Is Child Work Necessary?

Sonia Bhalotra
University of Cambridge

Abstract

This paper investigates why children work by studying the wage elasticity of child labour supply. It is argued that a negative wage elasticity favours the hypothesis that poverty compels work whereas a positive wage elasticity would favour the alternative view that children work because the relative returns to school are low. Using data for 2400 households in rural Pakistan, we estimate structural labour supply models for boys and girls, conditioning on full income and a range of demographic variables. We find that the income effect of a wage change dominates the substitution effect, producing a forward falling labour supply curve or one that is negatively sloped at low wages. We conclude that the poverty hypothesis dominates in this region though the evidence is stronger for boys than for girls. This suggests that trade sanctions or bans on child labour may be undesirable in the short run *unless* households are compensated for the loss in income. On the other hand, policies targeted at alleviating poverty or liquidity constraints are likely to reduce the prevalence of child work.

Existing studies have concentrated on the income elasticity, but this tells us nothing other than that leisure is a normal good. This is the first structural analysis of child labour and the first that estimates and draws inferences from the wage elasticity.

Keywords: child labour, poverty, gender, intertemporal labour supply.
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Contact address:
Department of Applied Economics, University of Cambridge
Sidgwick Avenue, Cambridge CB3 9DE
Tel 01223 335255; Email: sonia.bhalotra@econ.cam.ac.uk

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Sonia Bhalotra

University of Cambridge

1. Introduction

Why do children work? A common but not undisputed perception is that child participation in work is compelled by household poverty[2]. Indeed, both the geographic distribution of child workers today and the economic history of specific regions demonstrate a clearly negative association of child work and aggregate income[3]. However, it is unclear whether it was the rise in household incomes that eliminated child labour by dispelling the need for it, or whether the instrumental factor was the introduction of relevant legislation, itself a correlate of economic growth. In the last decade, microdata for developing countries have become available, which make it possible to disentangle household living standards (a microeconomic variable, which differs across households) from factors like the introduction of new laws, which apply equally across households. However, the results of these studies are mixed and a number find that the participation rates of children are uncorrelated with household income (see Section 2 below). While a handful of studies do establish a significant negative relation of household income with child work, it is argued in this paper that, by virtue of the methodology that these studies employ, this result does little more than affirm the plausible belief that child leisure is a normal good.

We are interested here in the stronger proposition that the income from child work is essential to the survival of the household. *This is what is meant by child work being* ***necessary*****.** In this case, once all other relevant variables are held constant, we should expect to observe children working towards a target income[4]. This "strong poverty hypothesis" can be tested without access to data on target incomes or poverty lines since a verifiable empirical implication is that the wage elasticity of hours of work is -1: a 10% decrease in the wage is made up by a 10% increase in work hours, so as to maintain child earnings at a constant level. More generally, a negative wage elasticity emerges at low wage rates when assets (or nonlabour income) fall below subsistence (e.g. Barzel and McDonald, 1973). It may be argued that the target is determined not by subsistence considerations but by selfish parents who enjoy above-subsistence consumption at the child's expense. However, it

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[2] See this view expressed, though not established, in Grootaert and Kanbur (1995) and Hamid (1994), for example. In much of the recent theoretical work on child labour (discussed in Section 2.1), it is axiomatic that households providing child labour are poor. However, it is only Basu and Van (1998) that use precisely the notion of *how poor* that is used in this paper.

[3] See the data in Basu (1999), for example.

is hard to see why the case of avaricious parents would yield the regularity associated with an elasticity of -1.

Are there any serious alternatives to the (strong) poverty hypothesis? Yes, there are alternative conceptualisations of the phenomenon of child labour in which household poverty plays, at best, a secondary role. One such view is that children work because the returns to work experience exceed the returns to schooling. This is not implausible in economies where schooling is of low quality or high cost[5], or where the extent of technological dynamism limits the payoff to school-learnt skills[6]. If this were the dominant explanation, we would expect to see a positive wage elasticity of child labour supply. Even where returns to school dominate, selfish parents may favour child labour over schooling because they have greater control over child income when their children are young[7]. In economies where structural change is rapid, it may alternatively be argued that parents cannot make good assessments of the returns to education. Whether children work because their households would not survive if they did not therefore remains an open empirical question, and one which this paper seeks to address.

Using survey data for 2400 households, this paper estimates labour supply equations for boys and girls who work for wages in rural Pakistan. The hypothesis that the wage elasticity of hours of work is not significantly different from (minus) unity cannot be rejected for the poorest 25% of households. This is consistent with the fact that the average expenditure level per capita in the lower quartile falls below the poverty line (see Table 2). At the means of the sample, the wage elasticity is insignificantly different from -1 for boys. For girls, it is significantly smaller than -1 but it is nevertheless negative- a result which suggests that the poverty hypothesis dominates the relative returns argument.

The paper is organised as follows. Section 2 surveys the evidence, delineating the contributions of this paper. The data are described in Section 3, where relevant descriptive statistics are presented. A theoretical framework is outlined in Section 4. Section 5 sets out the empirical model and the estimation strategy, paying particular attention to identification. Section 6 presents the results and Section 7 discusses policy implications. Section 8 concludes.

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[4] The target is the shortfall between income required for subsistence and income contributed by other household members plus asset income plus any borrowed funds.

[5] See Bekombo (1981) and Bonnet (1993) for a view that is sympathetic to the idea that limited inter-generational occupational mobility favours acquiring specific work experience over formal schooling. Related, is the argument that child labour in the English cotton mills fell in the early nineteenth century because this was the time when the working children of the previous generation had grown into a more productive cohort of adult workers (Galbi, 1997). However, from an empirical perspective, since inter-generational mobility is clearly endogenous to the education of children, it may be difficult to separate cause and effect.

[6] Rosenzweig (1995) elaborates the idea that returns to school are relatively low in regions where technical progress is slow and there is little new information to acquire or comprehend.

[7] In rural Bangladesh, for instance, 83% of children gave their earnings to their parents (Bangladesh Bureau of Statistics, 1996, Table 5.12, p.54).

2. Existing Literature and Contributions of this Paper

2.1. Theoretical work on child labour

There is a recent eruption of theoretical work on the economics of child labour. Eswaran (1998) jointly models child labour and fertility, showing how a poverty trap is created when child mortality is high and child labour is socially acceptable.Basu and Van (1998) *assume* that children only work when this is necessary to subsistence requirements[8]. Similarly, in their two period model of child labour, Baland and Robinson (1998) assume parental altruism and, implicitly, chronic poverty. Child labour exists because of the difficulty of enforcing inter-generational contracts, which makes it difficult to borrow against the future income of the child. Without direct reference to child labour in developing countries, Schultz (1961) and Becker (1993) also highlight the problem that markets for credit and insurance tend to fail for human capital investments. Lahiri and Jaffrey (1999), Ranjan (1999) and Grote, Basu and Weinhold (1998) present models in which child labour arises as the result of imperfect credit markets. Clearly, credit constraints are more likely to bind for the rural poor, not only because their average incomes are low but also because their incomes are particularly volatile. Finding that poverty compels child work is consistent with households being chronically poor or else with their being transiently poor and credit-constrained.

2.2. Empirical research on child labour

Are the axioms of the theoretical models underpinned by empirical evidence? This section surveys empirical research on child labour. There are a large number of case studies of working children observed at their place of work, detached from their family background (see the survey in Addison *et al (*1997) and interesting collections in Bequele and Boyden (1988) and Kanbargi (1991)). While these studies have served the useful purpose of highlighting the working conditions of children, they are unable to address the question of why children work since this requires information on both working and non-working children and their household circumstances. With the recent growth in availability of large nationally representative household surveys for low-income countries, a new generation of work on child labour has emerged (see Canagarajah and Coulombe (1998), Grootaert and Patrinos (1998), Kassouf (1998), Patrinos and Psacharopoulos (1997), Jensen and Nielsen (1997), Bhalotra and Heady (1998)), which has contributed to an increased understanding of the determinants of child labour. However, the results are diverse, corresponding to the diversity of regions and age-groups studied and to the variety of specifications used. There remains a paucity of focused empirical research on this subject. The following sections pick out findings that are relevant to the subject of this paper.

2.2.1. Descriptive data and the poverty hypothesis.

Studies for a diverse set of countries suggest that the *fraction of household income contributed by working children* is large enough on average that the household may rely upon it. In a survey of 110 households in the urban informal sector of Patiala in Northern India, Sharma and Mittar (1990) find that children's contributions are more than 20% in two-thirds of households, with a fifth of households enjoying a contribution of more than 40%. They also find that the proportion of households with per capita income below the poverty line is greater once children's earnings are excluded from household income. A further small survey in the Northern Indian city of Bhavnagar reveals that close to 60% of boys and girls contribute between 10 and 30% of household income (Swaminathan, 1998). Based upon observations in a village in Bangladesh, Cain (1977) estimates that boys are net producers by the age of 12. Looking at 10-14 year olds in rural Pakistan, I find that working boys contribute about a third of household *wage* income and girls about 15% (see Section 3). Using data for South Indian and Pakistani villages respectively, Jacoby and Skoufias (1997) and Sawada (1998) find that children are taken out of school in response to household income shocks. Whether this is to work or merely because the direct costs of school become unaffordable, we do not know. Patrinos and Psacharapoulos (1994) observe that children in Paraguay contribute as much as a third of household income at certain times of the year. In Asuncion in Paraguay, 6% of households depended entirely on child earnings and 50% reported that child work contributed at least half of household income (Myers, 1989). Kassouf (1998) finds that the contribution of 5-14 year old children in Brazil is less than 10% for a third of households but lies between 10-30% for almost 50% of the sample.

Is there any evidence to fuel hypotheses contrary to the poverty hypothesis? There is some evidence that children work in order to gain economic independence from their parents[9] or because the disutility from school attendance dominates the disutility from work (e.g. Delap (1998) on urban Bangladesh). As indicated in Section 1, a further reason that children may work which is, in principle, detached from sheer economic necessity, is in order to acquire training (see Aragao-Lagergren, 1997). This, however, is a stronger argument for child work on family enterprises (which the child may expect to inherit) than for child wage work, which is what this paper concentrates on. Burra (1995) and Gupta (1998) present arguments to suggest parental callousness in contemporary India. The debate over whether parents are unselfish and would only send their children to work if they had to, is alive in historical analyses of child labour (see Basu (1999, p.37)). For instance, the argument that (working class) parents were selfish (promoted by the British elite) is presented for industrialising Britain in Nardinelli (1990, p.94) and for nineteenth century America in Parsons and Goldin (1991). In opposition to this view, Anderson (1971) and Vincent (1981), for example, report

[8] Smoothing the discontinuous labour supply curve in Basu and Van gives a negative labour supply curve. However, as their paper is purely theoretical, they do not raise the hypothesis of the wage elasticity being -1 or discuss any other form of empirical verification of their model.
[9] See preliminary evidence in Iversen (1999) on rural Karnataka, India.

evidence that it was primarily under the compulsions of poverty that British parents set their children to work.

2.2.2. Econometric analyses and the poverty hypothesis

A number of the recent analyses of child labour that use contemporary microdata for developing countries find that the participation rates of children are uncorrelated with household income[10]. Since a majority of these analysis are conducted as if household income (or poverty status) were exogenous and this will tend to create a positive bias in the OLS coefficient, it is possible that a negative income effect would be identified if appropriate instrumental variables were used. This is done in Bhalotra and Heady (1998) for child work on the household farm in rural Ghana and Pakistan. The Smith-Blundell test rejects exogeneity of household food expenditure per capita and the OLS estimates have the expected upward bias. Nevertheless, while a negative income effect is identified for boys in Pakistan, there is no evidence that the work of girls in Pakistan or the work of boys and girls in Ghana is sensitive to household income. This may not be terribly surprising in the case of farm work, and further work is needed to generate robust estimates of income effects on child *wage* labour in different regions.

In a recent attempt to test the "luxury axiom" (poverty hypothesis), Ray (1999) defines an indicator variable that takes the value of 1 for households with income below the poverty line and includes this as a regressor in a labour supply model estimated on household survey data for Peru and Pakistan. The estimates reject the poverty hypothesis in Peru but, in Pakistan, child work is a significant function of poverty status. Defining an indicator variable for poverty throws away useful information on the variation in household income. This apart, Ray's strategy is subject to the same criticism as the other studies which describe the standard income effect as evidence that child labour is the result of poverty (namely, that they *merely show that leisure is a normal good*).

In this paper, by drawing inferences from the wage elasticity, we test the poverty hypothesis by a method that has not been considered so far but that we argue gives a stronger result, more pertinent to the question at hand. Are there any comparable estimates of wage elasticities in the literature? Most analyses cited in this section estimate reduced forms and do not include the wage as a regressor. An exception is the study by Ray (1999), which finds a positive wage elasticity for children in Pakistan and Peru, merging rural and urban data and combining wage work with work on the household farm or enterprise. Our estimates, which are for rural children in wage work are therefore not comparable with those in Ray[11]. In their studies of household production and time allocation, Levy (1985), Rosenzweig (1981) and Rosenzweig and Evenson (1977) find positive own-wage elasticities for children in the rural areas of Egypt and India respectively. However, negative

[10] A variety of direct income effects can be found in Kassouf (1998), Jensen (1999), Canagarajah and Coulombe (1998), Grootaert (1998), Patrinos and Psacharopoulos (1997), Patrinos and Psacharopoulos (1995), Psacharopoulos (1997)) and Ray (1998), amongst others. These studies have tended to discard the information on hours and to analyse the participation decision alone.

wage elasticities are ruled out by construction in their models. Turning from work on child labour to the larger literature on labour supply, there is some evidence of negative wage elasticities for adult men (see, for instance, Attanasio and MaCurdy (1997) for the US and Kooreman and Kapteyn (1986) for the Netherlands), though these are typically found at high wage levels. Negative wage elasticities *at low wages* have been found for Mexico using data on adults (Hernandez-Licona, 1996). Looking at children sharpens the question: Since the earnings of adults provide non-labour income for children, we would expect forward falling labour supply curves to be less likely to be observed for children than for adults.

2.3. Contributions of this paper

The main contribution of this paper is that it formulates a strong poverty hypothesis and argues that this can be tested by estimating the wage elasticity of child labour supply. The only related work in the existing literature,

The existing analyses of micro-data (see Sections 1 and 2.2.2) that are concerned with the relationship between child work and household poverty test a weak form the poverty hypothesis. In its weak form, defined by the coefficient on household income in a child labour supply equation, the hypothesis is rejected by some studies and not by others. However, many of these studies mis-specify household income as exogenous to child labour, which biases their results towards rejection of the weak poverty hypothesis. This aside, the weak poverty hypothesis is not particularly interesting: establishing it would get us no further than being able to claim that child leisure (like the leisure of any individual) is a normal good. The strong poverty hypothesis that we propose can be empirically verified by studying the wage elasticity of child labour supply, has not been investigated before.

A further weakness of most of the studies cited in Section 2.2.2 is that they tend to pool data on boys and girls and on rural and urban regions. They also tend to combine child wage labour with child labour supplied to a household business. We estimate separate labour supply curves for boys and girls and concentrate on rural areas, where child work and poverty are most prevalent. For reasons set out in Section 3, this paper focuses on wage work.

The empirical work in this paper is set in a partially structural model of child labour supply. Since decisions regarding child work and school attendance are unlikely to be made myopically and since there is considerable evidence that rural households achieve some degree of consumption smoothing (e.g. Townsend, 1994), a lifecycle model is adopted. Existing studies tend to condition on reported income and to omit the child wage. However, when there are lifecycle aspects to decision making, this yields wage elasticities that confounds the effects of shifts in wage profiles with movements along them (see Blundell and MaCurdy, 1998). This paper conditions on a lifecycle-consistent definition of income and therefore estimates a wage elasticity which picks up the effects of

[11] It is unlikely that the restrictions on the slope parameters of the labour supply function implied by Ray's specification are valid.

wage movements over time. The child wage, the child's completed schooling and household income are treated as endogenous variables in the equation describing child hours of work. Careful attention is paid to identification and tests are provided for the validity and the strength of instruments used. Few studies of child labour attempt to use instrumental variables methods, and applied work in other areas has tended to concentrate on instrument validity with little regard to the efficiency of the instruments. This is an important neglect because weak instruments can generate inconsistent estimates (see Bhargava (1991), Staiger and Stock (1994), Nelson and Startz (1990) and Bhargava and Sargan (1983)).

3. The Data

The data used for the analysis are the *rural* observations from the Pakistan Integrated Household Survey (PIHS) for 1991 which was gathered by the Government of Pakistan in association with the Living Standards Measurement Survey unit of the World Bank. There are 2400 rural households. Households are large and complex, the mean household size being 7.63 (mode=7). We therefore have information on more than 18282 individuals. The survey collects detailed data on schooling and on economic activity, including both wage employment and self employment. The participation and hours variables refer to the seven days preceding the survey. Child wages are calculated from earnings and hours data. This gives rise to the possibility that common measurement error will give a spurious negative correlation of hours and the wage, and this is taken care of by instrumenting the wage.

3.1. Defining children

Children are commonly defined as persons under 15 years of age, for example by the ILO and the UNICEF (e.g., ILO, 1996), though the studies cited in Section 2.2.2 use a variety of definitions in the range 5-18 years. Since employment questions in our survey are only addressed to individuals ten years or older, we cannot study any work done by under-10s. As discussed in Section

If we are interested in whether the income effect of a wage change dominates the substitution effect, it is not interesting to study participation[12]. Instead, we truncate the data to look exclusively at the hours of work of *working children,* and this leaves us with sample sizes of 72 and 120 for boys and girls respectively. Among children aged 10-14, there are 1200 boys and 1100 girls in the data sample of whom 72 boys and 120 girls work, and the restriction involved in pooling data on girls and boys was rejected. Since these are small, we expand the sample to 10-17 year olds. There are 1785 boys and 1585 girls in this age range of whom 178 boys and 189 girls work. We investigate whether the wage elasticity is different when the sample is restricted to 10-14 year olds and find that it is not (see

Section 6). Relevant descriptive statistics are also presented separately for 10-14 and 10-17 year olds so that the reader can see that the broad patterns are not dissimilar between the two groups.

Including 15-17 year olds in the analysis is more pertinent than it may first appear. An important concern with child work is that it competes with acquiring a formal education, and as many as 34% of 15-17 year olds in the sample are in school, as compared with 53% of 10-14 year olds. The proportion in school falls gradually after the age of 11, dropping sharply from 31% at age 17 to 17% at age 18. A cut-off at age 17 is therefore more data-consistent than a cut-off at age 14[13]. In the formal education structure in Pakistan, age 5-9 corresponds to primary school, 10-14 to middle school and 15-16 to secondary school. The data indicate that starting late is common[14], and there is casual evidence that it is not uncommon to drop out and return, or to repeat classes[15]. It is therefore unsurprising that many 17 year olds are in school. This is also consistent with the fact that children who have got as far as middle school have every incentive to continue rather than drop out and start work, because the returns to secondary school exceed the returns to middle school (see Bhalotra, 1999a). It is unusual in South Asia for children to leave home before they are 18, with the exception of daughters who will tend to join the extended family of their husbands once married. Indeed, our data show that 92% of 15-17 year olds are either children, grandchildren, niece/nephew or child-in-law of the head of household and this would suggest that, in principle, they have the option not to work[16].

3.2. Descriptive Statistics

3.2.1. The prevalence of child work

School enrollment is very low in Pakistan, even in comparison with other low income countries, and child participation rates are among the highest in the world (ILO, 1996). Refer to Table 1 where activity rates are set out for the 10-14 and 10-17 age groups. Child activities include *school attendance*, *wage employment*, unpaid employment on the household farm or enterprise (which shall be referred to as *household employment*), and *domestic work* including cooking, cleaning, caring for siblings and fetching water and firewood. School attendance, at 73%, is low for

[12] The wage elasticity in a participation equation cannot be negative. However, it is perfectly consistent with theory to find a negative wage elasticity for hours of work conditional on participation.

[13] It may be of some interest to note that school attendance in Ghana also peaks at age 11 (see Canagarajah and Coulombe, 1988) and, in Peru, it peaks at age 13 (Ray, 1999).

[14] Statistics on school attendance by age for 5-17 year olds in rural Pakistan are presented in Bhalotra and Heady (1998).

[15] Glewwe and Jacoby (1993) report that delayed school attendance is very common in Ghana. In Bangladesh, it is estimated that the average time taken to complete primary school is 9 years in rural areas (World Bank, 1996).

[16] What is meant here is that these individuals, being in relationships to household heads that are often associated with dependency, *could* possibly fall back on the earnings or nonlabour income of other family members. The moot question, then, is whether this nonlabour income is large enough to support them.

boys but, at 31% for girls, it is shocking. Among 10-14 year olds, 6% of boys and 12% of girls are in wage employment and a further 24% of boys and 30% of girls are employed on the household farm or enterprise. Comparing these figures with the participation rates for adults (not shown in the Table) puts them in perspective. Amongst adults (18 years and older), 36% of men and 15% of women are wage workers, and 54% of men and 45% of women work on the household farm or enterprise. We do not have data on domestic work for boys and since the hours are flexible and the remuneration completely invisible, it is therefore not discussed here[17]. The household employment of children in Pakistan (and Ghana) is studied in Bhalotra and Heady (1998, 1999) and school attendance in Bhalotra (1999b). This paper is primarily concerned with wage employment.

3.2.2. Gender differentials

The participation rate in wage work among 10-14 year old girls is 12%, as against just 6% for boys. After age 15, boys' participation overtakes that of girls[18]. Aggregating over the two age groups gives fairly similar wage employment rates for 10-17 year-old boys (10%) and girls (12%). Work on the household farm or enterprise also absorbs a similar fraction of boys and girls, a third in each case. Therefore, it is not work that explains the alarming gender disparity in school attendance that is exhibited in Table 1. Instead, the small fraction of girls in school is mirrored in the large fraction who report no activity (37% of girls as compared with 11% of boys). Recall that "no activity" may include domestic work. Indeed, the available data on time spent by girls on domestic work reveals that the girls recording no activity spend significantly more hours on domestic chores than other girls. These data suggest that researchers who regard child work as the inverse of school attendance must include domestic work in the definition of child work. Where data on domestic work are unavailable, *one needs to be careful about assuming that variables which release children from work will also put them in school.*

It may be tempting to think that the gender disparity in school attendance in rural Pakistan is explained by Muslim culture (this is often presumed, as in Ray (1999), for example). However, in rural Bangladesh which is also predominantly Muslim, 74% of boys and 75% of girls aged 5-16 were in school in 1995-6 (Ravallion and Wodon, 1999). These figures are not dissimilar to those for rural Ghana which, in 1992, had 74% of 10-14 year old girls in school as compared with 81% of boys of the same age. Therefore, further analysis of the gender differential in Pakistan is warranted[19].

[17] There are no data on domestic work for boys and the available data for girls do not appear suitable for analysis. All children engaged in other activities probably engage in light domestic work, and domestic work may explain the large fraction of children who are neither in school nor in the other sorts of employment ("none of the three" in Table 1).

[18] Presumably this is when many boys leave school and join work while girls, most of whom are not in school in any case, switch from wage work to work in the home with the approach of puberty.

[19] See Sathar and Lloyd (1994) for an analysis of intrahousehold inequalities in primary schooling in Pakistan. Bhalotra (1999b) analyses school attendance for boys and girls in Pakistan.

3.2.3. Work participation rates and competition with school attendance

Table 1 presents average hours of work and the sample probabilities of combining activities for 10-17 year olds. In contrast to sub-Saharan Africa (see Bhalotra and Heady (1998), Canagarajah and Nielsen (1999), for example), it is uncommon for children in Pakistan to combine activities. Only 3% of boys and 5% of girls are in wage work and household farm or enterprise work at the same time. What about combining work and school? Consider this first for household production and then for wage work.

The Table shows that 12% of boys combine household farm and enterprise work with school while only 2% of girls do this, even though such work takes an average of only 15-20 hours per week from the working child. Average school years completed by boys working on the household farm or enterprise is 3.6 as compared with 4.8 years for non-workers. For girls, school attainment among household-employed workers is 0.6 years on average against 2.2 years among non-workers. Thus, work on the household farm, though it is relatively low intensity, does compromise the educational attainment of children.

Average hours a week in wage employment, conditional on working, are 45 for boys and 35 for girls. While there is considerable variation around the mean, it is clear that for most children this is a *full-time activity*. Indeed, virtually no children combine wage work and school. It is thus clear that *wage work competes with schooling.* Indeed, among 10-17 year olds (boys and girls together), the school attendance rate is 63% for the sample who do not work, 24% for the sample who work on the household farm or enterprise, and less than 7% for the sample who work for wages. The average completed school years of boys in wage work are 2.1 as compared with 4.6 for those who are not in wage work, even though workers are older on average. The corresponding figures for girls are 0.6 years as compared with 1.9 years.

3.2.4. Child activities by income group

It is clear from Table 3 that, among boys and girls alike, average household income is lower for workers than for nonworkers. Since this is so even without deducting the child's contribution to household income, it suggests that poverty is an important determinant of child work. Table 2 presents child work and school participation rates by quartiles of household consumption expenditure per capita. These data also support the poverty hypothesis in that it is clear that *the rates of school attendance increase and of child work decrease in moving from the lowest to the highest quartile*.

Where is the poverty line? For 1990-1, the poverty line is at Rs. 243 per capita and at Rs. 304 per adult equivalent (Malik, 1995)[20], which is just above the mean expenditure per capita of the lowest quartile. Therefore, most of the households that are challenged to meet subsistence requirements are expected to be in this group.

Consider the numbers in Table 2 in more detail. Data are presented for 10-14 year olds, the group that we can confidently identify as children, and for 10-17 year olds, the group for which the models in Section 5 are estimated. The discussion that follows pertains to 10-14 year olds though the data for 10-17 year olds draw a similar picture. Amongst the poorest 25% of rural households in Pakistan, a remarkable 21% of girls are in wage work as compared with only 9% of boys. The participation rate of girls falls dramatically with household living standards, to 4.8% in the upper quartile. For boys the decline is much smaller and their participation rate in the upper quartile, at 4.4%, is similar to that of girls. *These data indicate that the burden of household poverty is born disproportionately by girls*. The rates of household employment also decline with household expenditure and, in every income group, are greater for girls than for boys. The gender differential is most remarkable in the relation of household living standards and school attendance. In the lowest quartile, only 18% of girls are in school as compared with 62% of boys and even in the upper quartile where average incomes are well above the poverty line, only 40% of girls are in school as compared with 84% of boys. The broad tendency for school attendance to substitute child work (*be it imperfectly*) as household living standards rise is just as evident in the data for 10-17 year olds.

Notice that *child work participation in the upper quartile remains at a level high enough to merit investigation*. The poverty hypothesis alone cannot explain this. It is recognised that household expenditure levels may be endogenous to child employment rates (though not, of course, to school participation rates). However, if the income contribution of children is subtracted away, the poorest households, amongst whom child work is more prevalent, will be even poorer. The pattern we observe across quartiles is therefore unlikely to be altered. Nevertheless, as a check, child activity rates were tabulated by quartiles of adult income[21] and in the upper quartile 6% of children were in wage work and 20% in self employment. The persistence of child work among the richest 25% of the rural population that is evident in Table 2 is therefore not the result of the endogeneity of expenditure.

3.2.5. The contribution of children to household wage income

Our earnings and hours data suggest that the contribution of children to the wage income of the household is substantial. Among rural households in our sample, 64% have at least one child (person aged 10-17 years). Of this subsample, 18% have at least one child in wage work. In

[20] This is the poverty line for rural Pakistan estimated from calorie-expenditure functions, using the Household Income and Expenditure Survey which has a similar sampling frame to the PIHS (the data that we use here).

[21] Household income consists of wage income and income from the household farm and enterprise. The latter can only be assigned to individual household members by estimation of a production function for farm/enterprise work, and this is deferred. Adult income is defined here as the difference between total household income and child wage income. If the intrahousehold allocation of labour (leisure) is such that parents first set their own labour supply and then set child labour supply conditional on their income, then adult income will be exogenous to child work. The full tabulation of child (10-17 year old) activity rates by adult income is available from the author on request.

households where at least one boy works, the average wage-income contribution of a boy is 33% and the corresponding figure for girls is 15%. This is not out of line with other estimates in the literature (see Section 2), and is large enough that it becomes plausible to suggest that the household may rely upon child income to make up subsistence expenditures.

4. A Theoretical Framework

A Multi-Period Household Model

An analysis of the labour supply of children cannot plausibly ignore the labour supply of adults in the household. This is particularly true in rural areas of low-income countries where children typically live in large integrated households. A simple household labour supply model can be derived by extending the individual model of consumer theory to include the leisures of all individuals in the household. Leisure refers to non-market time and it therefore includes time spent at school or in activities other than wage work.

This paper does not directly discuss within-household preference heterogeneity. An advantage of the "unitary model" that is implicitly assumed here is that it is more amenable to multi-period modelling and to allowing the non-separability of individual leisures in a household model. Its main contender, the bargaining model, has been successfully applied to study bargaining between spouses with outside options. However, it is unclear that children have outside options and it would seem more reasonable to assert common preferences between parent and child than between spouses[22]. A generalisation of the unitary framework which encompasses bargaining models is the collective model (see Chiappori (1988, 1992)) but this is unidentified once household production is introduced because separability is then violated (see Blundell and MaCurdy, 1998). In the present context of a rural economy where household production is substantial, separability may be too strong an assumption. Indeed, our estimates reject separability[23].

Lifecycle modelling might be expected to be particularly important in an analysis of child labour. The single period model is a valid simplification only if agents are myopic or if there exist no capital markets so that it is impossible to save and dissave. It is unlikely that decisions about child work and school are made myopically, irrespective of whether the decisions are made by parents or children. While formal capital markets are underdeveloped in the rural areas of most low-income countries, there is considerable evidence of informal means of saving and dissaving (see Besley, 1996). The Pakistan data used in this paper reveal that between 43% and 50% of households reported borrowing or lending money in 1991.

If intertemporal separability is assumed in the multiperiod model[24], the problem can be decomposed into two stages. In the first stage, the agent allocates wealth (full income) across periods and, in the second stage, she conditions on full income and allocates consumption and leisure in view

[22] The common preferences assumption of the unitary model is consistent with dictatorship by the parent which, in turn, is consistent with parental altruism.

[23] Separability is rejected in equation (6) in the text if the parents' wage rates are significant. We proxy adult wage rates with their education and age and these variables are significant.

[24] Separability over time rules out habit persistence and adjustment costs. However, the model is empirically intractable unless intertemporal separbility is assumed, as it is in all comparable studies (see Blundell and MaCurdy (1998), section 4.2).

of their relative prices (see Blundell and Walker (1986), for instance)[25]. The second stage problem therefore yields within-period marginal rate of substitution (MRS) conditions for the relative demands for consumption and leisure that are observationally the same as in the static model.

Let subscript i denote the child in question and let j denote all other household members. Then household utility is

(1) $U=U(C, X, L_i, L_j, \varepsilon)$, $C\geq 0$, $L_i, L_j \geq 0$

where U is a quasiconcave utility index defined over joint consumption (C), individual leisure (L) and a vector of individual and household characteristics, some of which are observable (X) and some of which are not (ε). The budget constraint is

(2) $C + W_iL_i + \sum_j W_jL_j = Y + W_iT_i + \sum_j W_jT_j \equiv M$

where the right hand side (M) is full income and the left hand side denotes total consumption of goods and leisure, W are wage rates, T are time endowments ($T\equiv L+H$), and Y is nonlabour income.

Since the intertemporal budget constraint defining the time path of assets is[26]

(3) $A_{t+1} =(1+r_{t+1})(A_t+ \Sigma_k W_{tk}H_{tk}-C_t)$,

full income (M), defined in (2), is now $M_t=C_t+\Sigma_k W_{tk}L_{tk} = rA_{t+1} + \Delta A_t + \Sigma_k W_{tk}T_{tk}$, where summation is over all household members. Subtracting $\Sigma_k W_{tk}L_{tk}$ from both sides gives

(4) $C_t -\Sigma W_tH_t = rA_{t+1} + \Delta A_t \equiv Y_t$

where Y denotes the *consumption* (as opposed to income) based measure of nonlabour income[27]. The measure of full income in the multiperiod model differs from that in the static model in taking account of asset accumulation and decumulation (ΔA_t), which may be important ways of smoothing consumption. ΔA_t provides the crucial link across periods. If $\Delta A\neq 0$, then the static model

[25] These authors show that conditioning labour supply on the current period allocation out of lifecycle wealth is an alternative to the Frisch approach of Heckman and MaCurdy (1980) in which the conditioning variable that captures future anticipations and past decisions is λ, the marginal utility of wealth. It is a particularly attractive alternative when the data, as here, are limited to a cross section. This is because M is observable in a cross section if consumption data are available, while λ is not.

[26] Equation (5) assumes perfect capital markets. If there are borrowing constraints, for instance because poor people may not have adequate collateral, then an additional constraint is $A\geq 0$ which, if it binds, will imply that consumption is constrained.

specification is incorrect and can produce misleading results on within-period behaviour (e.g., MaCurdy, 1981). As is clear from (6), measurement of Y does not require data on asset changes. *It can be measured in a cross section* as long as there are data on consumption expenditures (C) and labour earnings (WH).

If λ_m is the marginal utility of money, the first order conditions are

(5a) $U_c - \varepsilon_c = \lambda_m$

(5b) $U_{Li} - \varepsilon_i \geq \lambda_m W_i$

(5c) $U_{Lj} - \varepsilon_j \geq \lambda_m W_j$

where U_k denotes the marginal utility of k, and taste heterogeneity is introduced through the ε terms. The implied labour supply function for individual i, given H=T-L, is

(6) $H_i = H_i (W_i, W_j, X, Y, \varepsilon) \leq T$

where the inequality in (6) is strict for an interior solution.

Once we condition on Y, as defined in (4), the model is consistent with intertemporal two-stage budgeting with or without borrowing constraints. This formulation remains valid when the true model is static, and in the presence of unobserved heterogeneity. It is also consistent with employment constraints (W=0) and capital market imperfections ($r=\infty$). A further attraction of the two-stage budgeting method is that incorporating uncertainty about the future- which is known to be particularly large and important in agrarian societies- has no effect on within-period allocations (Blundell and MaCurdy (1998), Section 4.3).

5. An Empirical Model

5.1. The Equation of Interest

Desired hours of wage work of the child are given by (6). Let W denote the child wage, W_i, and let Z_h be a vector of exogenous variables including adult wage rates, W_j, and relevant individual and household characteristics, X. Suppressing the individual subscript for neatness, we can then write:

(7a) $H = H (W, Y, S, Z_h, e_h)$

[27] In a more "primitive" formulation, Altonji (1983) uses food consumption as a proxy for the unobserved marginal utility of money in his analysis of multi-period labour supply decisions of American men.

where Y is the consumption-based income measure defined in (6) and S is school years accumulated by the child up to the current period. This is expected to affect preferences for work (e.g. Pencavel, 1986) and, given increasing returns to school in these data (see Bhalotra, 1999a), we may expect to find a negative effect of S on H[28].

If I_h is an indicator variable for participation in work, then observed hours, H, are given by

(7b) $H = H^*$ if $I_h = 1$

$H = 0$ otherwise

We estimate hours of work conditional on participation because it is only on the intensive margin (continuous changes in hours of work) that the wage elasticity of labour supply can be negative[29].

A simple empirical specification that permits curvature in the labour supply curve and *allows the wage elasticity to be a function of household living standards* is the following,

$$(7c)\ H^* = \alpha + \beta \ln W + \gamma_1(Y/W) + \gamma_2(Y/W)^2 + \theta S + \delta Z_h + e_h$$

Since Y can take negative values and therefore cannot be logged, dividing by W is a convenient normalisation. This specification (without the quadratic term), which emerges from a Stone-Geary utility function, is discussed in Blundell, Duncan and Meghir (1994), and Stern (1986) discusses the properties of alternative functional forms for labour supply. The hypothesis to be investigated is that $\partial \ln H^*/\partial \ln W = (1/H)[\beta - \gamma_1(Y/W) - 2\gamma_2(Y/W)^2] = -1$. The interaction term between income and the reciprocal of the wage allows the wage elasticity of child labour supply to depend upon the level of household income[30].

5.2. The Other Endogenous Variables

Consider the processes determining the endogenous variables in (7), namely W, Y and S. Wages are assumed to be determined by a Mincerian process modified to include family background and "disequilibrium" variables (regional unemployment) that, together with age and other exogenous variables like region, religion and parents' education, are captured in Z_w in

[28] Alternatively, a positive effect may arise if parents feel that a few years of school is all that is necessary to launch a child on the labour market.

[29] In work in progress, I estimate participation models for child wage work (Bhalotra, 1999b). Bhalotra and Heady (1998) estimate tobit models for hours of work of children in family businesses.

[30] If we were interested in investigating the possibility that the adult labour supply curve bends backwards in a population where living standards are well above survival levels, we would include the square of the logarithm of the wage in the hours equation. This would allow the wage elasticity of hours of work to change sign with the level of the wage rate. In our context, the parallel argument is that the wage elasticity may change sign with the level of household income (and therefore, possibly, with the adult wage rate). There is no similar reason to include a quadratic in the child wage rate.

(8) $W = W(S, Z_w, e_w)$

The term e_w captures idiosyncratic wage variation as may result, for instance, from innate ability that is not captured by family background. It is likely that this is correlated with tastes for work, e_h, in which case W is endogenous in (7).

In a lifecycle interpretation of (7), income (Y) is endogenous by virtue of being defined by (past) consumption and leisure choices. Writing it as a function of exogenous variables Z_y and unobservables e_Y, gives

(9) $Y = Y(Z_y, e_y)$

Similarly, completed school years, S, is likely to be endogenous to current work hours in a lifecycle framework. If Z_s are exogenous variables, like access to school, that influence S then

(10) $S = S(Z_s, e_s)$

In fact, since there are probably unobservable attributes and circumstances that affect both the wage and school grade attainment (so that $cov(e_s, e_w) \neq 0$), S is endogenous not only in (7) but also in (8).

The four endogenous variables are thus defined by (7)-(10). The exogenous variables in the system are Z_h, Z_w, Z_s, and Z_y, the union of which we shall denote Z.

Means and standard deviations of the subset of variables that appear in the final hours model are presented separately for the samples of children in and out of wage work in Table 3. Appendix Table 1 lists all variables of potential interest in this analysis, together with their definitons.

6. Estimation Strategy

The equation of primary interest is (7), estimation of which raises the following issues. First, ours of work and wages are observed only for workers, creating the potential for selection bias. Following Heckman but relaxing the normality assumption, we include a polynomial in the inverse Mills ratio as a regressor. This approach rests on the semiparametric series estimator principle of Newey, Powell and Walker (1990).

Second, there is the potential for bias arising from endogeneity of W, Y and S, or from measurement error in these regressors. To deal with this, we use the generalised residuals method of Wu-Hausman and Smith and Blundell (1986). Let the main equation be

(11) $Y = X\beta + e$

with X endogenous or cov(X, e)≠0, and let the auxiliary equation describing X in terms of exogenous variables (where Z includes X) be

(12) $X=Z\gamma+u$

If u^e denotes the estimated value of u, then estimating

(13) $Y= X\beta+\beta_0 u^e+e^*$

generates consistent estimates of β (with cov(X, e^*)=0) and the significance of β_0 provides a test of the endogeneity of X in the main equation.

The data are rich and they afford overidentifying restrictions which is very useful (Card (1994) highlights the problems that may arise when a single instrument is used). We present tests of the validity and the strength of the instruments used (see Table 5 for the hours equation and Table 6 for the wage equation). Bound, Jaeger and Baker (1995) underline the importance of testing the strength of instruments, showing that weak instruments can lead to inconsistencies in IV estimates.

6.1. Identification of the wage in the hours equation

Obtaining a consistent estimate of the wage elasticity is central to the purposes of this paper. Identification is achieved through the interaction of the child's educational level with that of each of her parents, as well as through the interaction of the educational levels of the two parents[31].

Many empirical studies in this area make the very strong assumption that the *education of the individual* does not affect labour supply conditional on the wage (for example, Kooreman and Kapteyn (1986), Hernandez-Licona (1996), Fortin and Lacroix (1997)). It is unusual to see a test of this restriction. We were unwilling to make this assumption since it is very plausible that accumulated school years affect the decision to work at given wages, both because of unobserved heterogeneity and because of increasing returns to school years in the age range under consideration. Indeed, our estimates show a strong effect of completed school years on girls' hours of work. A second variable that is very often excluded from labour supply models is the *regional unemployment rate*. However, if there is disequilibrium in the labour market, a well-specified labour supply model should condition on the unemployment rate (see Ham 1986, Card, 1988). We find a highly significant effect of this variable in the boys' work hours equation[32].

[31] The return to the marginal school year for a child thereby depends upon the education level of adults in the household, which may be thought to be a desirable specification of the wage equation.
[32] Working children are classified as being in one of three activities: permanent agricultural employment, seasonal agricultural employment and non-agricultural employment. These occupation dummies were insignificant in the wage equation and were therefore not available as instruments.

To obtain consistent estimates of the parameters of (8), the *predictor equation for the wage*, we must deal with (a) endogeneity of school years in the wage equation and (b) the fact that wages are observed only for workers. To take account of (b), the wage equation is jointly estimated by maximum likelihood with a reduced form probit for work participation. Variables that, we find, influence work participation but not wages are household size and composition. Turning to (a), school years is instrumented with household size and composition and indicator variables for the presence of a primary, middle and secondary school in the community. Further discussion of these instruments is presented in Bhalotra (1999a) and tests are in Table 6.

6.2. Endogeneity of income in the hours equation

Instruments for Y include community-level variables which are expected to be correlated with the institutional opportunities for dissaving[33], and acres of land *owned* which we expect is exogenous since land is typically inherited (households also rent and sharecrop land but acreage under these arrangements may be endogenous, and is therefore excluded from the measure). By a similar argument, the value of inherited wealth such as jewellery may also be a valid instrument. If land and other wealth are used as collateral in taking loans, then these may be powerful instruments. Since expenditure is a household-level variable, the equation explaining Y includes the household average of school years and this turns out to have a large positive effect that is significant at the 1% level. This is consistent with Jolliffe (1997), who shows that average or maximum schooling tends to explain household income better than the schooling of the head of the household.

6.3. Endogeneity of completed schooling in the hours equation

On account of individual fixed effects, we expect that the current period decision on whether to work or attend school is correlated with past decisions in this sphere. Identification depends upon indicator variables for the presence of a primary, middle and secondary school in the community which affect schooling but do not directly affect hours worked[34].

6.4. Selection into work in the hours equation

Since unobservables driving participation in wage work are potentially correlated with the unobservables in the hours model, selection of participants for the analysis invites selection bias. The Heckman (1974) two-stage selection correction procedure is therefore used. Estimates (π_h) of the reduced form participation equation,

[33] For example, the data have an indicator variable for whether the cluster has a weekly market. This may be correlated with whether it has a bank or a credit association, which we do not directly observe.

[34] The specification would be more general if we were to run an ordered probit on levels of education (primary, middle, etc) and include the Mills ratio deriving from this. However, there are not enough data points for each grade level to make this a productive exercise. For an application of this procedure to wage equation estimates for British adults, see Blundell *et al* (1997).

(14) $I_h = I_h (Z_h, Z_w, Z_y, Z_s, e_I) \equiv I_h (Z, e_h)$

give the selectivity-correction term, $\lambda_h = \phi(\pi_h'Z/) / \Phi(\pi_h'Z)$, which when included in the hours equation restores the conditional expectation of the residual to zero. ϕ and Φ are the normal density and distribution functions respectively. To increase the robustness of this procedure to the assumed parametric distribution of the unobserved error terms, we also include $(\lambda^h)^2$ in the model[35]. The relation of the child to the household head affects participation in paid work but not hours of work conditional on participation. Tests of the exclusion restriction and of the strength of the instruments are in Table 5.

6.5. The Empirical Equation

The equations estimated are a reduced form probit for work participation, reduced form equations for the child's education (10), the child's wage (8), and household income (9), and the hours model which is the centre of interest,

(7d) $H^* = \alpha + \beta \ln W + \gamma_1(Y/W) + \gamma_2(Y/W)^2 + \theta S + \delta Z_h + \chi_1\varepsilon_w + \chi_2\varepsilon_y + \chi_3\varepsilon_s + \chi_4\lambda_I^k + \nu_h$

where, to recapitulate, H^* denotes actual hours of wage work conditional on participation, W is the observed wage of the child, Y is the consumption-based measure of household income, and S is the years of schooling completed by the child. Inclusion of the estimated residuals from the wage, school-years and income equations, ε_w, ε_y, and ε_s tests and corrects for the potential endogeneity of W, Y and S. Selection into work is corrected by inclusion of λ_I^k, a second-order polynomials in the inverse Mills ratios derived from the work probit. Available exogenous variables Z_h, include the child's age, an indicator of the child's current state of health, parents' school years and age (proxies for parent wage rates), variables that influence the relative attractiveness of farm work, and household size and composition. The latter capture the stage of the lifecycle at which the individual household is, as well as its gender composition. The stochastic term, ν_h, is expected to be uncorrelated with the regressors.

[35] Using US data on women's labour supply, Newey, Powell and Walker (1990) find no statistical difference between the conventional 2-step Heckman estimates and the semi-parametric estimates obtained using the series estimator and a weighted kernel, an alternative semiparametric estimator. They also estimate the first-stage probit by semi-parametric methods but find that their estimates are no different from the ML probit estimates. They conclude, in line with Mroz (1987), that the sensitivity of estimates of the hours of work model for women in the US depends more upon correct specification of the regression function and the choice of instrumental variables than on specification of the error distribution. In this paper, particular care is taken with the choice and the testing of instruments.

7. Results

7.1. Equation diagnostics

There is considerable variation in hours around the mean, a good deal more than is typically observed for adult hours of work in industrialised nations. The specified model explains about 60% of the observed variation. Table 5 presents tests of endogeneity/selection bias, a list of the exclusion restrictions used in each case, tests for the validity of these restrictions, and F (or, in the case of first-stage probits, χ^2) tests for the strength of the identifying variables. The inverse of the F-statistic is proportional to the bias in the second stage. Instruments for the wage equation are presented, with tests, in Table 6.

7.2. Overview of the results

The estimates confirm that children from households with higher income work fewer hours. Other variables that shift the hours supply curve include age, father's schooling, mother's schooling, acreage of land, household size and composition, the regional unemployment rate, and region dummies. These effects are discussed in Bhalotra (1999c).

7.3. The wage elasticity

Table 4 presents estimates of the wage elasticity for boys and girls at the mean levels of the wage, hours of work, and household income (Y). For both boys and girls, there is a highly significant negative wage effect. This suggests that the income effect dominates the substitution effect of a wage change, so that, conditioning upon household income, we may expect to observe children work longer hours at lower wages. Conversely, at higher levels of the child wage, hours of work may be expected to decline. These results are consistent with the notion that child work is directed at achieving a target income and, in this sense, *is* necessary. The interaction term between the reciprocal of the child wage and household income is consistent with the expectation that the negative effect of wages on hours is ameliorated at high levels of income, though this effect is much weaker for girls than for boys.

At the sample means, the wage elasticity is -1.12 for boys, which is insignificantly different from 1 at the 95% confidence level. The wage elasticity at the mean is -0.56 for girls, which is significantly different from 1 and insignificantly different from zero. Ideally, the equation would be estimated on subsamples of the data corresponding to expenditure quartiles. Since the numbers of working children are too small to permit this, we are forced to assume that the parameters of the estimated model, (7d) are constant. However, we observe the expected tendency for the wage elasticity to grow less negative at higher income levels, especially for boys. *In the poorest quartile, we cannot reject the hypothesis that children (boys and girls) work towards a target income*.

7.4. Robustness

We now consider some checks on the robustness of these estimates (full estimates available upon request). When the wage is treated as exogenous, the wage coefficients are still negative and significant but they are (spuriously) smaller, the direction of bias being consistent with both measurement error and a positive feedback effect. This motivates the IV procedures used here. As discussed in Section 3, children are commonly defined as being under 15. We therefore investigate age-related slope heterogeneity for the wage, the critical variable in the analysis. An indicator variable for the age range 10-14 years is interacted with each of the terms involving the wage. The results are robust to the age definition. It is often instructive to look at the simplest possible model. The hours model is re-estimated with only the child wage and household income as regressors. The central finding of a negative hours-wage elasticity persists. In an important departure from most such applied work, great care is taken to test both the *strength and the validity of the instruments* for the child wage, for household income, and for child school years. *Test statistics* are available from the author.

7.5. Analysis

It is natural to think of the target as that contribution of the child that would bring per capita household consumption up to a substistence level. If this target were fixed, we would expect the wage elasticity of hours of work to be unity (-1). In fact subsistence may not be a fixed point. By adjusting the composition and the quality of the bundle of subsistence goods, households can achieve a given level of consumption at a lower cost. In biological terms too, subsistence may be a range rather than a fixed level of consumption (see Payne, 1992)[36]. When wages fall, it may be difficult to increase hours of work of those children whose hours are already above or close to the average of 44 (boys) or 34 (girls) hours per week. The household may consequently have to take a cut in its standard of living. Similarly, if when child wages rise, the household wants to enjoy a slightly larger income, then child hours will fall less than proportionally. More likely, if the child in question has working siblings, the benefits of an increase in her wage may be expected to be shared amongst her siblings (by resulting in fewer work hours for them, given their wages), causing a less than proportionate fall in her hours of work[37]. For these reasons, while our hypothesis implies a negative wage elasticity, the elasticity may not be exactly minus one.

8. Policy Implications

At present, schooling in Pakistan is not compulsory and the only prohibition on child work applies to under-15s in hazardous industrial employment. Arguments for government intervention

[36] Though see Dasgupta (1993) and Gopalan (1992) who counter this propostion. Empirical evidence against the adaptation hypothesis is presented in Bhargava (1992), Schutlink *et al* (1993) and Spurr *et al* (1994).

[37] In work in progress, I investigate the hours of work of all children within the household rather than of the individual child.

may stem from the belief that governments care more for child welfare than do parents, or else from the recognition that even where the private returns to education are relatively low, the social returns may be very high. Indeed, there is growing evidence that the education of individuals has positive effects on investments in the health and education of their children[38]. Educated children are likely to become better voters and better workers in addition to becoming better parents, so the dynamic benefits to educating children may be unestimably large. While the importance of investing in education is undeniable, is it correct to think that improving the supply of education will eliminate child labour? This will depend (amongst other things) upon whether the demand for education is suppressed by poverty. Even where school attendance is free and high-quality schools are accessible, the poorest households may not be able to afford the *opportunity cost of schooling*. This immediately raises the question of whether they could borrow to finance their childrens' education. While borrowing is entirely consistent with transient poverty *if* credit markets are sufficiently developed, it is not a viable option for the chronically poor. The further possibility that the chronically poor could borrow against the future incomes of their children is complicated by the problems associated with inter-generational contracting (which are modelled by Baland and Robinson, 1998).

This paper provides support for the hypothesis that the income from child work is necessary to survival, at least for the average household in the first quartile of the expenditure distribution. Thus, while improvements in the supply (quantity and quality) of schooling in the rural areas considered may impact positively upon the marginal household, they are unlikely to eliminate child labour. The opportunity cost of school appears to be unaffordable for the poorest 25-50% of households in rural Pakistan. Policy interventions designed to alleviate poverty or to develop credit markets are therefore likely to help reduce the extent of child labour.

The results of this paper cast some doubt on policies that have recently been proposed as ways of eliminating child labour[39]. To the extent that *trade sanctions* displace children into industries that pay lower wage rates, they will increase average hours of child work. This contradicts their stated purpose. Similarly, a *ban* on child work may have deleterious effects in the short run, threatening the survival of both parents and children. While this possibility must be recognised, it needs to be qualified for at least three reasons. First, given sufficient time, households may be expected to adjust their fertility in response to the ban. Consequently, in the long run, a ban may bring lasting benefits despite its short run costs[40]. Second, the *en masse* removal of children from the

[38] The equations estimated in this paper demonstrate a negative effect of both parents' education on child wage work. Using the same data to investigate child work on the household farm, Bhalotra and Heady (1998) also find a negative effect flowing from mothers' education. Several other studies find similar evidence.

[39] The recent surge in public interest in child labour has provoked debates on the setting of international labour standards (e.g. Golub (1997), Fields (1995), Basu (1999), Bhalotra (1999)).

[40] Suppose that most parents have children because they enjoy them or because they do not adopt family planning methods for whatever reason. Then some of them may find that, having had the children, they do not have the resources to keep them alive and well. They may then send some of

labour market may cause adult wage rates to be bid up, in which case the loss in child income will be compensated by the increase in adult income (Basu and Pham, 1998). Third, if parents are the decision makers and *their notion of a target income* includes tobacco and alcohol, for example, then a ban on child labour is likely to improve child welfare.

9. Conclusions

Concern with child work centres around the possibility that it lowers school attainment. For children in *wage work* in rural Pakistan, mean weekly hours of work are close to "full time", though smaller for girls than for boys. This work is therefore very demanding and, as we saw in Section 3, it virtually rules out school attendance.

Using a large household survey for Pakistan, this paper investigates the hypothesis that poverty compels child work. In particular, we investigate whether the income contribution that children make is required by the household to maintain subsistence expenditures. We argue that, if child work is necessary in this sense, then we will observe a forward falling labour supply curve (negative wage elasticity) for children. Of course, finding a negative wage elasticity is not *sufficient* to conclude that child work is necessary[41]. What the negative wage elasticity says is that children work towards a target income. What we do not know is whether this target income is determined by the household's subsistence requirements. In principle, the target may be set to cover child costs, or to meet consumption desires of parents that exceed subsistence needs. However if, in the extreme, parents were trying to maximise child earnings, then we would not expect to see hours fall as the wage rate increases (a negative wage elasticity) but, rather, to see a zero wage elasticity.

What do we find? At the mean levels of income, wage and work hours in the entire sample (i.e. across all four quartiles), the wage elasticity is not significantly different from (minus) unity for boys. For girls, however, the mean elasticity is -0.39 and this is significantly smaller than one. Among households in the lowest expenditure quartile, we are unable to reject the hypothesis that both boys and girls work towards a target income since the wage elasticity is insignificantly different from -1. If adult income and household assets were large enough that the household could manage without the child's contribution, then we would expect a positive wage elasticity in the child labour supply equation. We also observe the expected negative impact of household income on hours of child work. However, this paper emphasises that studying the income elasticity is not as useful as studying the wage elasticity.

The key result of this paper has important policy implications (see Section 8). It favours policies targeted at alleviating poverty or liquidity constraints. On the other hand, trade sanctions may

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their children to work. However, if a ban is set in place and parents become aware that child work is not an option, they may make an effort to control their fertility even if they would otherwise not.

[41] Let A=(child work is necessary) and B=(wage elasticity is negative). The point is that A⇒B but not the other way round. While it is worth emphasising this in the current context, it is of course not

not be desirable unless households are compensated for the loss in child income. The effects of a ban on child labour will depend upon the time frame in which it is assessed, on the extent to which the absence of child labour on the wage labour market increases the adult wage, and on whether the target income that we see children working towards puts the household at or above subsistence.

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unusual to scientific methodology that one cannot prove a hypothesis but only either reject it or claim that it is consistent with the evidence.

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Table 1

Detailed Activity Rates for Rural Children

	BOYS		**GIRLS**	
	Participation	**Work Hours**	**Participation**	**Work Hours**
		10-14 year olds		
Wage employment	**0.06 (0.24)**	**45 (22)**	**0.12 (0.32)**	**31 (16)**
Household employment	0.24 (0.42)	26 (20)	0.30 (0.46)	15 (15)
School attendance	0.73 (0.45)		0.31 (0.46)	
Number of children	1200	1200	1100	1100
		10-17 year olds		
Wage employment	**0.10 (0.30)**	**46 (21)**	**0.12 (0.33)**	**32 (15)**
Household employment	0.29 (0.45)	29 (21)	0.31 (0.46)	16 (18)
School attendance	0.66 (0.48)		0.26 (0.44)	
None of the three	0.11 (0.31)		0.37 (0.48)	
Activity combinations:				
All three	0.003 (0.05)	41 (19)	0.002 (0.04)	22 (0)
Wage & Household work	0.03 (0.17)	57 (27)	0.05 (0.21)	43 (24)
Wage work & school	0.009 (0.10)	42 (16)	0.006 (0.08)	20 (0)
Household work & school	0.12 (0.32)	16 (14)	0.02 (0.15)	7 (5)
Number of children	1785	1785	1585	1585

Notes: Figures are means, and standard deviations are presented in parentheses. *Household work* refers to work on the household farm or enterprise, and does not include domestic work. *Number of children* refers to all children in the age-group. The numbers working (and, equivalently, the *number of observations for the reported regressions*) can, of course, be read off the Table as the fraction participating.

Table 2

Participation Rates of Children by Quartiles of Consumption Expenditure

	Quartile 1	Quartile 2	Quartile 3	Quartile 4
10-14 year olds: 1203 boys and 1092 girls				
wage work				
boys	8.6%	7.0%	5.0%	4.4%
girls	20.5%	15.0%	7.3%	4.8%
household work				
boys	26.9%	25.2%	24.2%	17.7%
girls	32.6%	34.4%	26.0%	25.6%
school				
boys	61.7%	65.9%	80.0%	83.9%
girls	18.4%	25.7%	39.0%	39.7%
p.c. expenditure	Rs. 223.6	Rs. 362.7	Rs. 514.1	Rs. 1176.7
10-17 year olds: 1785 boys and 1585 girls				
wage work				
boys	11.9%	9.9%	9.3%	9.0%
girls	20.5%	14.4%	8.6%	6.3%
household work				
boys	33.0%	29.3%	28.2%	24.1%
girls	33.6%	36.5%	28.8%	26.8%
school				
boys	54.3%	61.6%	72.0%	74.6%
girls	16.0%	19.0%	34.2%	35.0%

Notes: Quartiles are of household per capita consumption expenditure per month. The **poverty line** for rural Pakistan in 1990-1 was Rs. 243 per capita and Rs. 304 per adult equivalent (Malik, 1995). *Household work* refers to work on household-owned farms or enterprises, and it excludes domestic work.

Table 3

Summary Statistics of Variables Used in the Analysis

	BOYS				**GIRLS**			
	workers		**nonworkers**		**workers**		**nonworkers**	
	mean	**s.d.**	**mean**	**s.d.**	**mean**	**s.d.**	**mean**	**s.d.**
hours of wage work	**46.0**	**21.1**			**32.8**	**16.7**		
ln child wage (actual)	**1.38**	**0.99**			**0.93**	**0.89**		
ln child wage (predicted)	**1.30**	**0.44**	**0.50**	**0.81**	**1.22**	**0.44**		
age	14.6	1.9	14.2	3.2	15.3	3.2	14.8	3.3
age2	218	54	212	94	245	97	230	100
recent illness dummy	0.12	0.33	0.15	0.36	0.20	0.40	0.19	0.39
child's school years	2.1	2.8	4.8	3.6	0.52	1.7	1.8	2.9
λ_s*(selection into school)*	0.62	0.37	0.40	0.36	1.43	0.52	1.24	0.68
*(fathers'*child) school years**	3.5	9.1	17.4	29	1.4	6.9	10.0	24.4
fathers' school years	1.2	2.1	2.6	3.6	1.5	2.5	2.8	3.5
fathers' age	50.3	9.8	49	9.9	50.4	8.6	49	9.4
*fathers'school*fathers'age*	17.5	29.7	37.2	52.6	22.7	37	40.4	51
"income"÷10^2	1.66	1.04	2.98	5.06	1.47	1.09	2.80	4.35
"income$^{2"}$*÷10*^{4}	19.6	30.6	56.3	279	9.13	16.2	49.9	229
ln wage"income"÷10*^{2}	1.66	1.32	2.73	7.63	3.83	3.17	10.3	26.4
ln(per capita adult wage)	0.45	0.71	0.37	0.74	0.69	0.73	0.40	0.75
(ln per capita adult wage)^2	0.70	0.96	0.68	1.0	1.0	1.5	0.72	1.1
acres of land operated	2.0	5.5	7.2	20.8	3.9	6.0	6.0	18.7
household size	8.7	3.0	10.2	5.2	7.9	2.7	10.1	5.1
proportion children<10 yrs	0.28	0.17	0.27	0.16	0.25	0.17	0.27	0.16
proportion males 20-59 yrs	0.16	0.10	0.18	0.10	0.17	0.11	0.18	0.10
proportion females 20-59 yrs	0.17	0.08	0.17	0.08	0.18	0.10	0.17	0.09
proportion adults>59	0.05	0.08	0.05	0.08	0.05	0.10	0.05	0.08
cluster unemployment ratex10^2	3.66	5.1	3.47	5.1	1.69	2.5	3.30	5.0
λ_l*(selection into wage work)*	1.36	0.48	1.98	0.75	1.35	0.41	2.1	1.2
N	146		2075		172		2054	

Notes: *Worker* refers to wage worker. *Child* refers to 10-17 year old.

Table 4

Wage Elasticity of Hours by Quartiles of Consumption Expenditure

	BOYS		**GIRLS**	
	elasticity	**95% confidence interval**	**elasticity**	**95% confidence interval**
At mean of population	**-1.12**	-1.68, -0.56	**-0.56**	-0.84, -0.29
At mean of quartile-1	**-1.84**	-2.84, -0.84	**-0.76**	-1.25, -0.27
At mean of quartile-4	**-0.35**	-0.71, 0.01	**-0.31**	-0.71, 0.09
R^2 ; root MSE	0.56; 11.2		0.66; 9.75	
mean (s.d) of $H_j \mid H_j > 0$	44.3 (19.8)		34.3 (16.2)	
# observations; # clusters	157 ; 79		133 ; 44	

Notes: Dependent variable=hours in wage work of 10-17 year olds**, s**tandard errors robust to heteroskedasticity and adjusted for cluster-based sampling. Variables in the model include child age, health and accumulated education, fathers' and mothers' education and age, the full income of the household, interaction of child wage with full income, acres of land owned, household size, household composition, regional unemployment rate. There are also selection correction terms for participation in work and past participation in school, and residuals from auxiliary regressions of the child wage and household income on a set of explanatory variables. The instruments are discussed in the Empirical section of the text & detailed *tests of the efficiency and validity of the instruments* can be obtained from the author (see Tables below too).

Table 5

Instruments in the Hours Equation

	BOYS	**GIRLS**
Wage		
ε_w (s.e.)	-10.1 (1.4)**	-8.4 (2.6)**
ε_w^2 (s.e.)	-2.9 (0.76)**	-1.02 (0.28)**
Validity of	F(6, 78) = 1.41	F(7, 43) = 1.03
restrictions	p>F = 0.22	p>F = 0.43
Strength of	F(6, 81) = 16.22	F(7, 43) = 3.00
instruments	p>F = 0.0	p>F = 0.01
Income		
ε_y (s.e.)	0.0056 (0.0078)	0.020 (0.013)
ε_y^2 (s.e.)		-0.000023 (3.5e-06)**
Validity of	F(6, 70) = 0.64	F(9, 37) = 1.10
restrictions	p>F = 0.70	p>F = 0.39
Strength of	F(6, 138) = 2.33	F(9, 37) = 13.1
instruments	p>F = 0.04	p>F = 0.0

Attained school		
λ_s (s.e.)	-23.4 (10.6)	-1.5 (3.3)
λ_s^2 (s.e.)	12.5 (5.8)	
Validity of	F(8,78)=1.25	F(10, 43)=1.61
restrictions	p>F=0.28	p>F=0.14
Strength of	$\chi^2(8)=35.9$	$\chi^2(10)=34.9$
instruments	$p>\chi^2=0$	$p>\chi^2=0$
Work Particip.		
λ_I (s.e.)	-0.07 (3.2)	-4.8 (2.7)
Validity of	F(4,78)=1.74	F(6, 43)=0.70
restrictions	p>F=0.15	p>F=0.65
Strength of	$\chi^2(4)=21.3$	$\chi^2(6)=17.1$
instruments	$p>\chi^2=0$	$p>\chi^2=0$

Notes: λ are generalised residuals from the school and work probits, p denotes probability, hh is household, d(x) suggests x is a dummy, ** is significant at 5%. F(n,m) is an F-test for joint significance of the instruments in the wage equation when it is estimated by GLS in a 2-step framework, n is number of restrictions, and m=(number of clusters-1). χ^2 is a test for joint significance of the instruments in the reduced form probits, k being the number of restrictions.

Table 6

Instruments in the Wage Equation

	BOYS	**GIRLS**
Attained school		
λ_s (s.e.)	0.072 (0.18)	0.49 (0.22)**
Validity of	F(22, 124)=1.04	F(12, 56)=1.54
restrictions	p>F=0.42	p>F=0.14
Strength of	χ^2 (k=22) =45.4	χ^2 (k=12) =34.6
instruments	p>χ^2 =0	p>χ^2 =0
Work Partic.		
λ_I (s.e.)	0.36 (0.18)**	-1.12 (0.18)**
Validity of	as for school above	F(1,56)=0.08
restrictions		p>F=0.78
Strength of	χ^2 (k=22)=71.97	χ^2(k=1)=3.14
instruments	p>F=0.0	p>F=0.07

Notes: λ are generalised residuals from the school and work probits, p denotes probability, hh is household, d(x) suggests x is a dummy, ** is significant at 5%. F(n,m) is an F-test for joint significance of the instruments in the wage equation when it is estimated by GLS in a 2-step framework, n is number of restrictions, and m=(number of clusters-1). χ^2 is a test for joint significance of the instruments in the reduced form probits, k being the number of restrictions.

Appendix Table 1

Variables In The Empirical Model

name	**definition**
Child variables	
age	Age of child in years
d(ill)	1 if child was ill in the last month
school years	Years of school completed by the child
d(relation to head)	A set of dummies indicating if the child is the child, grandchild, sibling, or nephew /niece of household head. Index j therefore runs from 1 to 4. Less than 2% of 10-17 yearolds have relations to the head other than these.
d(occupation)	Working persons are in one of three occupations: non- agricultural work, permanent agricultural work, seasonal agricultural work. Two dummies are included to capture this information.
Adult variables	
fathers' schooling	Years of school completed by the father. Alternatively, level of education attained by father (spline).
mothers' schooling	Years of school completed by the mother. Inadequate variation in spline formulation.
adult schooling	Average years of school of all adults in household.
fathers' age	Age of father in years
mothers' age	Age of mother in years
Household variables	
income	Consumption-based measure of income arising in a lifecycle context, see equation (7). Computed as $(C-\Sigma_i W_i H_i)$ where C is consumption expenditure, $\Sigma_i W_i H_i$ is household labour income, and i runs from 1 to N, N being household size.
acres of land owned	Constructed to include acres owned, rented and sharecropped.
d(rent land)	1 if household rents land
d(sharecrop land)	1 if household is a sharecropping tenant

Table 4 contd. Variables In The Empirical Model

d(head in agriculture)	1 if primary occupation of head of household is in agriculture, permanent or seasonal.
d(head unemployed)	1 if head of household reports him/herself as unemployed. See (U) in this Table.
d(female head)	1 if head of household is a female.
household size	Number of members currently resident in the household. Includes servants, guests.
household composition	Proportion of household members of gender s in the age range a-b. The age ranges specified are 0-5, 5-9, 10-14, 15-19, 20-59, 60 and older. In particular equations, data-consistent restrictions are imposed to aggregate over some groups in the interests of parsimony.
d(religion)	1 if head of household is muslim.
d(region)	Pakistan has 4 major provinces (k=4): Punjab, Sindh, Baluchistan and NWFP. Dummies for three are included.
Community variables	
d(primary school)	$prim^b$=1 if either a coeducational or a boys' primary school is present within the cluster. Computed by the author. Similarly, $prim^g$ is 1 if a coed or girls' school exists. Primary school is usually age 5-9.
d(middle school)	Definition as for $prim^s$ but for middle school (age 10-14).
d(secondary school)	1 if there is a secondary school (age 15-16) in the community, not gender specific.
unemployment rate	Computed by the author at cluster-level from individual responses to survey questions. An individual is unemployed if he/she is not working but available and looking for work. The reference period is a week.

Notes: Squares of variables and interactions between variables are not specified here.