] We assume that adult income is exogenous with respect to child-time allocation decisions. As suggested by a referee, allowing adult income to be endogenous may help us to identify a level of income above which child labor is hired in. While the theoretical model may be adjusted to allow for this identification, our data only allows us to identify whether a child works outside the household. We do not have information on whether a household hires children.

$$\frac{\partial Z}{\partial C} = U_1 - \lambda = 0 \tag{8}$$

$$\frac{\partial Z}{\partial S} = U_3 - \lambda(w + p) = 0 \tag{9}$$

$$\frac{\partial Z}{\partial L} = U_2 - \lambda w = 0 \tag{10}$$

These may be solved for optimal $C$, $S$ and $l$. From the time constraint, (2), household child labour supply, $L^S$, equals $T$ less the sum of $S$ and $l$. Since optimal S and $l$ are each functions of $w$, $p$, $E$ and $Y$, optimal $L^S$ may be represented as:

$$L^{S*} = L^S(w, p, E) \text{ [5]}. \tag{11}$$

Consider, first, the case of household optimal child labour supply exceeding optimal demand, i.e. $L^{D*} < L^{S*}$. Child labour input in household production will consist entirely of household child labour, so that optimal intra-household child labour supply is given by:

$$L^{H*} = L^D(w, E) \tag{12}$$

Since household child labour unused in household production will be supplied to the labour market, optimal extra-household child labour supply may be denoted as:

$$L^{M*} = L^S(w, p, E) - L^D(w, E) \tag{13}$$

From (12), changes in the price of schooling, $p$, will not influence the optimal intra-household labour supply of children engaged in extra-household (market) work. On the other hand, (13) indicates that optimal extra-household child labour supply may respond to changes in the price of schooling. Clearly, the adults in this model make no distinction between the child's extra-household and intra-household work, since the sole object of each type of child labour is the augmentation of household consumable resources. The adults allocate generic household child labour supply between market work and household production, such that the marginal benefits (increases in the household budget) from the two activities are equalized, i.e. $f'(L; E) = w$.

Next, consider the situation of $L^{D*} > L^{S*}$. In this case, $L^{M*} = 0$ and intra-household labour supply will be given by:

[5] We assume that exogenous adult contribution to household income, *Y*, is a function of a sub-set of the variables, $E$, that parameterize the household utility and production functions.

$$L^{H*} = L^{S}(w, p, E) \tag{14}$$

with the difference $L^{D*} - L^{S*}$ drawn from the labour market. Equation (14) implies that the price of schooling, $p$, may influence the intra-household labour supply of children unengaged in market work.[6] Thus, the model predicts that while extra-household labour supply may respond to changes in schooling costs, the effect of these costs on a child's intra-household labour supply may depend on whether she is also engaged in market work.

It is possible that extra-household child labour and schooling costs are positively related, whereas intra-household child labour remains insensitive to reduction in schooling costs, even when the supply of extra-household labour has ceased. A decrease in extra-household child labour from reduction in schooling costs coupled with the insensitivity to such cost reduction of the intra-household labour supply of even children unengaged in market work, is clearly inconsistent with the like treatment by households of extra-household and intra-household child labour. The phenomenon might occur if households differentiated between the two types of child labour. An explanation may involve benefits from intra-household child labour other than increases in household consumption. For example, households may view children engaged in household production as accumulating valuable human capital "on the job" - skills that may not be learned at school. Children assisting in household agricultural activities may become knowledgeable of the distinctive features, even peculiarities, of the family farm, knowledge of value in the making of farm management decisions. Girls occupied in household domestic chores might accumulate human capital valued in the marriage market.

The above model suggests that there is a manifest sequence in the reduction of child labour through educational policy. When both extra-household and intra-household child labour are supplied, reduction in the price of schooling may at first decrease only extra-household child labour. Only once a child ceases to supply extra-household labour might her intra-household labour supply begin to decline.[7]

There are three implications of the model: (i) the extra-household labour supply of children may be (positively) associated with schooling costs; (ii) the intra-household labour supply of children providing extra-household labour ought to be unresponsive to changes in schooling costs; (iii) the intra-household labour supply of children unengaged in market work

[6] The AHM sketched above may be used to assess changes in children's time allocation patterns in response to other interventions. For example, as long as children are engaged in market work, any policy that leads to an increase in the unearned income of households will have no impact on child time allocated to household work but may reduce children's market work. On the other hand, as long as leisure is a normal good, an increase in unearned income may reduce time allocated to household work among children unengaged in market work.

[7] The predicted insensitivity of household demand for child labor to the price of schooling is a consequence of the separation of the production and consumption decisions of households. A test of this prediction may, therefore, be considered a test of separation. If separation holds, the price of schooling ought not to influence child labor demand. However, if it doesn't, variables that potentially influence the supply of household child labor such as the price of schooling may also affect household demand for child labor.

may be (positively) associated with schooling costs. These implications may be tested via estimation of child labour-supply functions.

Assume (12) takes the linear form:

$$L^{H*} = L^{D}(w, E) = \boldsymbol{a}\, w + E'\,\boldsymbol{b} + e \qquad (15)$$

where error $e$ represents the effect of unobservables. Similarly, assume (14) is expressible as:

$$L^{H*} = L^{S}(w, p, E) = \boldsymbol{d}\, w + \boldsymbol{g}\, p + E'\,\boldsymbol{l} + u \qquad (16)$$

where $u$ denotes the effect of unobserved attributes in vector $E$. Hence, optimal extra-household child labour supply may be specified as:

$$L^{M*} = L^{S}(w, p, E) - L^{D}(w, E) = (\boldsymbol{d} - \boldsymbol{a})\, w + \boldsymbol{g}\, p + E'(\boldsymbol{l} - \boldsymbol{b}) + u - e \qquad (17)$$

Whether schooling costs affect extra-household labour supply may be tested via estimation of (17). The prediction that schooling costs may affect the intra-household labour supply only of children unengaged in market work may be verified by testing if variables capturing schooling costs belong as regressors in (16) but not in (15).

These labour supply functions may be estimated by a variety of methods. Since a large proportion of children is not engaged in work, OLS estimation of these functions is not appropriate. Assuming normality of the error terms, a standard type-one Tobit model (Amemiya, 1984) may be used. While this model would account for the effect of the independent variables on the probability of working and on the hours of work, it is restrictive. This model forces the parameters that explain censoring to equal those explaining variation in the hours of work. An alternative that does not impose this restriction is Heckman's (1974) two-step method or, if maximum-likelihood is preferred, the type-2 Tobit model (Amemiya, 1984). This approach also assumes (joint) normality of the error terms. Identification in the two-step method usually requires that there be at least one variable determining sample selection that is not an explanatory variable in the primary equation of interest. In our case, it is difficult to find variables that are plausible determinants of children's workforce participation that do not influence hours worked. Hence, identification relies upon the non-linearity of the inverse-Mills ratio. To enable comparisons and to provide a comprehensive picture, we present type-one Tobit and Heckman's two-step estimates of child labour supply functions. In addition, we provide Probit estimates of the determinants of workforce participation.

# 4 Data and Descriptive Statistics

The empirical analysis is based on data drawn from the Pakistan Integrated Household Survey (PIHS), conducted by the World Bank and the Federal Bureau of Statistics of Pakistan in 1991 as part of the Living Standards Measurement Surveys (LSMS). The survey covered 4,800 households in 300 communities divided equally between rural and urban areas. The data are rich in measures of household and community characteristics. Since work by children younger than 10 is unreported in the PIHS, and workers older than 14 are generally not considered child labourers, the analysis is performed upon a sample of 1900 10-14 year old children drawn from among the survey's rural respondents.[8] Descriptive statistics of the variables used in the analysis are presented in Tables 2, 3 and 4.

**Table 2: Hours worked per week by children, age 10-14, in Pakistan 1990-91 (Standard Deviation)**

| | Total | Male | Female |
|---|---|---|---|
| Hours of work - all activities | 14.43<br>(20.6) | 8.42<br>(17.9) | 21.2<br>(21.4) |
| Hours worked outside the household | 2.36<br>(10.4) | 2.4<br>(11.3) | 2.33<br>(9.26) |
| Hours worked on family farm or enterprise | 4.46<br>(11.6) | 6.02<br>(14.5) | 2.78<br>(7.08) |
| Hours spent on domestic work | 7.60<br>(13.5) | .<br>. | 16.06<br>(15.9) |
| Hours of work - excluding domestic work | 6.83<br>(15.3) | 8.42<br>(17.9) | 5.1<br>(11.5) |
| *N* | 1900 | 1004 | 896 |

Table 2 summarizes the time children spend on average in different types of work activities. Total time at work (including domestic work) is about 14 hours a week, with females (21 hours) working considerably longer than males (8 hours). This is largely due to their substantial contribution to household chores. Exclusion of domestic tasks from the concept of work reduces the total duration of the work week to 7 hours, with males working 8 hours and females working about 5 hours. The apparent sensitivity of time at work to the definition of work

[8] Our data set has information on 2,199 children in the age group 10-14. However, missing information with regard to some of the variables in our analysis reduces the sample size upon which the bulk of our empirical analysis is based to 1,900 observations. There is nothing to suggest that these 299 excluded observations share any common characteristics. So their exclusion ought not to lead to sample selection bias.

indicates that it is important to choose the latter carefully. If domestic work is excluded from the definition of work, children's time at work appears to be modest and suggests that child labour may not harm children's school attendance or academic performance.

The decomposition of work activities indicates that the average child spends 2 hours per week on extra-household labour, consisting of work "on some other person's farm" or "for a firm or an individual", for which payment is received in cash or kind. Both males and females appear to spend about the same time on work outside the household. About 5 hours per week on average are spent working on the family farm or enterprise. There are gender differences: males work about 6 hours on these tasks, while the contribution of females is smaller, about 3 hours.

**Table 3: Descriptive Statistics**

| Variable | Full Sample | |
|---|---|---|
| | Mean | SD* |
| **Child characteristics** | | |
| Male = 1 | 0.528 | 0.499 |
| Age | 11.84 | 1.42 |
| Ever attended school = 1 | 0.612 | 0.487 |
| **Educational characteristics** | | |
| Annual primary schooling costs (enrolment & uniform costs in Rupees) | 131.84 | 167.15 |
| Distance to closest middle school | 5.953 | 11.18 |
| Distance to closest secondary school | 4.618 | 7.55 |
| Proportion of area primary schools with electricity | 0.369 | 0.368 |
| Proportion of area primary schools with water | 0.549 | 0.397 |
| Proportion of areas primary schools with brick walls | 0.829 | 0.277 |
| **Household characteristics** | | |
| Highest education level of adult male (years) | 4.261 | 4.791 |
| Highest education level of adult female (years) | 0.663 | 2.242 |
| Landholding (acres) | 2.894 | 9.725 |
| Annual per capita expenditure (Rupees) | 4223 | 3197 |
| Family size | 9.98 | 4.655 |
| Number of male members 0-4 age group | 0.632 | 0.858 |
| Number of female members 0-4 age group | 0.715 | 1.020 |
| Number of male members 5-9 age group | 0.952 | 1.008 |
| Number of female members 5-9 age group | 0.912 | 1.012 |
| **Community and regional controls** | | |
| Distance of community from *tehsil* capital (km) | 22.01 | 15.31 |
| Access to paved road | 0.703 | 0.456 |
| Access to canal irrigation | 0.610 | 0.487 |
| Visited by agricultural extension worker in past 6 months | 0.562 | 0.496 |
| Residing in Punjab = 1 | 0.515 | 0.499 |
| Residing in Sind = 1 | 0.256 | 0.436 |
| Residing in NWFP = 1 | 0.166 | 0.372 |
| ***Number of Observations*** | 1900 | |

*SD: Standard Deviation

Table 3 presents descriptive statistics of the independent variables in our analysis. School costs are measured by a set of three variables. The first of these measures the direct costs of primary schooling and consists of the sum of the annual enrolment fee and the cost of a uniform

at area primary schools. The sample average of the annual direct cost of attending primary school is about Rs132. Descriptive statistics conditional on labour market status suggest a positive relationship between labour supply and direct primary schooling costs (see Table 4). This cost of primary schooling ranges from Rs125 a year for children who do not participate in the labour force to Rs165 for children who provide extra-household labour. In the absence of measures of the direct costs of middle and secondary schooling, distances to the closest middle and secondary schools are taken to capture the costs of, respectively, middle and secondary schooling. Most schools in rural Pakistan were single-sex at the time of the survey (Alderman et al., 1996). Thus, the closest middle, and secondary schools considered are girls-only or coeducational schools in the case of girls, and boys-only or coeducational schools in the case of boys. While we include these measures as proxies for the cost of attending school, their effect on labour supply is uncertain. Higher transportation costs associated with a distant school may lead to lower school attendance and a positive relation between distance to school and labour supply. On the other hand, proximity to school may make it easier for a child to work as well as go to school, resulting in a negative relationship between distance to school and child labour supply. The descriptive statistics in Table 3 indicate that a child must travel 6 km on average to a middle school. The statistics in Table 4 suggest there is a positive relation between labour supply and distance to school. On average, a non-working child must travel about 4 km to a middle school while one engaged in extra-household labour must travel about 9 km.

**Table 4: Selected Descriptive Statistics**

| Variable | $L^S = 0$ | | $L^S > 0$ | | $L^M > 0$ | |
|---|---|---|---|---|---|---|
| | Mean | SD* | Mean | SD | Mean | SD |
| **Child characteristics** | | | | | | |
| Age | 11.58 | 1.352 | 12.058 | 1.440 | 12.45 | 1.426 |
| Ever attended school = 1 | 0.845 | 0.362 | 0.421 | 0.494 | 0.254 | 0.437 |
| **Educational characteristics** | | | | | | |
| Annual primary schooling costs | 125.94 | 155.11 | 136.64 | 176.28 | 164.74 | 203.53 |
| Distance to closest middle school | 4.018 | 8.444 | 7.530 | 12.79 | 9.139 | 10.438 |
| Distance to closest secondary school | 4.416 | 7.194 | 4.784 | 7.836 | 6.770 | 8.515 |
| Proportion of area primary schools with electricity | 0.371 | 0.372 | 0.368 | 0.365 | 0.387 | 0.383 |
| Proportion of area primary schools with water | 0.541 | 0.394 | 0.555 | 0.399 | 0.477 | 0.411 |
| Proportion of areas primary schools with brick walls | 0.840 | 0.267 | 0.820 | 0.284 | 0.787 | 0.277 |
| **Household characteristics** | | | | | | |
| Highest education level of adult male (years) | 4.825 | 4.987 | 3.802 | 4.576 | 2.016 | 3.112 |
| Highest education level of adult female (years) | 0.822 | 2.502 | 0.538 | 1.998 | 0.180 | 1.098 |
| Landholding (acres) | 2.818 | 10.24 | 2.956 | 9.289 | 0.490 | 1.311 |
| Annual per capita expenditure | 4200 | 3083 | 4240 | 3288 | 3667 | 2701 |
| Family size | 10.26 | 5.278 | 9.757 | 4.066 | 8.860 | 2.802 |
| ***Number of Observations*** | 853 | | 1047 | | 122 | |

*SD: Standard Deviation

Another policy prescription to reduce child labour is improvement in school inputs (quality). While we do not have information on measures with direct bearing on student achievement, we explore potential school input effects by including three measures that capture

the quality of the local school infrastructure. These are: the proportion of area primary schools with access to water supply, the proportion supplied with electricity, and the proportion with walls made of permanent material.

The variables, $E$, that parameterize the household utility and production functions include the highest educational level among the household's adult males and adult females. Since it is plausible that the demand for intra-household child labour is high on family farms, household landholding is included in vector $E$. Household demographic characteristics include family size, which may be positively related to household labour supply and, therefore, negatively related to pressures upon the individual child. Since children must often care for their younger siblings, the numbers of younger children in 4 age-sex categories are also included as regressors. It is evident from the statistics in Table 4 that, as compared to children who do not work, children who provide extra-household labour come from families with less educated adults, smaller landholdings and lower per capita expenditures. Difference between children who do not work and children who supply only intra-household labour supply are not as pronounced (see Tables 3 and 4).

Vector $E$ also contains a set of community variables that may influence household decisions. These include variables that may enhance the productivity of farming households such as the presence of canal irrigation and access to agricultural extension agents. Since employment opportunities are plausibly concentrated in more populated areas, the degree of remoteness of a community may influence demand for child labour. Hence, distance from the *tehsil* (sub-district administrative unit) capital and the presence of a paved road are also included as variables in vector $E$.

The local child wage rate, $w$, is poorly reported in the PIHS. Hence, we assume that child wages are a function child age and sex. In addition, based on the assumption that there is a positive correlation between child wages and adult male wages, we include the cluster level average daily adult male wage as a regressor to capture variation in child wages across clusters.

# 5 Results

Although, our primary aim is to explore the differential effect of schooling costs on extra-household and intra-household labour supply, in order to aid comparisons with the existing literature, we begin by eschewing the distinction between these two types of child labour. Thus, we first estimate a child labour supply function with total weekly work hours as the dependent variable. This is followed by separate estimation of the supply functions of the two types of child labour. To conclude our empirical exploration, we also present estimates pertaining to school enrolment. As far as possible, we present estimates for the full sample as well as separately for boys and girls. Given the focus of this paper, we comment mainly on the effects of schooling related variables and only briefly on the effects of the other explanatory variables.

## 5.1 Total Labour Supply

Table 5 presents type-one Tobit (column 1) and Heckman's two-step (column 3) estimates of a total (extra-household and intra-household) child labour supply function. The marginal effects of the variables are presented in columns 2 and 4.[9] The two sets of coefficient estimates and associated marginal effects closely resemble one another.[10] Consistent with the discussion in Chapter 4 of gender differences in mean weekly work hours, the estimated coefficients of the gender dummy indicate that girls work considerably longer hours than boys. As children age, they are more likely to work. Based on the marginal effects in columns 2 and 4, a one-year increase in age is associated with about a 3 hour lengthening of the workweek. The estimated coefficients of the included family characteristics show that children from households with more educated adults work fewer hours, though the reductions are small. An increase of one year in the schooling level of the most educated household adult male would lead to about a half-hour reduction in children's weekly hours of work. The schooling level of the most educated household adult female does not significantly affect child labour supply decisions. Turning to the key variables in our analysis, we see that the three measures of schooling costs are positively related to child labour supply decisions in both models. Although they are jointly significant (*p-value* 0.0305), only the direct cost of primary schooling is individually significant. The

[9] The marginal effect of a variable is calculated as the estimated coefficient of the variable in the labor supply equation times the predicted probability of working, the latter calculated at the mean values of the explanatory variables.

[10] As discussed, the Heckman two-step estimates presented here are identified on the basis of the non-linearity of the inverse-Mills ratio. To probe the sensitivity of the results, we imposed exclusion restrictions on the labor supply function, i.e. to aid identification. We sequentially excluded the family and community characteristics from the labor supply function. While the statistical significance of the coefficient on the inverse-Mills ratio was very sensitive to changes in specification, the coefficient on the direct school cost variable was always statistically significant at, at least the 1% level and lay in the range 0.011-0.016.

magnitude of the coefficient indicates that an increase in the direct costs of primary schooling by one standard deviation would lead to an increase in weekly labour supply of between 1.2-1.7 hours (167.15 x 0.007 or 167.15 x 0.01). The three school infrastructure measures are also jointly significant (*p-value* 0.0162), although only the coefficient of the variable measuring the supply of water to area primary schools is individually significant. Overall, it appears that increases in these school inputs would reduce children's hours of work.

**Table 5: Labor Supply - Hours worked per week and Participation (Standard Errors)**

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| **Variable** | **Tobit Estimates** | **Marginal Effects** | **Heckman Two-Step** | **Marginal Effects** | **Probit Marginal Effects** |
| Male | -30.98 | -16.64 | -20.47 | -12.38 | -0.605 |
| | (1.622) | (1.148) | (7.943) | (3.044) | (0.029) |
| Age | 5.208 | 2.747 | 4.626 | 2.785 | 0.084 |
| | (0.523) | (0.274) | (0.960) | (0.316) | (0.010) |
| Distance to closest middle school | 0.007 | 0.004 | 0.026 | 0.016 | 0.0003 |
| | (0.069) | (0.036) | (0.067) | (0.040) | (0.0017) |
| Distance to closest secondary school | 0.119 | 0.063 | 0.105 | 0.063 | 0.0002 |
| | (0.104) | (0.055) | (0.104) | (0.063) | (0.0001) |
| Annual primary schooling costs | 0.014 | 0.007 | 0.015 | 0.009 | 0.00014 |
| | (0.005) | (0.003) | (0.005) | (0.003) | (0.00008) |
| Electricity | -1.621 | -0.855 | -1.846 | -1.111 | 0.023 |
| | (2.411) | (1.271) | (2.441) | (1.493) | (0.063) |
| Water | -4.823 | -2.543 | -5.571 | -3.353 | -0.023 |
| | (2.05) | (1.081) | (2.071) | (1.277) | (0.052) |
| Brick walls | -3.978 | -2.098 | -2.14 | -1.288 | -0.092 |
| | (2.794) | (1.437) | (2.922) | (1.703) | (0.068) |
| Highest Education Level - Male | -0.898 | -0.474 | -0.758 | -0.456 | -0.013 |
| | (0.181) | (0.095) | (0.226) | (0.110) | (0.004) |
| Highest Education Level - Female | -0.659 | -0.348 | -0.714 | -0.429 | -0.008 |
| | (0.387) | (0.204) | (0.402) | (0.236) | (0.007) |
| Landholding | 0.094 | 0.050 | 0.049 | 0.029 | 0.002 |
| | (0.079) | (0.042) | (0.084) | (0.049) | (0.001) |
| Family Size | -1.531 | -0.807 | -1.742 | -1.048 | -0.015 |
| | (0.316) | (0.167) | (0.354) | (0.204) | (0.007) |
| Number of males 0-4 age group | 1.734 | 0.914 | 1.882 | 1.133 | 0.025 |
| | (1.016) | (0.535) | (1.054) | (0.612) | (0.020) |
| Number of females 0-4 age group | 1.977 | 1.042 | 2.797 | 1.683 | 0.010 |
| | (0.954) | (0.503) | (0.971) | (0.621) | (0.021) |
| Number of males 5-9 age group | 3.028 | 1.597 | 3.349 | 2.015 | 0.036 |
| | (0.895) | (0.472) | (0.973) | (0.556) | (0.019) |
| Number of females 5-9 age group | 3.409 | 1.798 | 3.896 | 2.344 | 0.029 |
| | (0.932) | (0.492) | (1.000) | (0.583) | (0.021) |
| Average Male Wage | 0.051 | 0.027 | 0.103 | 0.062 | -0.0018 |
| | (0.068) | (0.036) | (0.072) | (0.046) | (0.0015) |
| Number of Observations | 1900 | | 1900 | | 1900 |
| Log Likelihood Value | -5458.36 | | . | | -896.58 |

Notes: The specification also includes a set of community controls. These are the distance of the community from the tehsil capital, access to a paved road, access to canal irrigation, and whether the community was visited by an agricultural extension worker in the past 6 months.

Separate estimates of the type-one Tobit model for boys and girls are presented in Table 6. Direct primary schooling costs are positively related to the labour supply of both boys and girls, although the marginal effect is somewhat larger for girls. For boys, distance to the closest secondary school is positively related, while distance to the closest middle school is negatively related, to weekly work hours. Although the latter result may appear odd, it is plausible that proximity to middle school allows children to work longer hours. The distance measures of school cost play a rather limited role in the labour supply of girls.

**Table 6: Labour Supply - Hours worked per week (Standard Errors)**

| Variable | Tobit Estimates Male | Marginal Effects Male | Tobit Estimates Female | Marginal Effects Female |
|---|---|---|---|---|
| Male | . | . | . | . |
| Age | 9.992 | 2.584 | 3.609 | 2.905 |
| | (1.357) | (0.344) | (0.534) | (0.431) |
| Distance to closest middle school | -0.547 | -0.142 | 0.049 | 0.039 |
| | (0.312) | (0.081) | (0.061) | (0.048) |
| Distance to closest secondary school | 0.580 | 0.150 | 0.032 | 0.025 |
| | (0.273) | (0.071) | (0.107) | (0.086) |
| Annual primary schooling costs | 0.027 | 0.007 | 0.012 | 0.010 |
| | (0.013) | (0.003) | (0.005) | (0.004) |
| Electricity | -4.932 | -1.275 | -0.953 | -0.767 |
| | (5.897) | (1.524) | (2.525) | (2.033) |
| Water | -3.866 | -1.000 | -6.090 | -4.902 |
| | (4.926) | (1.274) | (2.175) | (1.752) |
| Brick walls | -13.067 | -3.380 | 0.764 | 0.615 |
| | (6.647) | (1.717) | (2.972) | (2.392) |
| Highest Education Level - Male | -1.891 | -0.489 | -0.522 | -0.420 |
| | (0.454) | (0.116) | (0.189) | (0.152) |
| Highest Education Level - Female | -0.400 | -0.104 | -0.803 | -0.647 |
| | (1.013) | (0.262) | (0.388) | (0.312) |
| Landholding | 0.305 | 0.079 | 0.025 | 0.020 |
| | (0.185) | (0.048) | (0.085) | (0.069) |
| Family Size | -1.242 | -0.321 | -1.828 | -1.472 |
| | (0.786) | (0.203) | (0.326) | (0.263) |
| Number of males 0-4 age group | 0.348 | 0.090 | 2.417 | 1.946 |
| | (2.605) | (0.673) | (1.037) | (0.835) |
| Number of females 0-4 age group | 0.375 | 0.097 | 3.004 | 2.418 |
| | (2.383) | (0.616) | (0.987) | (0.795) |
| Number of males 5-9 age group | 5.016 | 1.297 | 2.379 | 1.915 |
| | (2.162) | (0.559) | (0.943) | (0.759) |
| Number of females 5-9 age group | 1.442 | 0.373 | 4.511 | 3.631 |
| | (2.270) | (0.587) | (0.987) | (0.759) |
| Average Male Wage | 0.119 | 0.031 | 0.045 | 0.0361 |
| | (0.171) | (0.044) | (0.071) | (0.057) |
| Number of Observations | 1004 | | 896 | |
| Log Likelihood Value | -1754.21 | | -3596.37 | |

Notes: The specification also includes a set of community controls. These are the distance of the community from the tehsil capital, access to a paved road, access to canal irrigation, and whether the community was visited by an agricultural extension worker in the past 6 months.

The main conclusion yielded by these estimates, based upon treatment of hours of work as a single entity, is that, consistent with conventional wisdom, reduction in the cost of schooling and improvements in its quality as measured by school infrastructure, would lead to a reduction in children's labour supply in rural Pakistan.

## 5.2 Extra-Household Labour Supply

**Table 7: Extra-Household Labor Supply - Hours worked per week and Participation (Standard Errors)**

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| **Variable** | **Tobit Estimates Full Sample** | **Marginal Effects Full Sample** | **Probit Estimates Full Sample** | **Marginal Effects Full Sample** |
| Male | -4.138 | -0.117 | -0.1118 | -0.007 |
| | (7.010) | (0.202) | (0.146) | (0.009) |
| Age | 12.89 | 0.362 | 0.200 | 0.012 |
| | (2.569) | (0.138) | (0.037) | (0.002) |
| Distance to closest middle school | 0.436 | 0.012 | 0.008 | 0.0004 |
| | (0.329) | (0.010) | (0.005) | (0.0003) |
| Distance to closest secondary school | 1.399 | 0.039 | 0.021 | 0.0012 |
| | (0.476) | (0.018) | (0.012) | (0.0007) |
| Annual primary schooling costs | 0.066 | 0.002 | 0.001 | 0.00006 |
| | (0.021) | (0.001) | (0.0005) | (0.00003) |
| Electricity | 0.293 | 0.008 | 0.021 | 0.0012 |
| | (10.67) | (0.298) | (0.222) | (0.013) |
| Water | -26.10 | -0.734 | -0.442 | -0.026 |
| | (9.43) | (0.356) | (0.211) | (0.013) |
| Brick walls | -11.67 | -0.328 | -0.159 | -0.009 |
| | (12.35) | (0.365) | (0.271) | (0.016) |
| Highest Education Level - Male | -3.621 | -0.102 | -0.054 | -0.003 |
| | (0.987) | (0.043) | (0.012) | (0.0009) |
| Highest Education Level - Female | -3.774 | -0.106 | -0.063 | -0.004 |
| | (2.621) | (0.079) | (0.036) | (0.002) |
| Landholding | -6.083 | -0.171 | -0.093 | -0.006 |
| | (1.951) | (0.063) | (0.027) | (0.001) |
| Family Size | -2.265 | -0.064 | -0.028 | -0.002 |
| | (1.633) | (0.050) | (0.022) | (0.001) |
| Number of males 0-4 age group | 0.014 | 0.000 | -0.019 | -0.001 |
| | (4.819) | (0.135) | (0.085) | (0.005) |
| Number of females 0-4 age group | 1.664 | 0.046 | 0.013 | 0.0007 |
| | (4.660) | (0.132) | (0.080) | (0.005) |
| Number of males 5-9 age group | 9.124 | 0.256 | 0.129 | 0.008 |
| | (4.089) | (0.140) | (0.066) | (0.004) |
| Number of females 5-9 age group | -4.097 | -0.115 | -0.066 | -0.004 |
| | (4.608) | (0.134) | (0.064) | (0.004) |
| Average Male Wage | 1.306 | 0.037 | 0.019 | 0.001 |
| | (0.312) | (0.015) | (0.006) | (0.0004) |
| Number of Observations | 1900 | | 1900 | |
| Log Likelihood Value | -933.42 | | -376.14 | |

Notes: The specification also includes a set of community controls. These are the distance of the community from the tehsil capital, access to a paved road, access to canal irrigation, and whether the community was visited by an agricultural extension worker in the past 6 months.

Columns 1 and 2 of Table 7 present Tobit estimates of (17), the extra-household child labour supply function, for the full sample of children.[11] It is clear that, consistent with the model's predictions, the direct costs of primary schooling and the costs of post-primary schooling as measured by distances to the closest middle and secondary schools, are positively related to hours of work. The three cost variables are jointly significant (*p-value* 0.0001), and the estimates suggest that a one standard deviation rise in the direct costs of primary schooling would increase weekly extra-household hours of work by about twenty minutes (167.15 x 0.002 x 60), a 14% increase in the mean weekly hours of extra-household work (100 x 167.15 x 0.002/2.36). There is some evidence that improvements in school infrastructure as measured by the proportion of area primary schools supplied with water would reduce extra-household child labour supply. A one standard deviation increase in the proportion of area primary schools with water supply is associated with a seventeen (0.397 x -0.734 x 60) minute reduction in mean extra-household work. In sum, there appears to be a strong link between schooling related variables and extra-household child labour supply. This is supported by Probit estimates of the effects of the variables upon the probability of participation in market work, reported in columns 3 and 4 of Table 7.[12]

## 5.3 Intra-household Labour Supply

A testable implication of the theoretical framework in Chapter 3 is that schooling costs do not influence the intra-household work hours of children simultaneously engaged in extra-household labour while potentially influencing the intra-household labour supply of children unengaged in market work. Table A3, presents Tobit estimates of the intra-household labour supply function of children engaged in market work. Analogous estimates pertaining to children unengaged in market work are reported in column 1 and 2 of Table 8. Gender specific estimates of the intra-household labour supply function of children unengaged in market work are reported in Table 9.

The estimates in Table A3 indicate that the intra-household labour of children engaged in market work labour is not significantly related to schooling costs or to schooling inputs. This is consistent with the model's prediction of the insensitivity of intra-household child labour supply to changes in the costs of schooling as long as extra-household labour is also supplied. However, the estimates in columns 1 and 2 of Table 8 indicate that schooling related variables are not significantly related even to the intra-household labour supply of children unengaged in market work. Since the above sets of estimates do not indicate that the sensitivity of intra-household

[11] The proportion of children supplying extra-household labor is only about 6% (122 observations). This small number of uncensored observations makes it difficult to obtain gender specific-estimates of the extra-household labor supply function. Hence, we do not estimate separately by gender in this chapter.

[12] We model intra- and extra-household labor supply separately. One possibility would be to treat these two types of labor as endogenous and allow them to be jointly determined. While this may be an attractive possibility, the lack of identifying instruments precludes this approach.

child labour supply to changes in schooling costs differs by whether children also supply wage labour, the intra-household labour supply function is re-estimated upon the full sample of children. Columns 3 and 4 of Table 8 present the ensuing estimates. It is not surprising to find that intra-household child labour is not significantly related to schooling costs in the full sample of children.

Gender specific estimates (Table 9) indicate that, for boys and girls, the schooling cost and input variables are jointly insignificant at conventional levels. Only in the case of boys is a school cost related variable, namely, distance to the closest middle school, individually significant, but the variable is negatively, rather than positively, correlated with intra-household work hours. Hence, while schooling costs and extra-household child labour supply appear positively and significantly correlated, schooling related variables are generally insignificant correlates of the intra-household labour supply of children unengaged in extra-household work. This finding is inconsistent with the theoretical model in Chapter 3. As discussed, the adults in the model make no distinction between their child's intra-household and extra-household work, since the sole object of each type of labour is the augmentation of household consumable resources. Child labour is simply efficiently allocated between market and household work. The above finding suggests that intra-household child labour does not result simply from an efficient allocation of generic household child labour between market work and household production, but that adults consider intra-household child labour to be different from extra-household child labour. Perhaps intra-household child labour contributes to children's human capital in a manner that schooling cannot.

The other independent variables in the regressions have the expected sign configuration. Older children work longer hours, with this being more pronounced among girls than boys. A 14 year old male (female) may be expected to work 6.5 (10) hours per week more than a 10 year old male (female) in household production. Children from households with more educated adults supply fewer hours per week of intra-household labour. The landholdings of a household are expected to be positively related to its demand for child labour and, for boys, this variable is positively related to work hours, though the marginal effect is small - an increase in landholdings by one acre increases boys' intra-household weekly work hours by about five minutes. The demographic variables, i.e. family size and the number of younger children (age 0-9), do not influence the intra-household work hours of boys. For girls, larger families are associated with a decline in their contribution to household work, while the presence of younger children appears to increase their workload. Given the nature of work traditionally undertaken by females in rural Pakistan, the positive relationship between girls' hours of work and the presence of younger children in the household is as expected.

**Table 8: Intra-Household Labor Supply – Hours worked per week and Participation (Standard Errors)**

| Variable | Tobit Estimates $L^{M*}=0$ | Marginal Effects | Tobit Estimates Full Sample | Marginal Effects | Probit Marginal Effects $L^{M*}=0$ |
|---|---|---|---|---|---|
| Male | -31.30 | -15.79 | -31.34 | -16.022 | -0.632 |
| | (1.566) | (0.783) | (1.483) | (0.732) | (0.029) |
| Age | 4.180 | 2.040 | 3.972 | 1.977 | 0.074 |
| | (0.498) | (0.242) | (0.468) | (0.232) | (0.010) |
| Distance to closest middle school | -0.022 | -0.011 | -0.033 | -0.016 | -0.0003 |
| | (0.065) | (0.031) | (0.062) | (0.031) | (0.0018) |
| Distance to closest secondary school | -0.003 | -0.001 | -0.024 | -0.012 | -0.0009 |
| | (0.100) | (0.048) | (0.094) | (0.046) | (0.003) |
| Annual primary schooling costs | 0.006 | 0.003 | 0.006 | 0.003 | 0.00005 |
| | (0.005) | (0.002) | (0.0045) | (0.002) | (0.00009) |
| Electricity | -2.165 | -1.057 | -2.330 | -1.160 | 0.013 |
| | (2.303) | (1.124) | (2.167) | (1.078) | (0.065) |
| Water | -3.269 | -1.596 | -2.822 | -1.405 | -0.011 |
| | (1.954) | (0.954) | (1.842) | (0.971) | (0.055) |
| Brick walls | -2.204 | -1.076 | -1.638 | -0.815 | -0.074 |
| | (2.666) | (1.301) | (2.511) | (1.250) | (0.073) |
| Highest Education Level - Male | -0.641 | -0.313 | -0.573 | -0.285 | -0.010 |
| | (0.169) | (0.082) | (0.162) | (0.080) | (0.003) |
| Highest Education Level - Female | -0.505 | -0.247 | -0.557 | -0.277 | -0.007 |
| | (0.357) | (0.174) | (0.348) | (0.173) | (0.008) |
| Landholding | 0.139 | 0.068 | 0.139 | 0.069 | 0.002 |
| | (0.071) | (0.035) | (0.069) | (0.035) | (0.0016) |
| Family Size | -1.351 | -0.659 | -1.305 | -0.649 | -0.015 |
| | (0.296) | (0.144) | (0.283) | (0.141) | (0.007) |
| Number of males 0-4 age group | 1.345 | 0.657 | 1.307 | 0.651 | 0.026 |
| | (0.962) | (0.469) | (0.912) | (0.454) | (0.021) |
| Number of females 0-4 age group | 1.706 | 0.833 | 1.482 | 0.738 | 0.009 |
| | (0.896) | (0.438) | (0.855) | (0.426) | (0.022) |
| Number of males 5-9 age group | 2.182 | 1.065 | 2.023 | 1.007 | 0.027 |
| | (0.853) | (0.417) | (0.807) | (0.402) | (0.021) |
| Number of females 5-9 age group | 3.734 | 1.823 | 3.735 | 1.859 | 0.036 |
| | (0.875) | (0.428) | (0.835) | (0.416) | (0.023) |
| Average Male Wage | -0.090 | -0.044 | -0.108 | -0.054 | -0.003 |
| | (0.066) | (0.032) | (0.062) | (0.031) | (0.0017) |
| Number of Observations | 1778 | | 1900 | | 1900 |
| Log Likelihood Value | -4746.39 | | -5110.85 | | -827.57 |

Notes: The specification also includes a set of community controls. These are the distance of the community from the tehsil capital, access to a paved road, access to canal irrigation, and whether the community was visited by an agricultural extension worker in the past 6 months.

**Table 9: Intra-Household Labor Supply – Hours worked per week (Standard Errors)**

| Variable | Tobit Estimates Boys, $L^{M*} = 0$ | Marginal Effects | Tobit Estimates Girls, $L^{M*} = 0$ | Marginal Effects |
|---|---|---|---|---|
| Male | . | . | . | . |
| Age | 7.547 | 1.640 | 3.209 | 2.537 |
| | (1.335) | (0.286) | (0.515) | (0.407) |
| Distance to closest middle school | -0.634 | -0.138 | 0.039 | 0.031 |
| | (0.032) | (0.070) | (0.056) | (0.048) |
| Distance to closest secondary school | 0.449 | 0.097 | -0.124 | -0.098 |
| | (0.266) | (0.057) | (0.105) | (0.083) |
| Annual primary schooling costs | 0.012 | 0.003 | 0.008 | 0.006 |
| | (0.014) | (0.003) | (0.005) | (0.004) |
| Electricity | -8.459 | -1.839 | -0.957 | -0.756 |
| | (5.882) | (1.278) | (2.442) | (1.931) |
| Water | -4.597 | -0.999 | -2.855 | -2.258 |
| | (4.890) | (1.064) | (2.092) | (1.654) |
| Brick walls | -8.108 | -1.762 | 0.172 | 0.136 |
| | (6.575) | (1.427) | (2.861) | (2.262) |
| Highest Education Level - Male | -1.221 | -0.265 | -0.429 | -0.339 |
| | (0.440) | (0.095) | (0.179) | (0.141) |
| Highest Education Level - Female | -0.406 | -0.088 | -0.536 | -0.424 |
| | (0.995) | (0.216) | (0.358) | (0.283) |
| Landholding | 0.396 | 0.086 | 0.048 | 0.038 |
| | (0.169) | (0.037) | (0.078) | (0.061) |
| Family Size | -1.035 | -0.225 | -1.651 | -1.305 |
| | (0.779) | (0.169) | (0.306) | (0.243) |
| Number of males 0-4 age group | -0.444 | -0.096 | 2.083 | 1.647 |
| | (2.645) | (0.575) | (0.978) | (0.773) |
| Number of females 0-4 age group | -0.098 | -0.021 | 2.865 | 2.265 |
| | (2.343) | (0.509) | (0.936) | (0.741) |
| Number of males 5-9 age group | 2.927 | 0.636 | 2.140 | 1.692 |
| | (2.190) | (0.476) | (0.895) | (0.708) |
| Number of females 5-9 age group | 2.619 | 0.569 | 4.479 | 3.542 |
| | (2.237) | (0.487) | (0.932) | (0.737) |
| Average Male Wage | -0.090 | -0.020 | -0.083 | -0.065 |
| | (0.172) | (0.038) | (0.069) | (0.054) |
| Number of Observations | 949 | | 829 | |
| Log Likelihood Value | -1423.46 | | -3229.53 | |

Notes: The specification also includes a set of community controls. These are the distance of the community from the tehsil capital, access to a paved road, access to canal irrigation, and whether the community was visited by an agricultural extension worker in the past 6 months.

## 5.4 Schooling

**Table 10: Probability of Attending School (Standard Errors)**

| Variable | Marginal Effects Full Sample | Marginal Effects Males | Marginal Effects Female |
|---|---|---|---|
| Male | 0.453 | . | . |
| | (0.029) | | |
| Age | -0.013 | -0.005 | -0.026 |
| | (0.008) | (0.008) | (0.012) |
| Distance to closest middle school | -0.004 | -0.0001 | -0.004 |
| | (0.002) | (0.002) | (0.002) |
| Distance to closest secondary school | -0.005 | -0.004 | -0.004 |
| | (0.002) | (0.001) | (0.005) |
| Annual primary schooling costs | -0.0002 | -0.00003 | -0.0003 |
| | (0.0001) | (0.0001) | (0.0001) |
| Electricity | -0.072 | -0.128 | 0.120 |
| | (0.081) | (0.050) | (0.084) |
| Water | 0.169 | 0.042 | 0.293 |
| | (0.050) | (0.038) | (0.068) |
| Brick walls | -0.072 | 0.024 | -0.201 |
| | (0.081) | (0.069) | (0.092) |
| Highest Education Level - Male | 0.044 | 0.030 | 0.046 |
| | (0.004) | (0.003) | (0.005) |
| Highest Education Level - Female | 0.043 | 0.020 | 0.059 |
| | (0.012) | (0.009) | (0.013) |
| Landholding | -0.003 | 0.002 | -0.009 |
| | (0.002) | (0.002) | (0.004) |
| Family Size | -0.008 | -0.013 | 0.003 |
| | (0.006) | (0.005) | (0.008) |
| Number of males 0-4 age group | -0.019 | -0.001 | -0.050 |
| | (0.019) | (0.016) | (0.027) |
| Number of females 0-4 age group | 0.013 | 0.019 | -0.002 |
| | (0.016) | (0.015) | (0.024) |
| Number of males 5-9 age group | 0.009 | 0.026 | -0.017 |
| | (0.016) | (0.014) | (0.025) |
| Number of females 5-9 age group | -0.0005 | 0.025 | -0.043 |
| | (0.019) | (0.017) | (0.064) |
| Log Likelihood | -926.94 | -425.27 | -469.84 |
| Number of Observations | 1926 | 1006 | 920 |

So far, we have examined the cross-price effect of schooling on child labour supply. An assessment of the direct effect of school costs on schooling decisions should lead to a clearer interpretation of the results thus far. Almost 61% of our sample has attended school. There are stark differences across gender. While 80% of boys have attended school at some stage, the corresponding figure for girls is 39%. Probit estimates of the school attendance decision are reported in Table 10.[13] For the full sample, the estimated coefficients of the three school cost variables have the expected negative signs. The variables are individually and jointly statistically

[13] There is information on the schooling decisions of some of the children who were excluded from the sample due to lack of information about their hours worked. This explains the slightly larger data set of 1,926 observations upon which the schooling model is estimated.

significant at conventional levels. It is indicated that a decrease in the direct costs of primary schooling of one standard deviation would increase the probability of school attendance by about 3 percentage points (167.15 x 0.0002). The gender specific estimates show that the above is mainly attributable to the behaviour of girls, in that a reduction of one standard deviation in primary schooling costs would increase the probability of a girls' school attendance by 5 percentage points on average while having no discernable effect on the school attendance decisions of boys. The effects of the three school quality variables are ambiguous.

## 5.5 A final synthesis

To compare the relative effect of school costs on school and work decisions, consider the Probit estimates of labour force participation presented in Tables 5, 7 and 8. Without drawing a distinction between the two types of labour (Table 5), we estimate that a one standard deviation decrease in annual primary schooling costs (Rs 167.15) is associated with a 2.3 percentage point decrease in the probability of working. The corresponding direct price effect is a 3.3 percentage point increase in the probability of school attendance. The corresponding increase and decrease in, respectively, the probabilities of school attendance and working may be construed as evidence of the substitutability of children's schooling and work. At the same time, since the increase in the probability of school attendance is higher than the decline in the probability of working, it would appear that schooling and leisure are substitutes as well, as suggested by Ravallion and Wodon (2000).

Drawing a distinction between extra-household and intra-household child work leads to a less sanguine conclusion about the substitutability of children's schooling and work. Based on the estimates in Table 7, a one standard deviation decrease in annual primary schooling costs is significantly associated with a 1-percentage point decrease in the probability of extra-household work. Given that the participation rate in extra-household work is only about 6%, this is a substantial effect. The analogous effect on the probability of intra-household labour (Table 8) is a decrease of 0.9 percentage points, though the effect is not statistically significant. In other words, the effect of annual primary schooling costs on child labour supply arises mainly from its effect on extra-household child labour supply. This, combined with the significant effect of schooling costs on school attendance and the low rates of children's participation in market work in rural Pakistan, suggests that a substantial portion of increased school attendance from a decrease in schooling costs will be attributable to reduction in children's leisure. Furthermore, while children's extra-household labour and schooling appear to be substitutes, it seems their intra-household labour and schooling are not substitutable.

# 6 Conclusion

The International Labour Organization considers improvement in access to schools and school quality to be the most effective way of reducing child labour in less developed countries (ILO, 1998). Improvement in access to schools, interpretable as reduction in schooling costs, is expected to raise school attendance at the expense of child labour. Given that the child labour force consists mainly of unpaid family workers (ILO, 1996), this paper examined whether work by rural Pakistani children in household production (intra-household child labour) responds differently to changes in schooling costs than their work in the labour market (extra-household child labour).

A model of child labour drawing on Gronau's (1977) model and agricultural household models as discussed by Singh, Squire, and Strauss (1986) was presented. The model predicted that (i) the extra-household labour supply of children may be positively related to schooling costs; (ii) the intra-household labour supply of children working in the labour market (i.e. providing extra-household labour) ought to be unresponsive to changes in schooling costs; (iii) the intra-household labour supply of children unengaged in market work may be positively related to schooling costs.

Our empirical work indicated that schooling costs and extra-household child labour supply are positively related. A one standard deviation decrease in annual primary schooling costs is associated with a 1-percentage point reduction in the probability of child participation in extra-household labour. As theoretically predicted, the intra-household labour of children engaged in market work is unresponsive to changes in schooling costs. However, though extra-household child labour supply and schooling costs appear positively related, the intra-household labour supply of even children unengaged in market work is unresponsive to changes in schooling costs, suggesting parents distinguish between the two types of child labour. It seems that while parents consider children's extra-household labour and schooling to be substitutes, they view intra-household child labour differently. The relative insensitivity of intra-household child labour to changes in schooling costs might arise if parents perceived that the benefits fom such labour consist of more than increases in household consumption. For example, parents may hold that participation in household production will lead to their children accumulating skills that may not be acquired at school. Regardless of the reasons, our findings indicate that intra-household child labour and schooling are not substitutes in rural Pakistan.[14]

[14] This finding suggests that working at home and attending school are not incompatible and that it may be possible for children to combine intra-household work and schooling. Similar views are echoed by Lieten and White (2001). On the basis of a participatory study of children's perspectives, Woodhead (1998, 1999) argues that most working children do not see work and schooling as incompatible alternatives and indeed favor a combination of work and school activities.

More generally, our findings suggest that a policy of reducing school costs is an effective way of combating extra-household labour supply. Hence, in countries or regions where extra-household labour is the dominant form of child labour, a policy of school cost reduction may be effective. However, given that the dominant form of child labour in many parts of the world is intra-household labour, our findings cast doubt upon the efficacy of a policy of school cost reduction in combating child labour.

# Appendix

**Table A1: Hours Worked per Week Conditional on Participation Children age 10-14, Pakistan 1990-91 (Standard Deviation)**

| | Total | Male | Female |
|---|---|---|---|
| Hours of work - all activities | 26.19 | 30.2 | 24.7 |
| | (21.5) | (22.3) | (21.1) |
| Hours worked outside the household | 36.8 | 43.8 | 31.1 |
| | (20.5) | (23.2) | (15.9) |
| Hours worked on family farm or enterprise | 18.7 | 25.1 | 11.7 |
| | (17.3) | (19.7) | (10.4) |
| Hours spent on domestic work | . | . | 19.0 |
| | . | . | (15.5) |
| Hours of work - excluding domestic work | 24.1 | 30.2 | 17.6 |
| | (20.2) | (22.3) | (15.4) |

**Table A2: Labor Supply - Hours worked per week - Excluding Domestic Work (Standard Errors)**

| Variable | Tobit Estimates | Marginal Effects |
|---|---|---|
| Male | -0.022 | -0.006 |
| | (0.072) | (0.021) |
| Age | 0.206 | 0.060 |
| | (0.025) | (0.007) |
| Distance to closest middle school | 0.002 | 0.0005 |
| | (0.003) | (0.0009) |
| Distance to closest secondary school | 0.009 | 0.002 |
| | (0.005) | (0.001) |
| Annual primary schooling costs | 0.0007 | 0.0002 |
| | (0.0002) | (0.00007) |
| Electricity | -0.084 | -0.024 |
| | (0.114) | (0.033) |
| Water | -0.259 | -0.075 |
| | (0.095) | (0.028) |
| Brick walls | -0.220 | -0.064 |
| | (0.129) | (0.038) |
| Highest Education Level - Male | -0.050 | -0.015 |
| | (0.008) | (0.002) |
| Highest Education Level - Female | -0.063 | -0.018 |
| | (0.022) | (0.006) |
| Landholding | 0.010 | 0.003 |
| | (0.003) | (0.001) |
| Family Size | -0.045 | -0.013 |
| | (0.015) | (0.004) |
| Number of males 0-4 age group | 0.052 | 0.015 |
| | (0.048) | (0.014) |
| Number of females 0-4 age group | 0.017 | 0.005 |
| | (0.045) | (0.013) |
| Number of males 5-9 age group | 0.076 | 0.022 |
| | (0.042) | (0.012) |
| Number of females 5-9 age group | 0.050 | 0.015 |
| | (0.044) | (0.012) |
| Average Male Wage | 0.001 | 0.0003 |
| | (0.003) | (0.0009) |
| Number of Observations | 1900 | |
| Log Likelihood Value | -1471.67 | |

Notes: The specification also includes a set of community controls. These are the distance of the community from the tehsil capital, access to a paved road, access to canal irrigation, and whether the community was visited by an agricultural extension worker in the past 6 months.

**Table A3: Intra-Household Labor Supply – Hours of Work (Standard Errors)**

| Variable | Tobit Estimates $L^M* > 0$ | Marginal Effects $L^M* > 0$ |
|---|---|---|
| Male | -35.12 | -15.85 |
| | (4.475) | (1.937) |
| Age | 1.389 | 0.673 |
| | (1.218) | (0.592) |
| Distance to closest middle school | -0.228 | -0.111 |
| | (0.244) | (0.118) |
| Distance to closest secondary school | -0.399 | -0.194 |
| | (0.298) | (0.147) |
| Annual primary schooling costs | 0.008 | 0.004 |
| | (0.010) | (0.005) |
| Electricity | 4.944 | 2.396 |
| | (5.619) | (2.737) |
| Water | 3.940 | 1.910 |
| | (5.077) | (2.448) |
| Brick walls | -2.656 | -1.287 |
| | (7.544) | (3.654) |
| Highest Education Level - Male | -0.478 | -0.232 |
| | (0.566) | (0.276) |
| Landholding | -2.130 | -1.033 |
| | (1.541) | (0.748) |
| Family Size | 1.235 | 0.598 |
| | (0.968) | (0.473) |
| Number of males 0-4 age group | 1.028 | 0.498 |
| | (2.709) | (1.314) |
| Number of females 0-4 age group | -4.571 | -2.216 |
| | (2.762) | (1.324) |
| Number of males 5-9 age group | 0.130 | 0.063 |
| | (2.241) | (1.086) |
| Number of females 5-9 age group | 4.729 | 2.292 |
| | (2.712) | (1.318) |
| Average Male Wage | -0.415 | -0.201 |
| | (0.175) | (0.083) |
| Number of Observations | 122 | |
| Log Likelihood Value | -342.68 | |

Notes: The specification also includes a set of community controls. These are the distance of the community from the tehsil capital, access to a paved road, access to canal irrigation, and whether the community was visited by an agricultural extension worker in the past 6 months.

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