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Does Child Labor Always Decrease with Income?

An Evaluation in the Context of a Development Program in Nicaragua

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Abstract

This paper investigates the relationship of household income with child labor. The analysis uses a rich dataset obtained in the context of a conditional cash transfer program in a poor region of Nicaragua in 2005 and 2006. The program has a strong productive emphasis and seeks to diversify the work portfolio of beneficiaries while imposing conditionalities on the household. The author develops a simple model that relates child labor to household income, preferences, and production technology. It turns out that child labor does not always decrease with income; the relationship is complex and exhibits an inverted-U shape. Applying the data to the model confirms that the relationship is concave when all children (8-15 years of age) are included in the sample. Expanding the analysis by stratifying the sample by age and gender shows that the relationship holds only for older children, both genders. The author investigates the effect of the conditional cash transfer program on child labor. The results show that the program has a decreasing effect on total hours of work for the full sample of children. Disentangling labor into two types – physically demanding labor and non-physical labor – reveals that the program has opposite effects on each type; it decreases physically demanding labor while increasing participation in non-physical (more intellectually oriented) tasks for children.

This paper—Social Protection Division, Human Development Network—is part of a larger effort in the department to understand the impact of social programs on children's work. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The author may be contacted at xdelcarpio@worldbank.org.

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I. Introduction

Prior theoretical work on child labor has attempted to establish a link between poverty and child labor by modeling the relationship and obtaining interesting, but disparate results. Parallel to this, a whole body of empirical work designed to study this seemingly important relationship emerged; a few notable papers mix both, theory and empirics, in order to improve our knowledge of the causes and consequences of child labor and provide us with the groundwork necessary to evaluate this complex relationship. Unfortunately, good panel data on child labor (e.g. children's time use, activity types) and income data in the same survey are rare; as a result, we have been limited in obtaining conclusive evidence on why child work is present in households at various levels of the income distribution.

The research question in this paper is evaluated in the context of a conditional cash transfer (CCT) program targeted at improving human capital outcomes of school aged children and the productive possibilities of a sub-set of households in a poor rural region in Nicaragua (see Macours and Vakis, 2005 for detailed program information). In this paper we ask if child labor always increases with income. Moreover, we expand our research question to incorporate the CCT program into the analysis and pose a secondary question, how does a cash transfer program, with three distinct interventions and meant to improve the economic welfare of the families, affect child labor? The empirical section makes use of a rich panel data-set collected for a randomized experiment.

The paper contributes to the child labor literature through a simple yet comprehensive model and an empirical application by revisiting the relationship between income and child labor; more specifically the paper evaluates what happens to child labor in households that are distinctly placed at various levels of the income distribution. The model illustrates the relationship of different forms of child labor with each other and with household production and assets; it allows for the inclusion of a transfer program through a tax on child labor or a subsidy to alternative activities (such as education or leisure). Given that the CCT program offers standard benefits[1] plus income to promote productive activities in non-agricultural work, the expected effect of the program on child labor ex-ante is ambiguous.

For the purposes of this paper we use several definitions that influence our theoretical and empirical approach. We follow the definition of human capital used by Bardhan and Udry (1999)

[1] Traditional CCT benefits are transfers for nutrition, education fees, materials, teachers etc. and cash for basic health visits. In this program the health component was not implemented.

where they use the term *human capital* to cluster factors such as nutrition, health, formal education and on-the-job training. We follow the international labor office (ILO) definition for child labor, that is any activity other than study or play that is remunerated or not for children 15 years or younger. We build on this definition in part of our analysis by disentangling the word *labor* into two types: non-physical labor—this is a combination of commercial savvy, calculation ability, intellectually oriented tasks—and, physical labor—based almost solely on physical strength.

The definition for non-physical labor is consistent with the objective of the program, to improve the economic opportunities of households by diversifying their labor activities from agricultural-dependency to non-agricultural activities. More specifically, in our sample households primarily dependent on non-agricultural work, to include tradesmen, professionals, merchants, service providers etc. earned 21% more income in 2005 than households mostly dependent on agricultural work. Many people lack the necessary skills to work in these activities and the costs to obtain the necessary skills are high enough to make them inaccessible for many. The program seeks to increase the earning potential of beneficiaries by promoting non-agricultural activities; it does this through vocational training, business creation and business training in order to enhance the skills of beneficiaries and reduce their exposure to risks stemming from agricultural dependency.

Given that the program was designed to reduce income vulnerability due to risk from weather shocks we consider that a skill enhancing activity is one that changes occupational practices of people (e.g., agriculture, animal raising) and increases their productive capacity in the future. These skills can be used through non-household employment as well as self-employment but not be directly dependent on land or animals. Any type of activity that has value added such as: services, commerce or trade (to include animal trading and commerce of animal products), formal or informal employment in a non-farm setting and/or profession qualifies in this category. A physically oriented activity on the other hand is one that depends on the land and/or animals directly, entails farming and harvesting farm products primarily for household consumption, raises animals primarily for household consumption not commerce, gathers goods (i.e., wood, water) for household use and takes care of household chores.

The remainder of the paper is organized as follows. In Section II, we present the background literature on child labor that helped motivate this research. Section III develops the theoretical model of income and child labor. Section IV presents the program background and gives some specific information on the selection of the sample used in this research. Section V presents some stylized facts and descriptive statistics from the dataset, focused on child labor and

other factors that influence the behavior of households toward child work. In Section VI we discuss the empirical implementation of the model. In Section VII we present the results and a brief discussion, and Section VIII contains concluding remarks.

II. Related literature

One side of the child labor and wealth (income) literature agrees with Basu and Van (1998) where they propose that having the child not work is a luxury that poor families can rarely afford, and as income increases the poor family can afford more leisure: "Luxury axiom"[2]. Other studies find that child labor is a consequence of inequality in the distribution of non-labor income (Swinnerton and Rogers, 1999) or economy wide poverty reflected at the household level (Grootaert and Kanbur, 1995). In the case of poverty, studies find that schooling is often traded for work during difficult economic times (Edmonds, 2003; Edmonds and Turk, 2004; Beegle, Dehejia, and Gatti, 2005). This finding is extremely important because it shows that parents recognize the importance of human capital accumulation and want to do what it takes to increase the earning potential of the kids in the future, such as enrolling them into school or engaging them in skill-forming activities, when resources permit it. This is consistent with altruistic arguments presented in the literature and stemming back to Becker and others (Becker and Lewis, 1973) but is not inconsistent with the possibility of parent's wanting to improve the human capital of their kids for reasons other than altruism.

Previous work also finds that when parents are faced with liquidity constraints, particularly in the absence of functioning capital markets (Baland and Robinson, 2000; Ranjan 2001; Dehejia and Gatti 2002) they are more likely to engage their children in work, despite their preference for having children not work at all or only in certain types of activities. These studies directly or indirectly argue that parents would be willing to borrow against the children's future earnings to potentially fulfill their preference of increasing the human capital acquisition of their children today, but in the absence of credit markets, they are forced to remove their kids from school (or reduce their study-leisure time) and in most cases have children work.

The opposite strand of the literature presents a wealth paradox argument that challenges the luxury axiom. This literature finds that child labor increases in periods of economic growth and children in wealthier families—in terms of assets and land which are found to be correlated to the household's income—work more than children in asset-poor households (Parsons and Goldin, 1989; Bhalotra and Heady, 2003; Rogers and Swinnerton, 2004). One of the arguments for this

[2] To be more specific, the luxury axiom proposed by Basu and Van in 1998 can be explained as follows: a family will send the children to the labor market only if the family's income from non-child labor sources drops very low. In other words, having a child not in the labor market is a luxury that poor families can rarely afford. This axiom indicates that as the family's income increases the consumption of this luxury is more feasible, thereby development efforts to reduce child work could concentrate in helping families attain a minimum level of income in order to reduce child work.

challenge is the presence of imperfect labor and land markets in most developing countries[3]. Another explanation is that children have to take up more domestic chores as adults are busied in household enterprises (Hazarika and Sarangi 2005). The unequal distribution of land in poor countries, with heavy reliance on land production in agrarian societies, is biased toward wealthier households. Wealthier households who are unable to hire laborers, due to labor shortages, have a larger incentive to employ their own family; particularly when the marginal product of labor is increasing in land size.

Other reasons given for preference for family over a hired hand are: moral hazard, easiness of shirking in volatile weather areas, reliance and overall trust (Deolalikar and Vijverberg, 1987; and Foster and Rosenzweig, 1994). In this paper we consider an alternative reason, that not all child labor is deemed negative or harmful (Edmonds, 2007) and parents, who seek to enhance the human capital of their children and/or recognize their capacity to learn, can potentially distinguish between the prospective contributions of some work activities. Moreover, not all child labor occurs at the expense of schooling or interferes with human capital accumulation, particularly for younger kids who tend to combine both activities (Cartwright and Patrinos, 1999); in some cases child work enables school attendance by increasing the household income as well as improves the productive capacity of the child through the attainment of labor skills.

Other potential advantages of child labor explored in this paper are consistent with findings in previous studies where child labor seems to serve as training experiences for the children who obtain and enhance new skills well before adulthood (Rogers and Swinnerton, 2002; Raju, 2005). Beegle, Dehejia and Gatti (2005) find that young adults who attained work experience as children had higher earnings in wages and farm work than others with less or no experience. More interestingly, the author's find that the loss in wages due to early abandonment of formal schooling was fully offset by the work experience obtained as a child. These results however, are applicable for a few years after the work experience is attained as the returns to work experience decrease over time.

A literature review by Dar et al. (2002) presents 13 empirical studies where the effects of household welfare on child labor are evaluated and find that there is strong support for the luxury axiom presented by Basu and Van (1998). The literature review also concludes that although welfare has a significant impact on child labor and the relationship appears to be inversely related there are some studies that cast doubt in the strength of the relationship pointing to other factors

[3] Weak land markets are a problem because few or no land sales take place, so the asset can only be productive if it is exploited through farming but not through selling or renting it. When credit markets exist, the dynamic could potentially change.

as being equally or more important. In an effort to reconcile the diversity of findings in the poverty and child labor relationship Basu, Das, and Dutta (2007) examine the possibility of an inverted U-shape relationship. This relationship provides the theoretical basis to this paper and the model developed in the paper.

This research is done in the context of a social program that transfers income and skills (through training) to families conditional on various types of human capital investments (i.e., school attendance, nutrition, vocational training) and physical capital investments (e.g., goods, equipment). More specifically, for one third of the treated families there is an added conditionality of starting a non-agricultural business while another third of families are conditioned on enrolling a family member in a vocational training course. This context of this paper is very different from the contexts explored in most studies in the child labor literature because of the type (multi-component) and design (randomized) of the program under evaluation. Other studies, namely impact evaluation reports on conditional cash transfer programs (Skoufias and Parker, 2001; Maluccio and Flores, 2004; Attanasio et. al. 2006; Glewwe and Olinto, 2004) present some resemblance to the context. In spite of this, some of these studies limit their analysis dichotomous outcome variables (Raju, 2006) and none of the programs include investments in productive activities in the household, a critical factor influencing child work.

III. Theory

III.1 Model structure: Income and child labor

In this section we present a model where there are benefits and costs of child labor, as in Basu, Das and Dutta (2007); and where different types of child labor are combined with adult labor and capital to obtain household production. Apart from exploring income effects on child labor, the model allows us to study the effect of a CCT on households' choices with respect to two types of child labor.

The model endogenizes the household decision regarding child labor. Its purpose is to illustrate the relationship of different forms of child labor with each other and with household production and assets. We focus on poor economies with simple production technologies and rudimentary markets. For simplicity we assume that all households produce a single good that cannot be saved or stored. Therefore, there is no trade across households, and in each of them consumption equals production. The analysis of this economy can then be addressed from the perspective of any household at a given period of time. There are four factors of production: physical capital (including land), K; adult labor, Q; non-physical child labor, H; and physical child labor, L. They are combined according to a constant-returns-to-scale Cobb-Douglas production function.

There are appealing features to the use of Cobb-Douglas; one is that it allows for partial substitutability between production factors (as well as partial complementarity). The second is that we can identify the optimal use of a factor of production as a function of overall production, the marginal product is a constant multiple of the factor intensity times the average product. The third feature is the ability to characterize the factor intensity as a simple parameter, thereby allowing us to do comparative statics. The production function looks as follows:

$$Y = AL^{\alpha} H^{\beta} Q^{\gamma} K^{1-\alpha-\beta-\gamma} \quad (1)$$

Where the factor intensities, $\alpha,\beta,\gamma,$ and $(1-\alpha-\beta-\gamma)$, are inside the interval (0,1). Moreover, we assume that the production function is so rudimentary that it uses considerably more intensively physical-labor than non-physical child labor. Therefore,

$$\alpha >> \beta \quad (2)$$

Capital and adult labor are household endowments and, thus, are provided at fixed supplies that are determined exogenously. The two types of child labor are flexible and derived endogenously as a family decision based on utility optimization. The utility function considers two main components that establish a trade-off for child labor: if children worked more intensively, more could be produced and consumed by the family but the children would be less happy and less developed. Specifically, then, the first component of the utility function is the consumption of the single good, *Y*. For simplicity and in order to consider decreasing marginal utility of consumption, we assume that the utility function is quadratic in consumption, with a positive coefficient on the linear term and negative one on the squared term. The second component is the disutility of child labor, which we model as a linear function of each type of child labor, both with negative coefficients. The utility function is then given by,

$$u = MY - \frac{P}{2}Y^2 - lL - hH \quad (3)$$

Where, the parameters *M* and *P* and the possibility of production *Y* are assumed to be such that the household will never reach negative utility of consumption. Families dislike child labor because it takes time and energy away from formal education and leisure, and because it may even hurt the health and normal development of the child. It then stands to reason that non-physical child labor imposes lower utility costs than the physically demanding type. This implies that,

$$h < l \quad (4)$$

Optimal child labor, L^* and H^*, is obtained by maximizing the utility function in equation (3) with respect to the control variables, L and H. Substituting the production function into the utility function and taking the corresponding partial derivatives,

$$\frac{\partial u}{\partial L} = M\frac{\partial Y}{\partial L} - \frac{P}{2}2\cdot Y\frac{\partial Y}{\partial L} - l$$

$$= M\alpha\frac{Y}{L} - PY\alpha\frac{Y}{L} - l$$

and,

$$\frac{\partial u}{\partial H} = M\frac{\partial Y}{\partial H} - \frac{P}{2}2\cdot Y\frac{\partial Y}{\partial H} - h$$

$$= M\beta\frac{Y}{H} - PY\beta\frac{Y}{H} - h$$

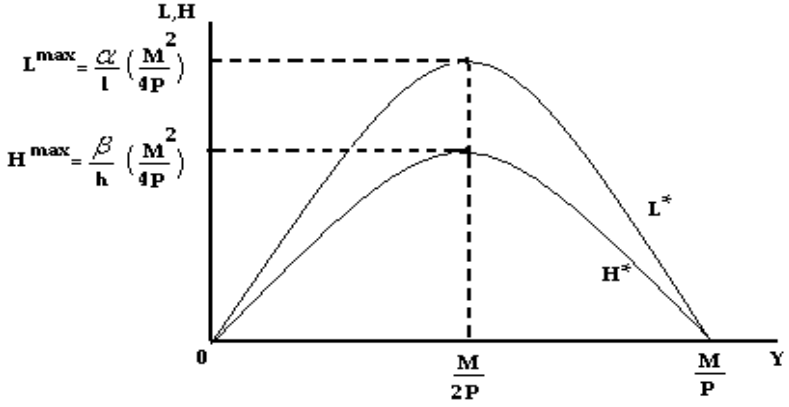
Then, applying the first-order conditions for utility maximization, $\frac{\partial u}{\partial L} = 0$ and $\frac{\partial u}{\partial H} = 0$, we obtain the expressions for optimal child labor,

$$L^* = \frac{M\alpha Y - P\alpha Y^2}{l} \tag{5}$$

$$H^* = \frac{M\beta Y - P\beta Y^2}{h} \tag{6}$$

Figure 1 presents these functions, along with some critical points for L^*, H^*, and Y. It illustrates the inverted-U-shape relationship between child labor and income/production. It also shows the differences and similarities between the two types of child labor: if the production function is sufficiently rudimentary, physically demanding child labor tends to be more prevalent than the non-physical type. Both, however, move in the same direction with respect to changes in income.

Figure 1. Optimal Child Labor (L^* and H^*) as a Function of Income (Y)



Beyond this graphical presentation, the equations for optimal child labor allow us to formally derive the following conclusions:

-*First*, *L** and *H** are concave functions of *Y*, which implies that optimal child labor first increases and then decreases with household production (or income). In fact, the marginal effect of production on child labor is given by,

$$\frac{\partial L^*}{\partial Y} = \frac{\alpha}{l}(M - 2PY) \tag{7}$$

$$\frac{\partial H^*}{\partial Y} = \frac{\beta}{h}(M - 2PY) \tag{8}$$

The turning point of this marginal is $Y' = \frac{M}{2P}$. Below this threshold, both types of child labor increase as production expands, although at gradually lower rates. Above the threshold, child labor declines as production increases. The intuition for this result is as follows: for very poor families, consumption is so low that they apply child labor to increase production when the opportunity arises (in the form of larger endowments of the other production factors). When families achieve a certain level of income, the cost and grief of child labor start to weigh more than the corresponding foregone consumption, and, therefore, child labor decreases as production opportunities arise.

-*Second*, the impact of the endowment of physical capital, *K*, and adult labor, *Q* on optimal child labor, *L** and *H**, depends on both the level of income, *Y*, and the relative scarcity of the corresponding factor endowment (i.e., *Y/K* and *Y/Q*). Specifically, the marginal effects are given by the following equations. For physically intensive child labor,

$$\frac{\partial L^*}{\partial K} = \left[(1-\alpha-\beta-\gamma)\frac{Y}{K}\right]\left[\frac{\alpha}{l}(M - 2PY)\right] \tag{9}$$

$$\frac{\partial L^*}{\partial Q} = \left[\gamma\frac{Y}{Q}\right]\left[\frac{\alpha}{l}(M - 2PY)\right] \tag{10}$$

And for non-physical child labor,

$$\frac{\partial H^*}{\partial K} = \left[(1-\alpha-\beta-\gamma)\frac{Y}{K}\right]\left[\frac{\beta}{h}(M - 2PY)\right] \tag{11}$$

$$\frac{\partial H^*}{\partial Q} = \left[\gamma\frac{Y}{Q}\right]\left[\frac{\beta}{h}(M - 2PY)\right] \tag{12}$$

The mechanism by which changes in K and Q affect L* and H* goes through income: the endowed production factors affect income and consumption, and this in turn determines optimal

child labor. Thus, in all cases, the second term in brackets is the marginal effect of income on the respective type of child labor ($\partial L^*/\partial Y$, and $\partial H^*/\partial Y$), and the first term is the marginal product of the corresponding endowed factor of production ($\partial Y/\partial K$, and $\partial Y/\partial Q$). Then, an increase in capital or adult labor would produce a rise in child labor if the household is relatively poor and would lead to a reduction only if it is sufficiently rich. Moreover, the effect on child labor would be larger (in absolute value) if the endowment of the changing production factor (*K* or *Q*) is relatively scarce (so that it's marginal product is large). For illustration, consider the following example. Suppose a household is sufficiently rich (so that $Y>Y^*$), and this wealth is based on a large supply of adult labor despite a low endowment of land capital. The result just presented implies that, for this household, an increase in land capital would have a larger reducing impact on child labor than a rise in adult labor would.

-*Third*, physical child labor, L^*, will be larger than non-physical child labor, H^*, if the household production function is relatively backward (in the sense of being more intensive in the use of unskilled labor) and the difference in the utility loss from the two types of child labor is sufficiently small (which happens, for instance, when the learning opportunities of non-physical child labor are not substantial). Specifically, taking the ratio of equations (4) and (5),

$$\frac{L^*}{H^*} = \frac{\alpha}{\beta} \cdot \frac{h}{l} \tag{13}$$

Then, since α is much larger than β, and h only a little smaller than l, then $\frac{L^*}{H^*} > 1$.

Note that although L^* and H^* are functions of *Y*, the ratio of L* to H* is only a function of technological and preference parameters. It is important to realize that the utility loss of child labor can be different depending on the child's gender and age; moreover, this utility loss can also be affected by policy, as in the case of enforced prohibitions of specific types of child labor and pecuniary or in-kind transfers to promote certain others. In order to analyze these alternatives, it is interesting to assess how the size of one type of child labor relative to the other varies with the parameters *h* and *l*. Taking partial derivatives of equation (13),

$$\frac{\partial(L^*/H^*)}{\partial h} = \frac{\alpha}{\beta \cdot l} > 0 \tag{14}$$

and

$$\frac{\partial(L^*/H^*)}{\partial l} = -\frac{\alpha}{\beta} \cdot \frac{h}{l^2} < 0 \tag{15}$$

As expected, the impact of an increase in the cost of non-physical labor is a rise in the ratio L^*/H^*. Conversely, this ratio will decline if the cost of physical demanding child labor increases. For example, if the cost of L is lower for girls than for boys, then the proportion of girls doing agricultural labor will be larger than that of boys. Also, if the cost of H declines with age (because the opportunity cost of formal education is lower as the child gets older), then the proportion of children doing work using calculation skills at work will be smaller in older cohorts. Finally, if a conditional transfer program provides at the same time an implicit subsidy for children's time away from work (e.g., by rewarding school attendance) and creates more opportunities for non-physical labor (e.g., by promoting non-traditional business opportunities for the household), then both L^* and H^* will decline but the ratio L^*/H^* will increase.

-*Fourth,* the impact of Y on L^* is greater in absolute value than the impact of Y on H^*, except at the turning point, $Y=Y^*$, at which they are the same. In fact, except at the turning point, the ratio of the partial derivatives of L^* and H^* with respect to Y is exactly the same as the ratio of L^*/H^*:

$$\frac{\partial L^* / \partial Y}{\partial H^* / \partial Y} = \frac{\frac{\alpha}{l}(M - 2PY)}{\frac{\beta}{h}(M - 2PY)}$$

when $Y = Y' = \frac{M}{2P}$, then $\frac{\partial L^*}{\partial Y} = \frac{\partial H^*}{\partial Y} = 0$. Otherwise,

$$\frac{\left|\partial L^* / \partial Y\right|}{\left|\partial H^* / \partial Y\right|} = \frac{\alpha / l}{\beta / h} = \frac{\alpha}{\beta} \cdot \frac{h}{l} > 1$$

Therefore, for relatively poor families ($Y<Y^*$), physical intensive child labor rises faster than the non-physical type as income increases. By the same token, for relatively rich families ($Y>Y^*$), physically demanding child labor declines faster when income rises.

IV. Program background

The intervention presented here is a conditional cash transfer (CCT) program targeted in a shock prone region in the northern-central part of Nicaragua where beneficiaries were randomly assigned to one of three groups: treatment 1, treatment 2 or treatment 3. The selection of beneficiaries was done using a proxy-means approach commonly used for targeting households in this type of program. The selection design had two stages. The first stage was to select, at the community level, whether a community would be treated or not-treated. This stage was done by pairing communities based on geographic and climatic parity and conducting a draw of which

would receive the program. Once the treatment communities were determined all households below a poverty threshold (approximately up to 90% of the total distribution, excluding the top 10%) were eligible for the program and were randomly assigned to one of the three interventions through a participatory lottery.

The experimental design of the program (Macours and Vakis 2005) provides the ability to have more than one counterfactual (control versus treatment) by providing three distinct interventions and one control; each one of the groups is comparable to the other at baseline which allows for the effectiveness of each intervention to be evaluated. As Bourguinon, Ferreira and Leite (2003) stated in their paper, having more than one counterfactual allows us to answer policy questions more assertively.

This program has some similarities with a previously implemented CCT in the country[4] but was modified and created as a pilot to fit the context for a region that suffers from various climatic and economic shocks. The intervention provides income transfers and some in-kind benefits (e.g., training) to poor families in the region to improve their human capital (i.e., education, nutrition, training, health) and physical capital (e.g., inventory for businesses, equipment). The approximate value of the cash transfers is in the range of 25 to 45 percent of household income, depending on which package the household receives. Two-thirds of randomly selected families receive one of two productive options: a training program or a matching grant for a productive investment such as a small-start-up business. These benefits are intended to diversify the economic activities and improve future labor options of members in beneficiary households.

As mentioned before, the program consists of three main treatment types or interventions (1) "basic intervention" which funds education (contingent on school enrollment), health (contingent on regular check-ups) and nutrition; (2) "Training intervention" which consists of the basic intervention plus an occupational training program that includes a $90 transfer for transport and opportunity costs. This intervention consists of scholarships that allow one member of the household to select among a number of vocational courses to be delivered at the municipal headquarters by specialized instructors. These participants also had classes in labor-market participation, civic responsibility and business-skill improvement; classes were usually attended by students alone. (3) "Productive investment or business grant intervention", which is the basic intervention plus a $200 grant to invest in a non-agricultural productive activity (i.e. a new non-agriculture business or an expansion of an existing one) aimed at encouraging recipients to diversify their income source. This intervention also has a business training component that is

[4] *Red de Proteccion Social* (RPS) implemented in 2000, see Maluccio and Flores 2005 for evaluation.

delivered upon the creation of the business (e.g., business-plan writing, business planning). Beneficiaries participated in business-skill training workshops organized locally where other family members could attend, but were not conditioned on attendance.

The conditionality of all three interventions requires that the primary female of the household attend group meetings and collect payments while school-age children attend school regularly. The mean household yearly income in 2005 is approximately $1,312 US dollars (21,000 Cordobas); program benefits range from US$270 to US$470 for household with one eligible child (per household) in cash plus in kind services which signify approximately 25 to 45 percent of annual household incomes.

V. Data and stylized facts

We use a two-round panel (2005 and 2006) data-set[5] from a detailed household survey designed for the program. The data contain information for 4,200 households in six municipalities located in the north-central part of Nicaragua. The households in this region are mostly subsistence farmers who rely on basic grain agriculture and some animal farming activities; agricultural participation of children is not uncommon and overall child labor, including domestic activity, is commonplace. Table 1 provides descriptive data on child labor by age and gender and illustrates how a large part of working children are employed on family farms and family enterprise while the majority engage in domestic chores.

The second round of data was collected 9 months after the program was implemented, 3 months before it concluded which may influence why some of the benefits in parts of the program (particularly the vocational training course) had not been completely delivered. The panel allows us to observe various outcome variables at p_1 based on the income conditions of the household at p_0. We can observe the same household over a years' time which can help us separate changes of child labor over time that are attributable to exogenous changes such as the conditional cash transfer program under evaluation here and other economic environment or labor market changes.

We disaggregate work hours from a dichotomous outcome to actual time (hours) use. The data has detailed information on activity types worked, to include domestic chores[6]. Methodologically, the use of hours versus binary outcomes allows for a more robust estimation approach and more accurate investigation of the research question.

[5] The attrition rate is only 2% which is a result of extensive tracking of individuals and households throughout various regions were people had moved to.

[6] Kruger and Berthelon (2007) find that excluding domestic work from child labor calculations biases findings in favor of girls and against boys. In other words, it appears as if girls work less because most of their work in their sample in Brazil is in the house; the outcomes are reversed once they account for this labor.

V.1 Descriptive statistics

The data is structured so that the two work types presented in the model and defined earlier in the paper can be differentiated: physical labor work in our definition includes farm work, livestock raising for consumption, day laborer as a peon in a farm, water gathering, wood cutting and gathering and household chores such as manning the house, cleaning and caring for siblings. The second type is non-physical work which in our definition is a combination of commercial activity, retail, service, non-agricultural employment and professional activities.

Table 1 illustrates some descriptive statistics on child work in 2006 by gender and age groups; more than 50% of children between 8 and 15 years old work in non-domestic work, with the largest concentration of work hours taking place in agricultural activities, 4 hours for boys and 2 hours for girls. Regarding hours worked (not shown in the tables), when we include domestic work into the total work hours calculation we get 10 hours on average for both boys and girls. Females spend on average 9.7 hours a week in physical labor activities while males spend more than 10 hours in this activity. The difference for control and treatment groups is slightly wider, 1 hour more for girls and 1.2 hours more for boys in untreated households. There are no drastic differences between the three interventions types in this activity. Females in treated and untreated households work more in non-physical activity than males and kids in households receiving the business grant intervention, who work on average .8 hours.

In Table 2 we present some basic descriptive statistics for all controls and variables of interest in the analysis. The average household income in dollar amount is $1,400 and the household average size is 7. Communities are on average almost more than 1.5 hours away from the closest market located in the municipal center which indicates that many of these communities are located in remote places throughout the region. Table 3 illustrates the intensity of work for all children (8-15 years of age) by income quintiles; this illustration is broken down into young kids (8-12) and older kids (12.1-15) for further evaluation. We see an increase in work hours for all activities in the higher income quintiles; domestic work is the only exception, exhibiting the exact opposite relationship. The data also show that older kids work approximately 4 hours more per week on average in total work hours, with equally large differences in both non-physical and physical intensive labor activities.

VI. Empirical strategy

We depart from the basic empirical specifications and present various possibilities that enable us to investigate the research question posed in the paper. We first establish the relationship of income and all child labor without the program. We then allow for children type to vary in order to spot potential differences in the effect of income on child labor that may arise in the sub-

groupings. We then analyze how the program affects labor and then analyze how each of the program interventions affects total child labor and child labor by the two types of activities presented in the model. We conclude this part of the analysis by sub-grouping children into types (by age and gender).

In order to ensure that no outliers bias our results we cut 1% in the upper tail of the distribution for all (2005 and 2006) continuous variables in the analysis. Some data is missing or made missing in the survey due to sample attrition (2 percent) or digitizing errors, this is a small percent of the total sample and does not affect our findings. All estimations are clustered at the community level, following the data collection design. Lastly we conduct several robustness exercises (bootstrapping and widening of the sample to include younger children) and find the results are unchanged.

VI.1 Basic specification

We begin this section by investigating the relationship between income and child labor. We then proceed to investigate how a program that increases household income as well as contribute to human capital opportunities through various investments affects child labor. In the data section we established the success of the randomization which allows us to use the cross section of households in the second period to test the hypothesis that the relationship between income and child labor is linear up to a point and non-linear thereafter. We test the relationship using all three treatment groups and control group in our sample ($t_n = (t_0, t_1, t_2, t_3)$).

We investigate the effect of income on child labor. The intensity of child labor is measured by the total average hours worked LH_{ihc} (LH is child labor, L for physical child labor and H for non-physical child labor) in all activities, including domestic work, as a dependent variable. Domestic work accounts for a non-trivial number of children who reported zero hours worked in other non-domestic activities but had more than zero hours in domestic duties.

The child labor data has a left hand side censoring problem, particularly for non-physical labor, resulting from our inability to observe negative work hours for children who would normally have less than zero if it were possible. We use a special case of censored regressions (tobit) to accurately calculate the effect of our variables of interest on child labor. We use tobit for all estimations to keep all results consistent and easily comparable with each other. We first estimate:

$$LH_{ihc,p1} = \alpha + \eta Y_{h,p0} + \kappa S_{h,p0} + \varepsilon \qquad (16)$$

where $LH_{ihc,p1}$ is the dependent variables related to the intensity of child work estimated for child *i* in household *h* and community *c* (cluster) and in the latter period $_{p1}$, $\eta Y_{h,p0}$ is household income lagged, $\kappa S_{h,p0}$ is a control for household size (later included in the full vector of controls), α is a constant and ε is a normally distributed error term. In order to test the inverted-U relationship of poverty and child labor we included a squared term for $\phi Y^2{}_h$ in all specifications.

The sample of children included in the study is restricted to kids who are currently 8 through 15 years of age in 2006 (7-14 in 2005) because a great part of kids do not enter primary education until the age of seven and are this is the target group for the program. We include a vector of individual $X_{i,(p0)}$ characteristics and household $X_{h,(p0)}$ attributes in all estimations as controls; all right hand side variables for household and community are lagged for 2005. Community characteristics that affect the supply and demand of child labor are also included in the estimations $X_{c,(p0)}$. The revised equation is:

$$LH_{ihc,p1} = \alpha + \eta Y_{h,p0} + \phi Y^2{}_{h,p0} + \beta_i' X_{i,p0} + \beta_h' X_{h,p0} + \beta_c' X_{c,p0} + \varepsilon \qquad (17)$$

We explore the gender and age dimensions in the study by looking at sub-samples of young girls and boys (8-12) and older girls and boys (12.1-15). Qualitatively we know gender differences exist in terms of typical work activities performed by children in this region of Nicaragua; boys are typically engaged in agricultural work while girls care for the home and help their parents. Young children are typically assigned domestic work and basic agriculture while older children assist adults in more difficult tasks in both non-physical and physical work. We explore this estimation for *L* and *H* separately.

For the individual characteristics included in the X_i vector, we include: age of child, labor is expected to increase with age (Patrinos and Psacharopoulos, 1997; Cartwright and Patrinos, 1999 etc.) and gender of child when appropriate. In X_h we include: household size at baseline, number of children in various age cohorts, all affecting the incidence of labor in the child labor literature (Kruger and Berthelon, 2003; Edmonds, 2006; Ponczek and Portela Souza, 2007). For community characteristics X_c we include two variables: total population in the community divided by total *manzanas* of land owned in the community; this variable controls for propensity of agricultural work in the community; and, total number of kids in the 7-14 age range in 2005 to total population in the community; this indicates availability of child laborers in the community.

Other controls are age, gender and education of the household head (Dar et.al., 2002[7]; Emerson and Portela, 2007). We also include territorial variables that proxy for remoteness by measuring the proximity to major services and markets. Previous work on poverty in Nicaragua finds that distance deters children, particularly girls and young children, from attending school due to the danger of access particularly during the winter months (Del Carpio 2007). We add distance, measured in terms of time, to the nearest elementary school, health center and the nearest large market (municipal headquarters).

Three-quarters of the sample received the program; it is of interest to apply our empirical estimation to investigate the effects of the program, and each of its interventions, on several child labor outcomes. We first include a dummy $\delta_h T_h$ (1=treated, 0=control) and then include all three intervention dummies where we change $\delta_h T_h$ to (t_0, t_1, t_2, t_3) in the specification, using the non-intervention group (control) as a benchmark. The parameter δ_h is the coefficient for impact of the program and then each intervention by type. The complete specification with controls is:

$$LH_{ihc,p1} = \alpha + \delta T_{h,p0} + \eta Y_{h,p0} + \phi Y^2{}_{h,p0} + \beta_i' X_{i,p0} + \beta_h' X_{h,p0} + \beta_c' X_{c,p0} + \varepsilon \qquad (18)$$

We repeat the empirical exercises in the program section by separating L and H from each other and evaluating the effect of the program on each separately. We expect that the implicit subsidy of the program on children's alternative activities away from work will reduce child labor; by the same token, we expect that as the new productive opportunities in the household arise it may be viewed as an opportunity for some children, particularly those unbound by the conditionality, to contribute to the households' production as well as gain some new skills. Therefore we expect $\delta_h T_h$ to decrease L^* and increase H^* for the older cohort.

VII. Results

We present the results of our empirical work in two main parts: (1) the income-child labor relationship, including the analysis for various types of children as presented in the first result in the theoretical section, (2) the effect of the CCT program on child labor, including the analysis of the effect on two types of work activities and a differentiation by various types of children.

VII.1 Income and all child labor

In this section we first present the results from the empirical application of $Y' = \frac{M}{2P}$ in the theoretical part. In the model we also find that the utility loss of child labor can be different depending on the child's gender and age; these are represented in the model by the multiplicative

[7] In this paper the authors conduct and extensive literature review of the effect of parental schooling on child labor, many of the studies included find a negative impact; only one finds no impact.

terms that give the intensity of child labor. We develop this part of the model empirically by stratifying the sample into gender and age groups to account for various types of children.

VII.1a Analysis of the effect of income on child labor

In the model we assume there is a disutility of child labor, modeled as a linear function of each type of child labor, both with expected negative coefficients. The quadratic term indicates that the relationship between income and child labor has a concave shape (inverted-U) and parents have distaste for child labor, conversely since not all child labor is the same we illustrate the differences in the model and present them as they relate to each other and with household production.

As the model shows, when the family is on the left hand side of the inverted-U and to the left of the maximum turning point (poor family), we see an increase in total child labor. A basic empirical exercise (table 4) tests the U-relationship using total number of work hours (physical and non-physical work combined) and shows that indeed income is increasing (positive) up to a point and decreasing (negative) thereafter; this relationship is statistically significant when we group all kids together, regardless of type.

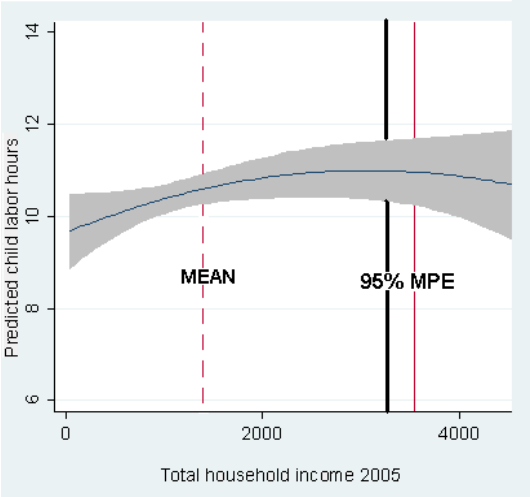
These results confirm the first finding of the model, that there is a concave function in the relationship between income and child labor that indicates that child labor first increases and then decreases as household production passes the maximum point. This can be interpreted from an economic view point and a statistical stand point. The economic interpretation is that both coefficients are going in the direction expected for an inverted-U shape, however given the low levels of income of the population sampled in this study, it is only possible to see an inverted-J relationship, where the majority of the households fall to the left side of the maximum point estimate (MPE example 1) or the point where the curvature takes place. In other words, the sample mean and the majority of the households fall well below the point where an extra dollar of income leads to a decrease in child labor. From a statistical stand point, the inverted-U relationship is observed in the appropriate signs for all children.

In the income figure below, the shape of the curve appears to be more or less uniform, as if household incomes for the sample were evenly distributed; however, we note that 95% of the households fall to the left of the thick solid line ($3,247) and the peak of the curve is at $3,531, beyond the 95 percentile of the distribution.

Example 1. Maximum point estimate calculations

	All kids	*Girls*	*Boys*
Total household income (in 1000) US$	1.780	1.970	1.446
Income squared	-0.252	-0.322	-0.158
Maximum Point Estimate	**$3,531.7**	**$3,059.0**	**$4,575.9**

Income (definition 1) and predicted child labor (both genders)



Note: calculations done on all kids 8-15 years of age, Confidence Interval 95%

VII.1b Income and child labor by types

We are also interested in the effect of the intensity factors α and β which are part of the production function, and l and *h* which represent the cost of labor in the utility function. This multiplicative term in equations (7) and (8), allow us to distinguish between various types of children (young and older boys and girls) and evaluate how high families maximize labor given their income level. We stratify the sample first by gender, where we observe that the income-labor relationship for girls and boys have an inverted-U shape but statistical significance only holds for girls; we obtain the same result when we add a full set of control variables.

When we look at the coefficients for boys and girls we observe striking differences between the two genders; table 4a shows (see figures 1a and 1b for a side-by-side graphical presentation in the appendix) that boys require substantially more income (approximately $1,500) than girls for total labor hours to begin decreasing. Taking it back to the theory, this can be explained through the differences in types of children and the idiosyncratic costs that each type has and intensity that each type of kid is assigned. The utility loss for child labor will vary by child type; for example is the context in which the child lives biases favoring one gender over the other the utility loss of having one child work versus the other will influence the work allocation strategy of the family.

We stratify the sample further, to incorporate age into the mix. In table 4a we observe that the relationship for older girls and boys (age 12.1-15) is concave and significant; the coefficient for the linear term is substantially larger than the quadratic coefficient. An increase in income for older boys appears to have a stronger increasing effect on total labor than that of older girls; however the decreasing effect observed through the negative coefficient on the quadratic

term is slightly larger for older girls than for older boys. We can't say anything conclusively for young kids (ages 8 through 12) because the statistical significance is lacking in the specifications. We can assume that given that most of the households' income fall well before the maximum point, and only less than 10 percent of households pass the maximum point estimate, the relationship is more like an inverted-J. Particularly for girls and older boys, whose sign on the income coefficients indicate that they follow the inverted-U pattern.

VII.2 The program and child labor

Here we evaluate the effect of the program on all child labor by identifying the relationship between the program and each type of intervention on total labor hours. We present the effect of the program on two types of labor activities: physical and non-physical work. These two types of labor activities are derived endogenously as the family decides based on its utility optimization strategy how much to allocate children to each one. In one part of the analysis we hold children type constant (all children 8-15) to isolate the effect of the program on each type of labor activity; we then introduce types of children to see how the effect of the program varies. We begin this part by comparing the performance of each intervention and the control groups on various types of child labor outcome variables.

VII.2a Analysis of the program-child labor relationship

We introduce the conditional cash transfer program that benefited three-quarters of our sample. The income-child labor relationship was established in the previous section without controlling for the program, here we seek to evaluate the performance of the program and see if the inverted-U shape persists despite the program. We disaggregate child labor (*LH* as represented in the empirical part) into two types of child labor, L and H. We know from the model that the impact of an increase in the cost of non-physical work is a rise in the ratio L^*/H^* and the opposite is also true, if the cost of physical child labor increases.

Based on the model presented earlier, we expect the program to reduce child labor because it serves as a tax on child labor and reduces the utility cost of the household. Any transfer that subsidizes education for example, makes education cheaper and the extra money received by the household for abiding to the conditionality increase the opportunity cost by increasing the labor costs, irrespective of labor type (*l* or *h*). From the utility function we know that as the cost for *l* and *h* rise, all child labor is expected to decrease. When we evaluate each intervention and the corresponding conditionality alone, the amount of child labor by type changes depending on the intervention received by the household and the specifics of the intervention. For example, the basic intervention introduces a subsidy to the household making

the cost for labor higher when the child does not attend school; if the household is very poor it will increase its production when the opportunity arises by seeking the optimal level of H^* and L^*

In the case of the business grant intervention, the effect on child labor is different as the intervention introduces a new work opportunity in the household that directly or indirectly motivates child labor in one type of activity H, by lowering the cost of h compared to l. The household will seek to have an optimal level of H^* and L^*.

In Table 5 we include the program as a dummy variable (1 for program households and 0 for control households), we control for other determinants and find that the program has a decreasing effect on physical labor and total work hours. The effect is reversed for non-physical work with a positive and significant coefficient, meaning that the program promotes non-physical labor while decreasing physically demanding work. The labor-income relationship exhibits the expected signs but remains significant for total labor hour only. In Table 6, we disaggregate the program into its three interventions and find that the training intervention is the only one that significantly decreases physical labor and total labor hours for all kids. The basic intervention has a negative sign for all types of work but none have statistical significance. The third intervention (productive investment/business grant), has a positive effect on non-physical work and no effect on physical labor and total labor hours.

VII.2b The program and child labor by types of children

We now allow for type of children to vary by age and gender (bringing in the intensity factor in the production function over the cost factor in the utility function) as presented in equations (7) and (8). We expect to see that as the cost of L is lower for one type of child versus another, the proportion of that type of child in participating in physical labor will be greater than the other type of labor. Moreover if the opportunity cost of a non-working activity, such as education, is lower for older children not targeted by the program and are not subject to the school attendance conditionality we expect to see a larger proportion of children in this age cohort participating in work activities.

We stratify the sample by gender and then by age and gender. Table 7a shows that the basic intervention reduces total child labor hours for boys and increases non-physical labor for girls; all other relationships are not statistically significant. The vocational training intervention reduces physical labor for boys and total labor hours for boys. As expected, we find that the business intervention positively affects non-physical labor for boys and girls; this intervention has no effect on physically demanding labor and total labor hours.

We look at young and older children by gender and activity type and find that all interventions have positive coefficients for non-physical labor and negative coefficients for

physical labor. The basic intervention has an increasing effect on young children of both genders in non-physical activities and the business intervention has an increasing effect on children of all ages and both genders on the same activity. With respect to physical labor, the vocational training intervention has a reducing effect for young children and the business grant intervention has a reducing effect for young girls.

VIII. Conclusion

We began this paper by noting that a good theoretical foundation combined with empirical applications is not commonplace in the child labor literature due mostly to data restrictions. In this paper we attempt to provide a model that is applied to a rich dataset collected for a randomized experiment to answer whether child labor always increases with income; and, how a productively focused CCT with three distinct interventions affects child labor.

When we use total number of work hours the data shows that indeed income is increasing up to a point and decreasing thereafter; this relationship is statistically significant when we group all kids together, regardless of type. We conclude that the income and child labor relationship is concave but the heterogeneity in income of the sample indicates the actual shape; an inverted-J in samples with mostly poor households (left of the turning point) like the one analyzed here instead of an inverted-U.

We observe that the income effect on labor for girls and boys exhibits an inverted-U shape; statistical significance however only holds for girls. The stratification by gender also allows us to observe a large difference in the income level necessary for labor to begin decreasing between the genders, girls requiring far less total household income than boys for income-labor relationship to be negative. Once we analyze kids by gender and age group combined we find that the concavity observed earlier remains strong for older kids but becomes ambiguous, in terms of statistical significance, for younger children. The model provides a plausible explanation, families may look for the child with the highest potential to contribute to the households' production and assign it a high labor intensity factor. In general, older children are comparatively more productive than younger children, thereby making their intensity factor higher and the whole labor intensity ratio higher.

When we include the CCT program in our analysis, we find that it serves as a tax on child labor, making it less appealing for parents to send their children to work. When we disaggregate child labor into physical and non-physical work, we find that the program helps decrease physical work and increase non-physical labor among all children. In other words, the program makes the cost of physical work higher while unaffecting or decreasing the cost of non-physical labor. Specific components of the program have diverse effects. Children bound by the conditionality

of the program and receiving either the vocational or business grant interventions experience a decrease in physical work; while children receiving the basic intervention do not appear to have such an effect. Conversely, the business grant intervention and the basic intervention increase non-physical labor for the younger cohort.

Given the objectives and mechanisms of the program of providing a subsidy for school-age children's time away from work while rewarding school attendance and creating opportunities for intellectually driven activities in the household (encompassed in non-physical work), we find that the intended effect of the program spills over children. In other words, the decline in physical labor and total labor for children and increase in non-physical labor indicates a change in the labor composition of the household, even for children.

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Table 1. Descriptive child labor data by age and gender

ALL												
								ages 8-15				
	Obs.	*All*	*Obs.*	*Control*	*Obs.*	*Treat*	*Obs.*	*Basic B.*	*Obs.*	*Training B.*	*Obs.*	*Grant B.*
Child works in non-domestic activity	4287	54.4%	1096	55.3%	3191	54.1%	1043	52.7%	1079	53.1%	1069	56.3%
Child works in non-agro activity	4287	8.7%	1096	4.7%	3191	10.1%	1043	7.0%	1079	6.4%	1069	16.8%
Child works in agro or cattle activity, inc. as a ag-day labor	4287	44.8%	1096	46.2%	3191	44.3%	1043	42.9%	1079	46.0%	1069	44.0%
Child works in household chores (domestic activity)	4287	91.6%	1096	91.7%	3191	91.6%	1043	90.5%	1079	92.2%	1069	92.0%
Child works in domestic and non-domestic activities	4287	91.6%	1096	91.7%	3191	91.6%	1043	90.5%	1079	92.2%	1069	92.0%
Total hrs p/wk worked in non-agro activity	4214	0.399	1078	0.195	3136	0.469	1031	0.34	1067	0.291	1038	0.781
Total hrs p/wk worked by child in agro (inc peon) and cattle act.	4220	2.956	1071	3.218	3149	2.867	1031	2.84	1064	2.850	1054	2.915
Total hrs p/wk worked in chores	4235	7.050	1072	7.724	3163	6.821	1034	7.00	1069	6.698	1060	6.767
Total hrs p/wk in non-skill (physical) work	4287	9.870	1096	10.699	3191	9.591	1043	9.75	1079	9.446	1069	9.583
Total hrs p/wk worked in chores and work	4289	10.482	1097	11.201	3192	10.234	1043	10.26	1079	9.881	1070	10.568
FEMALE												
								ages 8-15				
	Obs.	*All*	*Obs.*	*Control*	*Obs.*	*Treat*	*Obs.*	*Basic B.*	*Obs.*	*Training B.*	*Obs.*	*Grant B.*
Child works in non-domestic activity	2102	51.2%	564	53.9%	1538	50.3%	494	49.4%	516	50.0%	528	51.3%
Child works in non-agro activity	2102	10.1%	564	5.5%	1538	11.8%	494	9.7%	516	7.6%	528	18.0%
Child works in agro or cattle activity, inc. as a ag-day labor	2102	41.4%	564	45.6%	1538	39.9%	494	38.3%	516	42.6%	528	38.6%
Child works in household chores (domestic activity)	2102	92.1%	564	92.7%	1538	91.8%	494	92.1%	516	92.1%	528	91.3%
Child works in domestic and non-domestic activities	2102	92.1%	564	92.7%	1538	91.8%	494	92.1%	516	92.1%	528	91.3%
Total hrs p/wk worked in non-agro activity	2063	0.4556	558	0.222	1505	0.542	485	0.495	510	0.335	510	0.794
Total hrs p/wk worked by child in agro (inc peon) and cattle act.	2097	1.9512	563	2.287	1534	1.828	493	1.706	514	1.839	527	1.932
Total hrs p/wk worked in chores	2061	7.9014	544	8.480	1517	7.694	487	7.930	510	7.673	520	7.494
Total hrs p/wk in non-skill (physical) work	2102	9.6938	564	10.462	1538	9.412	494	9.520	516	9.415	528	9.309
Total hrs p/wk worked in chores and work	2104	10.267	565	10.675	1539	10.117	494	10.253	516	9.857	529	10.244
MALE												
								ages 8-15				
	Obs.	*All*	*Obs.*	*Control*	*Obs.*	*Treat*	*Obs.*	*Basic B.*	*Obs.*	*Training B.*	*Obs.*	*Grant B.*
Child works in non-domestic activity	2185	57.4%	532	56.8%	1653	57.6%	549	55.7%	563	56.0%	541	61.2%
Child works in non-agro activity	2185	7.3%	532	3.8%	1653	8.5%	549	4.6%	563	5.3%	541	15.7%
Child works in agro or cattle activity, inc. as a ag-day labor	2185	48.0%	532	46.8%	1653	48.4%	549	47.0%	563	49.0%	541	49.2%
Child works in household chores (domestic activity)	2185	91.2%	532	90.6%	1653	91.4%	549	89.1%	563	92.4%	541	92.8%
Child works in domestic and non-domestic activities	2185	91.2%	532	90.6%	1653	91.4%	549	89.1%	563	92.4%	541	92.8%
Total hrs p/wk worked in non-agro activity	2151	0.344	520	0.165	1631	0.401	546	0.198	557	0.251	528	0.768
Total hrs p/wk worked by child in agro (inc peon) and cattle act.	2123	3.949	508	4.249	1615	3.855	538	3.875	550	3.795	527	3.898
Total hrs p/wk worked in chores	2174	6.242	528	6.946	1646	6.016	547	6.180	559	5.808	540	6.066
Total hrs p/wk in non-skill (physical) work	2185	10.048	532	10.951	1653	9.757	549	9.954	563	9.474	541	9.851
Total hrs p/wk worked in chores and work	2185	10.688	532	11.759	1653	10.344	549	10.262	563	9.904	541	10.885

Table 2. Means for variables in the analysis by gender

Kids age 8-15 (7-14 in 2005)	Total Observations	All kids	Girls	Boys
Income for household (in 1000) 2005	4256	1397.86	1389.68	1405.70
basic intervention	4181	24%	23%	25%
training intervention	4181	25%	24%	26%
business grant intervention	4181	25%	25%	25%
age of child in 2006	4289	11.58	11.58	11.58
household size 2005	4289	6.91	6.95	6.87
education level of head 2005	4289	1.32	1.32	1.32
age of head 2005	4289	44.78	44.79	44.76
gender of the household head (male=1, female=0) in 2005	4289	0.84	0.83	0.85
gender of child (boys=1, girls=0) 2006	4289	51%	--	--
#of children 5 yr & under 2005	4289	0.72	0.74	0.71
#of children 6-15 years 2005	4289	2.85	2.87	2.83
#of children 15-24 years 2005	4289	1.13	1.15	1.10
dist. in time to municipal hq 2005	4289	1.59	1.60	1.57
dist. in time to prim. School 2005	4289	0.27	0.27	0.27
dist. in time to health center 2005	4289	1.17	1.18	1.15
tot community owned land/tot population in community 2005	4235	7.88	8.01	7.75
tot # of kids in age group in the community /tot comm population 2005	4289	0.32	0.32	0.31

Table 3. Labor participation and hours by Income quintiles

All 8-15 both genders	**1st Quintile**		**2nd Quintile**		**3rd Quintile**		**4th Quintile**		**5th Quintile**	
	Obs.	***All***	***Obs.***	***All***	***Obs.***	***All***	***Obs.***	***All***	***Obs.***	***All***
Total hrs p/wk worked in non-agro activity	904	0.2782	927	0.4229	928	0.3125	816	0.428	639	0.6213
Total hrs p/wk worked by child in agro (inc peon) and cattle act.	895	2.4688	931	3.0773	924	2.704	815	3.21166	655	3.4886
Total hrs p/wk worked in chores	900	7.2928	929	6.9698	928	7.1331	823	6.94848	655	6.8374
Total hrs p/wk in non-skill (physical) work	909	9.6514	942	9.915	939	9.7103	834	9.99532	663	10.201
Total hrs p/wk worked in chores and work	911	10.02	942	10.478	939	10.006	834	10.9558	663	11.198
Age group 8-12 both genders	**1st Quintile**		**2nd Quintile**		**3rd Quintile**		**4th Quintile**		**5th Quintile**	
	Obs.	***All***	***Obs.***	***All***	***Obs.***	***All***	***Obs.***	***All***	***Obs.***	***All***
Total hrs p/wk worked in non-agro activity	514	0.2393	504	0.3433	523	0.2524	447	0.2774	355	0.4873
Total hrs p/wk worked by child in agro (inc peon) and cattle act.	515	1.7462	507	2.1302	526	1.6492	448	2.35156	363	2.6088
Total hrs p/wk worked in chores	513	6.5058	505	6.082	523	6.3002	450	5.99444	361	6.0166
Total hrs p/wk in non-skill (physical) work	516	8.2109	509	8.156	529	7.8686	453	8.28035	364	8.5687
Total hrs p/wk worked in chores and work	516	8.393	509	8.5921	529	8.069	453	8.92274	364	9.2912
Age group 12.1-15 both genders	**1st Quintile**		**2nd Quintile**		**3rd Quintile**		**4th Quintile**		**5th Quintile**	
	Obs.	***All***	***Obs.***	***All***	***Obs.***	***All***	***Obs.***	***All***	***Obs.***	***All***
Total hrs p/wk worked in non-agro activity	390	0.3295	423	0.5177	405	0.3901	369	0.60976	284	0.7887
Total hrs p/wk worked by child in agro (inc peon) and cattle act.	380	3.4482	424	4.2099	398	4.098	367	4.26158	292	4.5822
Total hrs p/wk worked in chores	387	8.3359	424	8.0271	405	8.2086	373	8.09946	294	7.8452
Total hrs p/wk in non-skill (physical) work	393	11.543	433	11.983	410	12.087	381	12.0344	299	12.189
Total hrs p/wk worked in chores and work	395	12.145	433	12.694	410	12.506	381	13.373	299	13.52

Table 4. Analysis of income and total hours of all child labor

	Total # of hours worked in all activities					
	All kids age 8-15		Girls age 8-15		Boys age 8-15	
	tobit (1)	tobit (2)	tobit (1)	tobit (2)	tobit (1)	tobit (2)
Income for household (in 1000) 2005	1.258*	1.748**	1.583*	1.947**	0.907	1.446
	(1.8)	(2.42)	(1.88)	(2.31)	(1.01)	(1.58)
Income for household squared	-0.187*	-0.252*	-0.270*	-0.322*	-0.102	-0.158
	(-1.86)	(-1.74)	(-1.66)	(-1.91)	(-0.59)	(-0.9)
age of child in 2006		1.372***		1.248***		1.483***
		(18.74)		(12.4)		(11.87)
gender of child (boy=1, girl=0) 2006		0.323				
		(0.83)				
household size 2005	-0.193***	-0.836***	-0.120	-0.337	-0.263***	-1.315***
	(-2.69)	(-3.21)	(-1.39)	(-0.97)	(-2.59)	(-4.02)
education level of head 2005		-0.350		0.017		-0.696**
		(-1.54)		(0.07)		(-2.46)
age of head in 2005		0.052**		0.033		0.074**
		(2.5)		(1.3)		(2.54)
gender of household head 2005		-0.010		-0.801		0.789
		(-0.02)		(-1.41)		(0.95)
# of children under 5 years 2005		1.424***		0.971*		1.819***
		(3.5)		(1.82)		(3.32)
# of children 5-14 years 2005		0.582*		0.076		1.050**
		(1.74)		(0.17)		(2.65)
# of children 15-24 years 2005		0.113		-0.202		0.417
		(0.39)		(-0.52)		(1.05)
dist. in time to municipal hq 2005		-0.052		-0.173		0.048
		(-0.24)		(-0.76)		(0.15)
dist. in time to primary school 2005		0.724		1.373*		0.112
		(1.05)		(1.67)		(0.12)
dist. in time to health center 2005		0.297		0.393		0.235
		(0.9)		(1.18)		(0.53)
tot community owned land/tot population		-0.042**		-0.058***		-0.024
in community 2005		(-2.26)		(-2.65)		(-0.93)
tot # of kids age group in comm /tot comm		-17.689***		-14.30975**		-20.058**
population 2005		(-2.75)		(-2.39)		(-2.28)
Observations	4256	4200	2083	2053	2173	2147
Pseudo R-squared	0.04%	1.38%	0.05%	1.37%	0.05%	1.5%

Note: Absolute value of t statistics in parentheses.

Note2:* significant at 10%; ** significant at 5%; *** significant at 1%

Table 4a. Analysis of income and total hours of labor by child type (age and gender)

	Total # of hours worked in all activities							
	Young girls age 8-12		Young boys age 8-12		Older girls age 12.1-15		Older boys age 12.1-15	
	tobit (1)	tobit (2)	tobit (1)	tobit (2)	tobit (1)	tobit (2)	tobit (1)	tobit (2)
Income for household (in 1000) in 2005	1.138	1.598*	-0.148	0.105	1.7186	2.405*	2.461**	3.012**
	(1.2)	(1.68)	(-0.13)	(0.09)	(1.42)	(1.9)	(2.01)	(2.43)
Income for household squared	-0.184	-0.238	0.049	0.037	-0.324	-0.419*	-0.332	-0.383*
	(-0.91)	(-1.14)	(0.23)	(0.16)	(-1.39)	(-1.63)	(-1.46)	(-1.68)
age of child in 2006		1.737***		1.931***		0.788**		0.828*
		(9.95)		(8.64)		(2.05)		(1.8)
gender of child (boy=1, girl=0) 2006								
household size 2005	-0.223**	-0.646*	-0.225**	-0.636	0.028164	0.008	-0.392***	-2.192***
	(-2.16)	(-1.94)	(-1.7)	(-1.63)	(0.19)	(0.01)	(-2.8)	(-4.72)
education level of head 2005		0.029		-0.642		-0.016		-0.766*
		(0.11)		(-1.65)		(-0.04)		(-1.69)
age of head in 2005		0.051*		0.058		0.026		0.097***
		(1.66)		(1.56)		(0.81)		(2.33)
gender of household head 2005		-0.686		0.503		-0.929		1.188
		(-0.98)		(0.52)		(-1.01)		(1.07)
# of children under 5 years 2005		1.333**		0.809		0.538		3.029***
		(2.52)		(1.39)		(0.56)		(4.03)
# of children 5-14 years 2005		0.077		0.217		0.142		2.109***
		(0.2)		(0.45)		(0.17)		(3.4)
# of children 15-24 years 2005		-0.055		-0.069		-0.393		1.113**
		(-0.15)		(-0.15)		(-0.53)		(2.03)
dist. in time to municipal hq 2005		0.088		-0.281		-0.538		0.431
		(0.33)		(-0.78)		(-1.52)		(0.98)
dist. in time to primary school 2005		1.546*		0.395		1.136		-0.319
		(1.91)		(0.36)		(0.99)		(-0.28)
dist. in time to health center 2005		0.175		0.253		0.610		0.257
		(0.45)		(0.59)		(1.38)		(0.39)
tot community owned land/tot population		-0.057**		-0.027		-0.065**		-0.015
in community 2005		(-2.16)		(-1.01)		(-2.24)		(-0.44)
tot # of kids age group in comm /tot comm		-17.794***		-13.764		-9.555		-28.898***
population 2005		(-2.63)		(-1.38)		(-1.06)		(-2.59)
Observations	1153	1135	1119	1184	930	918	974	963
Pseudo R-squared	0.08%	1.51%	0.05%	1.22%	0.05%	0.37%	0.13%	0.66%

Note: Absolute value of t statistics in parentheses.

Note2:* significant at 10%; ** significant at 5%; *** significant at 1%

Table 5. Effect of the program on various types of child labor

	All kids age 8-15		
	physical labor	**non-physical labor**	**total labor hours**
program household (yes=1, no=0) in 2005	-1.178*	3.504***	-1.102*
	(-1.93)	(4.92)	(-1.64)
income for household (in 1000) in 2005	1.064	1.1719	1.723**
	(1.56)	(1.18)	(2.39)
income for household squared	-0.153	-0.0513	-0.024*
	(-1.12)	(-0.26)	(-1.66)
age of child in 2006	1.234***	0.832***	1.374***
	(19.23)	(7.64)	(18.76)
gender of child (boy=1, girl=0) 2006	0.235	-1.603***	0.356
	(0.66)	(-2.98)	(0.92)
household size 2005	-0.786***	-0.350	-0.843***
	(-3.2)	(-0.75)	(-3.24)
education level of head 2005	-0.296	0.450	-0.343
	(-1.46)	(1.3)	(-1.52)
age of head in 2005	0.054***	-0.004	0.052***
	(2.81)	(-0.14)	(2.55)
gender of household head 2005	0.044	0.000	0.031
	(0.08)	(0)	(0.06)
# of children under 5 years 2005	1.448***	0.482	1.426***
	(3.81)	(0.7)	(3.55)
# of children 5-14 years 2005	0.548*	-0.389	0.601*
	(1.76)	(-0.65)	(1.79)
# of children 15-24 years 2005	0.234	-0.360	0.115
	(0.84)	(-0.66)	(0.4)
dist. in time to municipal hq 2005	-0.098	0.428	-0.084
	(-0.49)	(1.18)	(-0.38)
dist. in time to primary school 2005	0.892	0.628	0.612
	(1.38)	(0.65)	(0.89)
dist. in time to health center 2005	0.298	-0.465	0.322
	(1.03)	(-1.11)	(0.99)
tot community owned land/tot population	-0.039***	-0.043	-0.048***
in community 2005	(-2.32)	(-1.2)	(-2.59)
tot # of kids age group in comm /tot comm	-11.340*	-8.021	-16.189**
population 2005	(-1.86)	(-1.11)	(-2.44)
Observations	4198	4130	4200
Pseudo R-squared	1.34%	3.10%	1.4%

Note: Absolute value of t statistics in parentheses.

Note2:* significant at 10%; ** significant at 5%; *** significant at 1%

Table 6. Effect of each program intervention on various types of child labor

	Child labor by activity types		
	All kids age 8-15		
	physical labor	non-physical	total labor hours
basic intervention	-1.052	1.414	-1.143
	(-1.56)	(1.47)	(-1.52)
training intervention	-1.407**	1.155	-1.620**
	(-2.09)	(1.41)	(-2.25)
business grant intervention	-1.013	6.288***	-0.533
	(-1.58)	(7.77)	(-0.75)
income for household (in 1000) in 2005	1.150*	1.440	1.7902***
	(1.75)	(1.49)	(2.61)
income for household squared	-0.180	-0.087	-0.261**
	(-1.41)	(-0.47)	(-1.92)
age of child in 2006	1.241***	0.834***	1.381***
	(19.25)	(7.38)	(18.98)
gender of child (boy=1, girl=0) 2006	0.268	-1.736***	0.422
	(0.73)	(-3.33)	(1.08)
household size 2005	-0.739***	-0.280	-0.793***
	(-2.98)	(-0.64)	(-3.06)
education level of head 2005	-0.255	0.411	-0.311
	(-1.31)	(1.19)	(-1.45)
age of head in 2005	0.053***	-0.012	0.051**
	(2.75)	(-0.42)	(2.48)
gender of household head 2005	-0.149	-0.190	-0.200
	(-0.28)	(-0.21)	(-0.37)
# of children under 5 years 2005	1.366***	0.283	1.311***
	(3.58)	(0.44)	(3.31)
# of children 5-14 years 2005	0.511	-0.456	0.558*
	(1.62)	(-0.78)	(1.66)
# of children 15-24 years 2005	0.194	-0.549	0.057
	(0.7)	(-1.05)	(0.2)
dist. in time to municipal hq 2005	-0.103	0.248	-0.095
	(-0.51)	(0.67)	(-0.43)
dist. in time to primary school 2005	0.865	0.571	0.626
	(1.34)	(0.65)	(0.92)
dist. in time to health center 2005	0.317	-0.227	0.359
	(1.08)	(-0.54)	(1.1)
tot community owned land/tot population	-0.037**	-0.029	-0.046**
in community 2005	(-2.13)	(-0.85)	(-2.34)
tot # of kids age group in comm /tot comm	-10.905*	-6.805	-15.456**
population 2005	(-1.78)	(-1)	(-2.35)
Observations	4101	4040	4103
Pseudo R-squared	1.33%	5.11%	1.4%

Absolute value of t statistics in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 7a. Analysis of the program on various labor activities by gender

	non-physical labor		physical labor		Total labor hours	
	Girls age 8-15	**Boys age 8-15**	**Girls age 8-15**	**Boys age 8-15**	**Girls age 8-15**	**Boys age 8-15**
basic intervention	2.462**	-0.147	-0.992	-1.056	-0.551	-1.675*
	(2.17)	(0.11)	(1.27)	(1.26)	(-0.66)	(-1.78)
training intervention	1.240	0.974	-1.127	-1.598*	-1.126	-2.073**
	(1.31)	(0.75)	(1.54)	(1.76)	(-1.48)	(-2.06)
business grant intervention	5.766***	6.852***	-0.812	-1.185	-0.076	-0.989
	(6.74)	(5.76)	(1.17)	(1.36)	(-0.1)	(-1.01)
income for household (in 1000) 2005	1.394	1.491	1.438*	0.789	1.899**	1.6252*
	(1.22)	(1.03)	(1.81)	(0.91)	(2.28)	(1.81)
income for household squared	-0.127	-0.004	-0.251	-0.089	-0.311*	-0.196
	(0.60)	(0.01)	(1.54)	(0.54)	(-1.82)	(-1.16)
age of child in 2006	0.782***	0.905***	1.160***	1.311***	1.247***	1.504***
	(5.14)	(4.88)	(11.69)	(11.66)	(12.28)	(11.77)
household size 2005	0.133	-1.038	-0.298	-1.155***	-0.335	-1.222***
	(0.28)	(1.62)	(0.90)	(3.52)	(-0.96)	(-3.77)
education level of head 2005	0.830**	-0.084	-0.002	-0.496**	0.027	-0.622**
	(2.47)	(0.15)	(0.01)	(2.07)	(0.11)	(-2.32)
age of head in 2005	0.023	-0.062	0.031	0.078***	0.031	0.073**
	(0.74)	(1.20)	(1.37)	(2.85)	(1.24)	(2.5)
gender of household head 2005	-0.331	-0.046	-0.960	0.686	-0.984	0.561
	(0.29)	(0.04)	(1.62)	(0.83)	(-1.63)	(0.66)
# of children under 5 years 2005	-0.161	1.114	0.910*	1.767***	0.886*	1.668***
	(0.26)	(1.19)	(1.80)	(3.26)	(1.66)	(3.08)
# of children 5-14 years 2005	-0.720	0.139	0.067	0.904**	0.045	1.014***
	(1.13)	(0.17)	(0.15)	(2.43)	-(0.1)	(2.63)
# of children 15-24 years 2005	-0.721	-0.160	-0.099	0.467	-0.206	0.300
	(1.28)	(0.23)	(0.26)	(1.19)	(-0.52)	(0.75)
dist. in time to municipal hq 2005	0.274	0.234	-0.196	-0.023	-0.178	-0.026
	(0.74)	(0.44)	(0.98)	(0.07)	(-0.76)	(-0.08)
dist. in time to primary school 2005	0.942	-0.061	1.472*	0.282	1.342*	-0.038
	(0.82)	(0.04)	(1.91)	(0.35)	(1.66)	(-0.04)
dist. in time to health center 2005	-0.431	0.037	0.383	0.277	0.452	0.307
	(0.87)	(0.07)	(1.22)	(0.68)	(1.36)	(0.69)
tot community owned land/tot population	-0.042	-0.016	-0.054**	-0.021	-0.059***	-0.030
in community 2005	(1.23)	(0.32)	(2.44)	(0.85)	(-2.57)	(-1.12)
tot # of kids age group in comm /tot comm	-8.402	-5.017	-7.596	-13.274	-12.288**	-17.518*
population 2005	(0.94)	(0.45)	(1.40)	(1.57)	(-2.1)	(-1.88)
Observations	1972	2068	2002	2099	2004	2099
Pseudo R-squared	4.50%	6.47%	1.38%	1.41%	0.0139	1.57%

Absolute value of t statistics in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 7b. Analysis of the program on non-physical labor by child type

	Total # of hours worked in non-physical labor			
	Young girls age 8-12	Young boys age 8-12	Older girls age 12.1-15	Older boys age 12.1-15
basic intervention	3.526**	-3.615*	1.858	2.651
	(2.15)	(1.77)	(1.43)	(1.55)
training intervention	1.737	0.486	0.948	1.830
	(1.17)	(0.30)	(0.79)	(1.02)
business grant intervention	6.311***	5.776***	5.393***	8.484***
	(5.17)	(4.27)	(4.31)	(5.39)
income for household (in 1000) 2005	-0.058	1.976	2.337	1.456
	(0.04)	(1.00)	(1.58)	(0.84)
income for household squared	0.072	-0.054	-0.263	-0.031
	(0.26)	(0.16)	(0.91)	(0.09)
age of child in 2006	1.056***	2.286***	0.276	1.204**
	(3.05)	(4.17)	(0.60)	(2.58)
household size 2005	0.622	-0.349	-0.276	-1.726*
	(1.07)	(0.51)	(0.42)	(1.87)
education level of head 2005	0.738	-0.495	1.003**	0.380
	(1.59)	(0.69)	(2.17)	(0.60)
age of head in 2005	-0.027	-0.061	0.071	-0.052
	(0.67)	(1.13)	(1.59)	(0.77)
gender of household head 2005	-1.071	1.091	0.049	-0.886
	(0.73)	(0.62)	(0.04)	(0.58)
# of children under 5 years 2005	-0.521	0.409	0.116	1.632
	(0.60)	(0.37)	(0.14)	(1.52)
# of children 5-14 years 2005	-1.250*	-0.544	-0.142	0.724
	(1.76)	(0.58)	(0.16)	(0.65)
# of children 15-24 years 2005	-1.292*	-0.896	-0.228	0.496
	(1.66)	(1.03)	(0.32)	(0.51)
dist. in time to municipal hq 2005	0.078	-0.045	0.409	0.494
	(0.17)	(0.08)	(0.78)	(0.70)
dist. in time to primary school 2005	-0.828	0.864	1.897	-1.388
	(0.53)	(0.74)	(1.37)	(0.72)
dist. in time to health center 2005	0.026	0.477	-0.756	-0.420
	(0.04)	(0.74)	(1.16)	(0.49)
tot community owned land/tot population	-0.013	-0.043	-0.074*	0.007
in community 2005	(0.33)	(0.76)	(1.71)	(0.10)
tot # of kids age group in comm /tot comm	-17.387	-18.041	-0.635	7.366
population 2005	(1.51)	(1.36)	(0.05)	(0.56)
Observations	1101	1144	871	924
Pseudo R-squared	5.28%	8.64%	3.89%	7.00%

Absolute value of t statistics in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

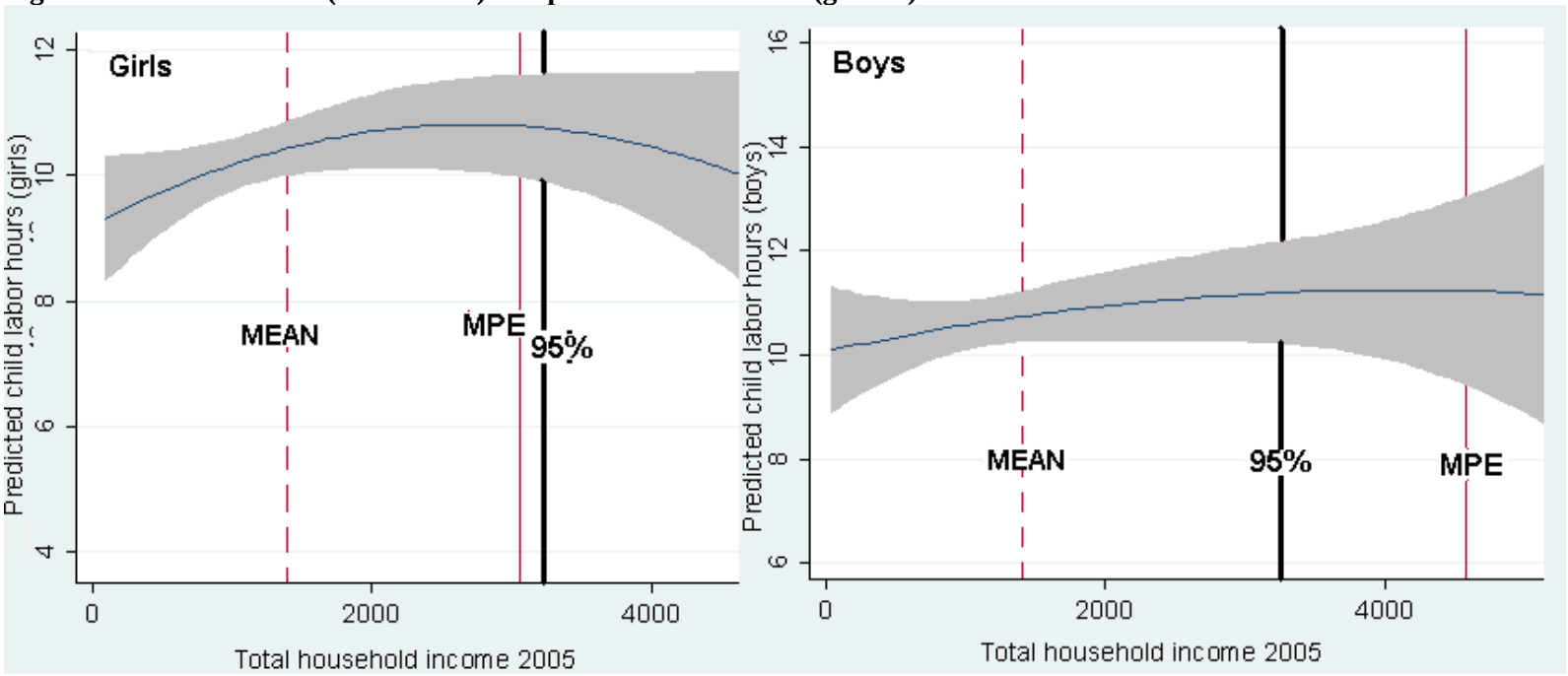
Table 7c. Analysis of the program on physical labor by child type

	Total # of hours worked in physical labor			
	Young girls age 8-12	**Young boys age 8-12**	**Older girls age 12.1-15**	**Older boys age 12.1-15**
basic intervention	-1.123	-1.160	-0.879	-0.691
	(1.31)	(1.30)	(0.82)	(0.55)
training intervention	-1.818**	-1.682*	-0.346	-1.360
	(2.27)	(1.80)	(0.34)	(1.04)
business grant intervention	-1.325*	-0.298	-0.196	-1.964
	(1.70)	(0.32)	(0.19)	(1.52)
income for household (in 1000) in 2005	1.372	-0.395	1.540	2.197*
	(1.46)	(0.36)	(1.40)	(1.95)
income for household squared	-0.203	0.107	-0.302	-0.323
	(0.94)	(0.47)	(1.36)	(1.59)
age of child in 2006	1.594***	1.682***	1.002***	0.615
	(9.92)	(8.62)	(2.63)	(1.48)
household size 2005	-0.586*	-0.652*	0.050	-1.770***
	(1.85)	(1.78)	(0.08)	(3.83)
education level of head 2005	-0.047	-0.454	0.040	-0.571
	(0.20)	(1.38)	(0.11)	(1.56)
age of head in 2005	0.046	0.067*	0.029	0.089**
	(1.63)	(1.95)	(0.99)	(2.21)
gender of household head 2005	-0.514	0.680	-1.478	0.784
	(0.79)	(0.70)	(1.57)	(0.77)
# of children under 5 years 2005	1.341***	0.904	0.325	2.769***
	(2.60)	(1.64)	(0.35)	(3.55)
# of children 5-14 years 2005	0.030	0.381	0.172	1.557***
	(0.08)	(0.87)	(0.21)	(2.65)
# of children 15-24 years 2005	-0.006	0.028	-0.247	1.051*
	(0.02)	(0.06)	(0.34)	(1.95)
dist. in time to municipal hq 2005	0.053	-0.319	-0.545*	0.259
	(0.22)	(0.93)	(1.71)	(0.56)
dist. in time to primary school 2005	1.783**	0.481	1.134	0.097
	(2.11)	(0.47)	(1.13)	(0.10)
dist. in time to health center 2005	0.168	0.260	0.565	0.414
	(0.44)	(0.65)	(1.34)	(0.66)
tot community owned land/tot population	-0.058**	-0.028	-0.052*	-0.005
in community 2005	(2.28)	(1.03)	(1.80)	(0.17)
tot # of kids age group in comm /tot comm	-10.173*	-6.568	-4.321	-22.459**
population 2005	(1.69)	(0.70)	(0.50)	(2.14)
Observations	1108	1158	894	941
Pseudo R-squared	1.53%	1.15%	0.41%	0.62%

Absolute value of t statistics in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

Figure 1a and 1b. Income (definition 1) and predicted child labor (gender)



Note: calculations done on all kids 8-15 years of age, Confidence Interval 95%. MPE is the Maximum Point Estimate