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Abstract

As it is often said that child labor comes on the expense of schooling. But the fact in Cambodia case is quiet different because most children are likely to combine work and study together. This means that child labor contributes to human capital of the child as long as we still find children combine both work and study. This study tries to investigate that perhaps hours worked of children rather than child participation rate in the labor force are really trade-off with schooling outcomes of children. If children's income play significant role in parents' decision over human capital formation of their children, thus we need to estimate the rate of return to child labor as well. By employing simple theoretical and empirical model, we found that education of the child plays crucial role in their wage rate and/or earning capacity, which is a considerable results to help encourage parents to invest in their children's education. Finally the most striking results out of this study is that working children contribute to their human capital because children's working hours stay below the threshold level of 3 hours per day.

Key words: child labor, Rate of Return, human capital, hours worked, trade-off, Cambodia.

JEL Classification Codes: J3, J2, D1, C31, C35

I. Introduction

1) Background

Child labor has long been recognized as the direct conflict to human capital formation of children and its common explanation is that schooling competes with labor intensive jobs for children such as wage labor, employment in family enterprises, or collection activities. By this view, the low current income of families keeps their children out of school and thus perpetuates poverty into the next generation (Ravallion and Wodon, 2002). However, this has come to our questionable hypothesis since most children in Cambodia are found in the combined activity of work and study. Most Children in developing countries is needed to help smoothening household's consumptions and at the same time they are able to stay in school. Of course, evidences on the child labor are mixed based on their cultural and adjustable strategies to their needs. Some studies found that poverty is the cause of child labor (Basu and Van, 1998; Edmonds and Turk, 2002), and thus it implicates that eradicating poverty will also eradicating child labor. Perhaps most, if not all, would agree with this strong association, however, the question is that how is the transitional mechanism to get one out of poverty. This is the most difficult task and has been challenged to all leaders in the world that have tried through their collective actions reflecting in the UN Millennium Summit and subsequently the Millennium Development Goals (UN, 2000). And at the same time, human capital formation through schooling and trainings are among the most important factors to fight against poverty. These binding correlations among poverty, human capital and child labor are presenting trade-off and thus trap in the vicious cycle of poverty. However, the situation does not really be like that because human are the most flexible and adjustable to their maximization needs. The results are mixed that some are purely child labor, some are purely child schooling and many are combined both work and study at time in the context of Cambodia.

Based on the above observation of outcomes of child labor and schooling, we have formulated our hypothesis of interests that child labor indeed lead to human capital formation of children in developing countries, taking the example of Cambodia case study, and we will try to prove that in general child labor has negative relationship with child schooling, but it is their hours worked rather than their participation rate that is trade-off. Like any theory ranked from production function to rate of return to human capital (Mincer, 1974; Becker, 1975), child labor supply hours will be trade-off with their schooling outcomes if children continue to work more than a threshold hours. Therefore, this study is important for policy makers to set up a threshold hours for which children will be monitored and allowed to work at the minimum hours, less than this level, and otherwise, their working will have negative impact on schooling. If the assumption of child labor benefits their human capital, thus the estimation of children's rate of return to their education is also our interests. Mincer's model provides that schooling is the forgone earning, and adults will start earning after the completion of their school. However our case is different because child laborers started earning at the same time of schooling. This is interesting to know that whether educated children will have

better bargaining power at their wage rate or not, and if it is so, this will encourage parents to choose both child labor and schooling at the same time for household whose consumptions has to be supplemented by children's income.

A bunch of literatures are at our disposal in terms of child labor and its schooling trade-off, for instance., Ravallion and Wodon (2000), Patrinos and Psacharopoulos (1997), Basu (1999), Jensen and Nielsen (1997). However, their analyses mostly are based on children's participation rate rather than hour worked. Exceptions are only Rossati and Rossi (2003), and Ray and Lancaster (2004) where hours worked of children had been accounted for. This, perhaps, indicates that data on labor supply of hours worked were unavailable in many countries, thus limited the analysis only in the domain of child participation rate. Without reinventing the wheels, we model after existing literatures especially Ray and Lancaster (2004) who tried to estimate the impact of child labor on schooling. However, the differences are that (i) there is yet to have theoretical model of hour worked of children and schooling trade-off. Based on our simple theoretical model, we found several interesting propositions which leads to the empirical estimations; (ii) in the empirical model, we allow our model of estimation to have more omitted variables to enter directly into the explanatory variables because non-inclusion of omitted variables into the model can cause serious problem on parameter estimates (Wooldridge, 2003), and the rank of sample covers children age 5-14 year old rather a specific target group 12-14 years because child labor are believed to be actively engaged in domestic work since they were young and this age group is compliance to the definition of child labor in Cambodia; (iii) we employ Probit model to estimate the binary school enrolment rather than using OLS. Due to different techniques and flexibility, we found different findings on the threshold level.

This study contributes to the growing evidence on the supply of child labor's hours and schooling trade-off. Building from simple theoretical and empirical model, this study estimates the rate of return to child labor, and subsequently move to estimate the main objective of hours worked and schooling trade-off by using Two-stages Least Square method as we presumed the endogeneity of hours worked of children in the our structural equation of schooling outcomes.

2) Objective of the study

With the fact that majority of children in Cambodia are found in the combined work and study, we presume that child labor increase human capital of children if children worked within a threshold level hours. And of course, children are able to guarantee their schooling because of their child labor. In other words, children's incomes are needed to smooth the household consumption. Hence, the rate of return of child labor is very important to be estimated before the question of how much time that each child labor has to work. With this view, this study aims to provide the following investigations:

- Estimate the rate of return to child labor. Here the study of child labor and their earning capacity become of interest because their earning start at the same time of studying for those children who are in the category of "both work and study".

- Find out salient determinants of schooling outcomes, and estimates the trade-off hours between hours supply of child labor and schooling outcomes.

3) Organization of this paper

This paper is organized as follows. In Section 2 we present literature review on rate of return of child labor, and trade-off between hours worked of children with their human capital formation. In Section 3 we present a simple theoretical and empirical framework. The theoretical model gives several interesting propositions on the important of wage rate of child labor, and subsequently the trade-off between child labor and their hours worked. Following these propositions, we built the empirical specification to estimates our hypotheses. In Section 4 we discuss the results of estimation. Section 5 is the conclusion. We present summary and further studies. Finally, Annex A contains the table of correlation among covariates used in our specification function.

II. Literature Review:

1) Rate of Return to Human Capital Investment

Since the beginning of the industrial revolution, literacy and knowledge have become increasingly valuable relative to basic manual skills. This increasing value has led to wage premiums for educated workers. Not surprisingly, an educated workforce is the dominant factor in explaining differences in regional growth and prosperity. As a result economists have extensively researched education's importance in determining individual differences in wages and regional differences in economic growth. The paper on investment in human capital by Becker (1962, 1975) emphasizes on education and training, the most important investments. Of course, formal education is not the only way to invest in human capital. Workers also learn and are trained outside of schools, especially on jobs.

A number of studies use Mincer's human capital earnings function because this model is the most commonly employed method in labor economics. Mincer (1974) uses a simple regression model "with a linear schooling term and a low-order polynomial in potential experience". Using Mincer's model, we can easily adopt this method for the estimation of rate of return to human capital of child labor. We simply brief the method as follow:

Supposed that:

n = length of working plus length of schooling of children

= length of working for children without schooling

Y_s = annual earnings of individual child with *s* years of schooling

V_s = present value of an individual's child earnings at start of schooling

r = discount rate

t = 0, 1, 2,…, n time, in years

d = difference in the amount of schooling, in years

e = base of natural logarithms

Then, the rate of returns to human capital of the child when discounting process is discrete is:

$$V_s = Y_s \sum_{t=s+1}^{n} (1+r)^{-t}$$

And when discounting process is continuous is:

$$V_s = Y_s \int_s^n e^{-rt} dt = \frac{Y_s (e^{-rs} - e^{-rn})}{r}$$

Similarly the present value of earnings of an individual child who engages in *s-d* years of schooling is:

$$V_{s-d} = Y_s \int_{(s-d)}^{n} e^{-rt} dt = \frac{Y_{s-d} (e^{-r(s-d)} - e^{-rn})}{r}$$

The ratio, $K_{s,\,s\text{-}d}$, of annual earnings after *s* years to earnings after *s-d* years of schooling is found by letting $V_s = V_{s-d}$:

$$K_{s,s-d} = \frac{Y_s}{Y_{s-d}} = \frac{e^{-r(s-d)} - e^{-rn}}{e^{-rs} - e^{-rn}} = \frac{e^{r(n+d-s)} - 1}{e^{r(n-s)} - 1}$$

The ration, $K_{s,\,s\text{-}d}$, is clearly larger than unity, and a positive function of *r*, and a negative function of *n*. This take to mean that people with more schooling have higher annual pay, the difference between earnings of individuals is due to difference in investment of d years of schooling, and difference is larger the shorter the general span of working life.

Since we are interested in the n as a fixed span of earning life, then we can write the ration, $K_{s,\,s\text{-}d}$, as follow:

$$V_s = Y_s \int_s^{n+s} e^{-rt} dt = \frac{Y_s}{r} e^{-rs} (1 - e^{-rn});$$

$$V_{s-d} = Y_{s-d} \int_{s-d}^{n+s-d} e^{-rt} dt = \frac{Y_{s-d}}{r} (1 - e^{-rn}) e^{-r(s-d)};$$

$$K_{s,s-d} = \frac{Y_s}{Y_{s-d}} = \frac{e^{-r(s-d)}}{e^{-rs}} = e^{rd}$$

Now supposed that $s - d = 0,$ then we obtain: $K_{s,0} = \frac{Y_s}{Y_0} = e^{rs}$. Taking the logarithms, we can write the following formula:

$$\ln Y_s = \ln Y_0 + rs.$$

This equation shows that percentage increments in earnings are strictly proportional to the absolute differences in the time spent at school, with the rate of return as the coefficient of proportionality. Precisely the equation shows the logarithm of earnings as a strict linear function of time spent at school.

2) Hours worked of children and schooling trade-off

In recent decade, the study on child labor and its trade-off with human capital formation has been wisely presumed (Basu 1999, Baland and Robinson, 2000; Fan, 2004; Rosati and Tzannatos, 2000; Basu and Tzannatos 2003; Ray and Lancaster, 2004; Patrinos and Psacharopoulos, 1995; Rosati and Rossi, 2004; Heady, 2003), but there is very little data that analyze hours worked of children and its trade-off with schooling outcome. In this section, we reviews and highlight a few existing results that related to our study.

Basu and Van (1998) gave important contribution to the policy analysis on the trade-off between child labor and their schooling status given the role of parents' wage rate the only most important determinant of child activities. In the same setting, Baland and Robinson (2000) use "bequests" constraint of parents and "capital market imperfections" to conclude the rationale decision of parents about the trade-off between child labor and the accumulation of human capital. Patrinos and Psacharopoulos (1995) found that factors predicting an increase in child labor also predict reduced school attendance and increased chance of repetition. Similarly, Heady (2003) use direct measure of reading and mathematics ability to conclude on a negative relationship between child labor and educational achievement in Ghana. However, small increase in child labor may not be trade-off with human capital investment (Fan, 2004) and increases in schooling do not necessarily translate into declines in child labor (Edmonds, 2005) since the positive impact of increased financial resources on education may outweigh the negative impact of reduced time of study. The outcome of child labor has been argued over decades and findings are varied from one to another based on historical, political, social and economical background (Han, 2005).

Unlike the above studies on the trade-off between child labor and their schooling that much of the evidence is on the impact of children's labor participation rates, rather than hours worked by children on child schooling, Akabayashi and Psacharopoulos (1999) use time-log data from a 1993 survey in the United Republic of Tanzania to investigate the relationship between child work and human capital development. It found that factors that increase children's working hours also decrease their hours of study and those hours of work are negatively correlated with studying ability. Ray and Lancaster (2004) concludes in the case study using evidence from Belize, Cambodia, Namibia, Panama, Philippines, Portugal, and Sri Lanka that children's work, even in limited amounts, adversely affects the child's learning as reflected in a reduction in the school attendance rate and in the length of schooling received by the child. However, the paper suggests that if some light work is permitted for children in the ages of 12 and 13 years, as suggested in ILO Convention 138, Art. 7, then it should be accompanied by a campaign to improve adult education levels. Better educated adults will, by ensuring that their children make more efficient use of the non labor time for study, help to reduce the damage done to the child's learning by her work hours. A similar study on child labor supply (Rossati and Rossi, 2003) seems to reject the assumption that a few hours of work only have negligible effects on human capital accumulation in the case of Pakistan and Nicaragua.

III. Theoretical and Empirical Framework

1) Theoretical Model

The conceptual framework of child labor supply and human capital formation trade-off is based on the standard economic assumption that individuals are rational utility-maximizers (see, e.g., Becker, 1965). In this simple theoretical model, we assumed that individual parents will allocate their children' time between working and schooling through their maximization of household utility. The human capital function of the child is assumed to be a function of time spent at school and school's expenditure for which individual household spent on school fee, textbooks, and other extra cost of child-schooling during the a year. All decisions are made by altruistic parents, and children are treated as recipients. We assume that parents' utility function is defined by equation (1):

$$\underset{l_C,x}{Max}\ U(C_p, h_C, a) \qquad \text{Eq (1)}$$

Where $\boldsymbol{C_p}$ is the consumption of parents, $\boldsymbol{h_c}$ is human capital function of the child, and ***a,*** is the household's characteristics. As mentioned, the human capital formation of the child is the function of school's expenditures, ***x***, and total available for study denoting $\boldsymbol{(1\text{-}l_c)}$, which is expressed as:

$$h_C = h_C(x, 1-l_C); \quad \begin{cases} \dfrac{\partial h_C}{\partial x} > 0 \\ \dfrac{\partial h_C}{\partial l_C} < 0 \end{cases} \qquad \text{Eq (2)}$$

And household budget constraint can be expressed as:

$$C_p + x = A + I_p + W_C l_C ;$$

Where ***A*** is household assets, $\boldsymbol{I_p}$ is parents' income and $\boldsymbol{W_c l_c}$ is child's income. We assume that parents' income function $\boldsymbol{I_p(.)}$ is a function of household assets, education, and other household' characteristics. For simplicity we can write the household budget constraint as:

$$C_p = A + I_p(.) + W_C l_C - x \qquad \text{Eq (3)}$$

Parents in each household choose to maximize their utility (1) subject to (2) and (3) which give the following propositions after the first order condition (FOC) is made with respect to $\boldsymbol{l_c}$ and ***x***.

$$\frac{\partial U}{\partial l_C} = \frac{\partial U}{\partial C_p} W_C + \frac{\partial U}{\partial h_C} . \frac{\partial h_C}{\partial (1-l_C)} (-1) = 0 \qquad \text{Eq (4)}$$

$$\frac{\partial U}{\partial x} = \frac{\partial U}{\partial C_p} (-1) + \frac{\partial U}{\partial h_C} . \frac{\partial h_C}{\partial x} = 0 \qquad \text{Eq (5)}$$

The results of FOC in equation (4) and equation (5) give us the following propositions:

Proposition 1: If $\boldsymbol{(1\text{-}l_c)>0}$***, and*** $\boldsymbol{W_c}$ ***is exogenous***

The equation (4) tells us that if $(1-l_c)>0$, the marginal utility of household's consumption is maximized when children are located at school, and at the same time wage rate of children is positive, $W_c>0$.

$$\frac{\partial U}{\partial l_C}=\frac{\partial U}{\partial C_p}W_C=\frac{\partial U}{\partial h_C}.\frac{\partial h_C}{\partial(1-l_C)}(+1) \qquad \text{Eq (6)}$$

This means that each individual household would choose their children to do combined work and study at the same time. Therefore, child wage rate is very important for household who chose to send their children to school as well as working. *This leads to the estimation on the rate of return to human capital formation of child labor*. Most importantly, the equation (6) shows that *increasing child labor will lead to increasing human capital of children as long as* $(1-l_c)>0$, *and* $W_c>0$. Therefore we can summarize the propositions 1 as follow:

- *If* $\frac{\partial U}{\partial C_p}W_C>\frac{\partial U}{\partial h_C}.\frac{\partial h_C}{\partial(1-l_C)}$; *Child labor and schooling at the same time*
- *If* $\frac{\partial U}{\partial C_p}W_C=\frac{\partial U}{\partial h_C}.\frac{\partial h_C}{\partial(1-l_C)}$; *The maximization case where child's working hours is yet to be trade-off with child's schooling hours.*
- *If* $\frac{\partial U}{\partial C_p}W_C<\frac{\partial U}{\partial h_C}.\frac{\partial h_C}{\partial(1-l_C)}$; *Child's working hours is negatively correlated with child's schooling hours.*

However, we shall note that since W_c is exogenous, there happened sometime that $W_c=0$, then marginal utility of child labor's hours is totally negative relationship with child's schooling hours.

$$\frac{\partial U}{\partial l_C}=\frac{\partial U}{\partial h_C}.\frac{\partial h_C}{\partial(1-l_C)}(-1) \qquad \text{Eq (7)}$$

This means that some households would prefer to send their children to school only if they value the child labor is bad for their children human capital formation.

Proposition 2: If $(1-l_c)=0$, *and* W_c *is exogenous*

In this proposition, it is clearly that households would locate their children in the labor market only. In this case, it is very serious for the future human capital formation since society are full of child labor, thus leads to low human capital stock in the future. Therefore, appropriate policy must be introduced immediately to avoid this kind of hazard situation.

2) Empirical Model

2-A) Rate of Returns to Human Capital of Child Labor

In the empirical specification of the human capital earning function, Mincer (1974) noticed that there is less of an interaction, if any, between experience and schooling and than between age and schooling. Experience profiles of log earning are much more nearly parallel than age profiles. If so, in an earning function in which earnings are logarithmic, years of work experience shall be enter additively and in arithmetical form. The experience term is not linear but concave. Therefore, the earning function is:

$$\ln E_i = \ln E_s + \beta_1 t_i - \beta_2 t_i^{\,2} + \beta_3 Ch_i + \beta_4 Z_i + U \qquad ; \quad i \in \{1,2,3....N\} \qquad \text{Eq (1)}$$

where $\boldsymbol{t_i}$ is years of experience, $\boldsymbol{E_s}$ is earning capacity after completion of schooling, and $\boldsymbol{Ch_i}$ and $\boldsymbol{Z}$ are characteristics of the child and community respectively, and $\boldsymbol{U}$ is a disturbance term.

$$\ln E_s = \ln E_0 + rs\ ;$$
$$\ln E_i = \ln E_0 + rs + \beta_1 t_i - \beta_2 t_i^{\,2} + \beta_3 Ch_i + \beta_4 Z_i + U \qquad \text{Eq (2)}$$

If work experience is continuous and starts immediately after completion of schooling, then work experience is equal to current age minus age at completion of schooling. However, we shall note that most child labor are doing combined work and study at the same time.

$$t = (A - s - b)$$

Where $\boldsymbol{A}$ is current age and $\boldsymbol{b}$ is age at the beginning of schooling. Thus the use of age alone instead of experience in the earning function results in the omission of some variables, as can be seen if the expression for $\boldsymbol{t}$, above, is substituted in the function.

2-B) Human Capital Formation of Children and Their Hours Worked Trade-off

This empirical model on human capital formation and hours worked trade-off is derived from the conceptual framework that expresses the negative relationship between human capital formation and hours worked trade-off. We use learning measures such as variable of Schooling Attainment Relative to Age (SAGE index), years of schooling, and school enrolment of the child as dependent variables. We model the learning measure of the child on set of explanatory variables such as age, age^2, education of parents, gender of the child, number of children in the household (age 5-14), number of babies in the household (aged 0-4), poverty status of each household (1 if above poverty line), school's expenditure, and hours worked of the child and its square. The inclusion of child labor hours, $\boldsymbol{H_i}$, and its square is designed to capture the trade-off point between labor hours and learning measure of the child. According to Orazem and Gunnarsson (2003), the child labor hours is likely to be endogenous, thus OLS coefficient estimates may yield biasedness. Therefore, we need to seek for appropriate instrumental variables in the dataset that have high correlation with hour worked of the child, but they are not correlated with the disturbance term of the structural equation. With these notions in mind, we can establish our regression model as follow:

$$L_i = \beta_0 + \beta_1 H_i + \beta_2 H_i^2 + \beta_3 Ch_i + \beta_4 SchEx + \beta_5 X_i + \beta_6 Z_i + U_{i1} \qquad \text{Eq.(1)}$$

$$H_i^* = \delta_0 + \delta_1 Ch_i + \delta_2 SchEx + \delta_3 X_i + \delta_4 IV_i + \delta_5 Z_i + U_{i2} \qquad \text{Eq.(2)}$$

From the structural equation (1), we have variable hours worked of children and its squares which are endogenous with learning measures. Avoiding this endogeneity, we have used instrumental variable ***IV_i*** containing variable such as "access to clean water, access to electricity, assets of TV, radios, cars, mobile phone, boats, motor-boats, tractors, bicycle, and other household assets". Note that the variable ***"SchEx"*** school's expenditure is not available in the dataset of CCLS-2000; however, since this variable is very important for our structural equation, we have obtained the coefficient estimates of from CSES-1999 by regress on sets of child and household characteristics. Because ***"SchEx"*** variable in the structural equation (1) is predicted value from other regression as above mentioned; therefore this variable is considered as independent and uncorrelated with the disturbance term. If ***"SchEx"*** is available from the dataset directly, we believe that this variable would be endogenous with learning measure, and thus will be instrumented as well, in which the estimation of structural equation is obtained through the search for coefficients estimate from set simultaneous equations either through Seemingly Unrelated Regression (SUR) or Three Stages Least Square (3SLS). Additional important household characteristic was added to the model such as poverty status variable rather than household's income because we try to avoid endogeneity of this variable in the structural model. The poverty status was constructed as a dummy variable taking value of 1 if individual household stays above poverty line, and value zero for otherwise. Finally the estimation of the structural equation (1) is simply the reduced form:

$$L_i = \beta_0 + \beta_1 H_i^* + \beta_2 H_i^{*2} + \beta_3 Ch_i + \beta_4 SchEx + \beta_5 X_i + \beta_6 Z_i + U_{i1} \qquad \text{Eq (3)}$$

First Order Condition (FOC) on (3), with respect to hours worked is to check the turning point of the hours worked of the child that beyond this turning point "hours worked threshold" of the child will trade-off with human capital formation. We can derive: $H_i^* = -\dfrac{\beta_3^*}{2\beta_4^*}$ is the trade-off hours worked with human capital formation of the child.

Among the three types of dependent variable of learning measure, there is only variable "school enrolment" is a dummy variable, in which the structural model need to be estimated through Probit model. Now, let ***L*_i*** is the dichotomous variable, take on the value {1} for child enrollment in school, and zero {0} for otherwise. Therefore the specification model is expressed through the latent variable as follow:

$$L_i^* = x_i\beta + U_{i1}$$
$$x_i\beta = \beta_0 + \beta_1 H_i^* + \beta_2 H_i^{*2} + \beta_3 Ch_i + \beta_4 SchEx + \beta_5 X_i + \beta_6 Z_i \qquad \text{Eq (4)}$$
$$U_{i1}|x_i \sim N(0,1)$$

where $x_i\beta$, the aggregated form of the explanatory variables. Therefore, the dependent variable (school enrollment of the child) can be observed as follow:

$$L_i \equiv 1(L_i^* > 0)$$
$$\Pr(Y_i = 1|x_i) = G(\beta_0 + \beta_1 H_i^* + \beta_2 H_i^{*2} + \beta_3 Ch_i + \beta_4 SchEx + \beta_5 X_i + \beta_6 Z_i) \qquad \text{Eq (5)}$$
$$= G(x_i\beta) = \Phi(z)$$

Then the standard normal cumulative distribution function and the standard normal density are:

$$\Phi(z) = \int_{-\infty}^{(z)} \phi(v)dv \quad ; \quad \phi(z) = \frac{1}{\sqrt{2\pi}} \exp[-\frac{(z)^2}{2}]$$

And the likelihood function is:

$$\ln L = \sum_i^s w_i \ln \Phi\{1-(x_i\beta)\} + \sum_{s+1}^n w_i \ln \Phi(x_i\beta) \quad ;$$
$$N = 1..., s, (s+1).....n$$

3) Dataset and Variables

In this study, we have used dataset of Cambodia Child Labor Survey, 2001 for our data analysis on child labor hours and other salient characteristics of the child. The sample size of this dataset covered 12,000 households which were interviewed on the nature of child labor in both economic and non-economic activity. Although the survey covers detailed information of child labor in the age group 5-17 years old for the comparative purpose of child labor in the regions as well as a compliance to ILO convention No.138, but we only consider working children in the age group of 5-14 years to be our sample in this study because the adopted new labor code in 1997 by Cambodia National Assembly sets the minimum age of employment at 15 only (Article 177). We have, therefore, 21153 children breaking down into 10824 male and 10329 female contain in the sample.

Table 1 presents descriptive statistics used in the empirical model. The variable SAGE meaning Index of Schooling Attainment Relative to Age is constructed to be one among the alternative measure of "schooling outcomes". The index is simply derived from the equation that:

$SAGE = \left(\frac{Years\ of\ schooling}{Age - Age\ of\ School\ Entry} \right) \times 100$. The higher of the index is the better of schooling outcomes of children. We also notice that the variable of school's expenditure is not available in the CCLS 2001 dataset. However, we have obtained the predicted value of this variable by using the coefficients estimates from another regression of Cambodia Socio-economic Survey 1999. This technique is very smart and eases our burden on the search of proxy of this variable.

Table 1: Descriptive statistics (sample consists of children aged 5-14)

Variable	Definition	Mean	Std. Dev.
Years of Schooling	Number of Years of Schooling of the Child	2.342079	2.131733
School Enrolment	=1 if Child Enrol in School	.745048	.4358445
SAGE	Index of Schooling Attainment Relative to Age	61.05663	57.14881
Hours worked ENE	Number of Hours Worked of the Child for Economic and Non-economic Activity	13.14201	14.24304
Hour worked E	Number of Hours Worked of the Child for Economic Activity	8.1804	12.46596
School's expenditure	Expenditure on Child's Schooling Such as "School fee…etc" per Child per Year	281.0938	243.6285
Age of child	Age of the Child	9.732331	2.783275
Age of child ^2	Age of the Child Squared	102.4645	53.96477
Female Child	=1 if Female Child; 0 for Male Child	.4882995	.4998749
Father's education	=1 if Father Completed Secondary Education or Higher	.3054886	.4606249
Mother's education	=1 if Mother Completed Secondary Education of Higher	.1692431	.3749754
Poverty status	=1 if Non-poor Household; 0 if Poor (Measure against National Poverty Line)	.8357207	.3705376
Nb. Babies	Number of Babies in Each Household (Age 0-4 Years Old)	.5647426	.738297
Nb. Children	Number of Children in Each Household (Age 5-14 Years Old)	2.908193	1.387854
HH size	Number of People in Each Household	7.42013	3.077704
Gender of HH	=1 if Male Is Household Head; 0 if Female	.8746277	.3311484
Age of HH	Age of the Household Head	44.07611	10.15445
Rural	=1 if Rural; 0 if Urban	.3167872	.4652347

Source: Author's calculation

Total observation: 21153

IV. Results of Empirical Estimates

1) Result Estimates on Rate of Return to Human Capital of Child Labor

Table 2 presents the coefficient estimates of rate of return to human capital of child labor in percentage term, while table 3 presents the same result but in real amounts of return in Riels. Because numbers of hours worked of children could be associated with decisions made by parents as whether their children shall work more hours or not, and that all depending on the wage rate of children. Therefore, we instrumented hours worked of children in the past seven days with appropriate variables such as household and child' characteristics which are not in the predetermined variables. In both table 2 and 3, column (a) presents the coefficients estimates performed by Ordinary Least Square (OLS), and column (b) presents the coefficients estimates performed by Two-stages Least Square (2SLS) under assumption of endogeneity exits in independent variable. Using Hausman-test of endogeneity, we confirmed that we do not have enough evidence to reject our null hypothesis of OLS. Therefore, we tend to use the results of OLS estimates rather than 2SLS estimates.

The results are interesting to our hypothesis of child labor and child schooling at the same time. Because most Cambodian children are likely to combined activity of schooling and working, therefore, their wage rate or earnings are most important to maintaining their household consumption and other security. As the result of child labor, then they are able to be located in school by their parents. Let us find the significance of these results if the education and their experience do have role in determining their earning income. We found that education among the child laborers give higher return around 14 percent to their income equivalence of 0.69 USD per week. This rate of return is high and can be comparable to the rate of return among adult labor of non-farm men in the United Sate of America in 1959 who earned in real amounts of 2,130 USD per average annual earnings (Mincer, 1974). The coefficient of experience of children working indicates that all working children with less than three years experience do not have negative impact on their earnings. At least children with four years of experience will give rate of return around four percent to their income. This finding is somehow the first finding of rate of return to child labor in terms of their education and experience. As adult workers, once they completed their schooling and start working at the first time, the first year of experience does give return to their income in smaller amounts than another year of experience. However, our case is different because children at the 1st year till the 3rd years of experience still have negative impact on their earning power. Unlike adult labor, child laborers need at least 4 years of experience in order to have positive impact on their earnings.

Table 2: Estimates of logarithms earning income of children in the past 7 days

Variable	Logarithms of earning income of children in the past 7 days (OLS)-Column (a)		Logarithms of earning income of children in the past 7 days (2SLS)-Column (b)	
	Coefficient	P-value	Coefficient	P-value
Hours worked in the past 7 days	.0347496	0.000	.064142	0.000
Experience	-.3491728	0.069	-.3194199	0.127
Experience^2	.0547566	0.082	.0509198	0.138
Child's edu	.1430335	0.015	.1596169	0.013
Female child	.0171668	0.934	-.0672683	0.769
Rural	-.242621	0.294	-.1404397	0.581
Constant	7.501179	0.000	6.359728	0.000

Test: Ho: difference in coefficients not systematic

$\chi^2 = 5.87$

P-value =0.4384

Source: Author's calculation

(a)- Report of OLS statistic:

Number of obs = 171 F(6, 164) = 9.09 Prob > F = 0.0000

R-squared = 0.2495 Adj R-squared = 0.2220 Root MSE = 1.3212

(b)- Report of Instrumental Variable statistic:

Number of obs = 171 F(6, 164) = 5.55 Prob > F = 0.0000

R-squared = 0.1093 Adj R-squared = 0.0767 Root MSE = 1.4394

Table 3: Estimates of earning income of children in the past 7 days

Variable	Earning income of children in the past 7 days (OLS) (a)		Earning income of children in the past 7 days (2SLS) (b)	
	Coefficient	P-value	Coefficient	P-value
Hours worked in the past 7 days	781.4379	0.000	1305.759	0.000
Experience	-7256.901	0.092	-6000.92	0.194

Experience^2	1364.971	0.053	1222.826	0.105
Child's edu	2757.119	0.035	2787.5	0.045
Female child	6884.759	0.140	5467.384	0.275
Rural	-5111.397	0.321	-5263.521	0.337
Constant	-9828.935	0.197	-27268.37	0.025

Test: Ho: difference in coefficients not systematic

$\chi^2 = 3.68$

P-value =0.7201

Source: Author's calculation

(a)- Report of OLS statistic:

Number of obs = 171	F(6, 164)	= 10.50	Prob > F= 0.0000
R-squared = 0.2775	Adj R-squared	= 0.2511	Root MSE = 29585

(b)- Report of Instrumental Variable statistic:

Number of obs = 171	F(6, 164)	= 5.57	Prob > F= 0.0000
R-squared = 0.1839	Adj R-squared	= 0.1541	Root MSE = 31442

2) Result Estimates on Hours Worked and Its' Schooling Trade-off

Table 4, 5 and 6 present results of OLS, 2SLS and Maximum Likelihood estimate of children's learning measure "schooling outcomes". Among the dependent variables, we have used child enrolment which is a nonlinear binary response model. All tables in the analysis of hours worked of children and schooling trade-off contained of column (a) and (b) which presents coefficients and/or marginal effects, and P-value of the 2SLS and OLS respectively.

The main objective of our estimates is to find the turning point of hours worked of children with their schooling outcomes. In order to capture the turning point, we allow variable of hours worked of children enter into our structural equation in linear and nonlinear form (square of hours worked of children). Before coming into our main objective of the trade-off between hours supplied of child labor and their human capital formation, we are also interested in interpreting the rest of explanatory variables such as age, age square of the child, a dummy variable taking value of 1 if female child, 0 otherwise, number of babies in the household, number of children in the household, household size, a dummies variable taking value of 1 if father's education or mother's education has higher education than primary school, poverty status taking value of 1 if each individual household is above poverty line, school's expenditure on each child per annum, and a dummy variable taking value of 1 if rural area, 0 otherwise.

Because the results in table 4, 5 and 6 are almost the same among the different kinds of estimations due to the different types of learning measure "schooling outcomes" that used. We, therefore, will interpret the dimensions of correlations in general and detailed interpretation on hours worked and its schooling trade-off in specific. Each table below consists of column (a) and (b) reporting coefficients estimate and its P-value. By using Hausman-test statistics, we found that our hours worked of children are endogenous with structural equation of learning measures. Hence, we tend to use the coefficients estimates from the 2SLS rather than OLS.

The results show that schooling outcomes are a nonlinear function of age. Being a female child reduce the chance of being at school. Children in rural area have disadvantage for their study if compared with urban children, the present large number of household size and with additional number of babies or children tend to reduce the probability of school enrolment. Children of non-poor household tend to be in school rather than working, parents with completion of primary or higher education play significant role in human capital formation of their children. School's expenditure shows strong positive correlation with schooling outcomes of children. School expenditure (school fee, extra-fee, text book, books, pencil, and other school's expense) is necessary for child schooling and it indicates that the larger expense on children's schooling will increase their human capital formation further. Male household head tends to reduce the probability of child's schooling. This indicates that Cambodia's situation of increasing children's education has constrained by old paradigm of parents who are male dominant in the household-decision making.

Finally we come to the most important ceteris paribus of hours worked of children. We find that the turning point or another word trade-off point between hours supplied of child labor and their human capital formation is in general about 3.10 hours. Detailed results of each regression of learning measures with regard to hours worked of children are (i) for the learning measure 'Schooling Attainment Relative to Age: SAGE index', the result shows that children can possibly work up to 15.682 hours per week (5 working days) or 3.136 hours per day without having negative impact on human capital formation. Beyond this threshold hours, child's hours worked will have negative effects on their schooling; (ii) for the learning measure 'Years of Schooling", children can possibly work up to 15.311 hours per week (5 working days) or 3.06 hours per day without having negative impact with human capital formation; and (iii) for the learning measure 'Child's School Enrolment", children can possibly work up to 16.184 hours per week (5 working days) or 3.236 hours per day without having negative impact with human capital formation.

These results somehow provide us confidence that child labor in Cambodia do help boosting their education higher as their income are endogenous in the parents' decision of their schooling. Because of these evolving decisions of each individual households with regard to their utility, the higher wage rate of child labor will prominently support child education and thus have long term impact on their human capital formation. Table 2 of descriptive statistics shows that an average hour worked of children in Cambodia is around 2.30 hours per day which stay yet below the trade-off hours of 3.10 hours.

Table 4: Regression coefficient estimates of 'Schooling Attainment Relative to Age: SAGE index'

Variable	SAGE (2SLS) (a)		SAGE (OLS) (b)	
	Coefficient	P-value	Coefficient	P-value
Hours worked	3.810398	0.000	.4882817	0.000
Hours worked ^2	-.1214891	0.000	-.0134712	0.000
School's expenditure	.0138534	0.000	.0213364	0.000
Age of child	40.26561	0.000	51.23381	0.000
Age of child ^2	-1.67842	0.000	-2.321626	0.000
Female Child	.5888317	0.514	-.1939586	0.776
Father's education	5.549531	0.000	6.451405	0.000
Mother's education	5.59974	0.000	6.260939	0.000
Poverty status	5.048359	0.000	7.293713	0.000
Nb. babies	-3.139797	0.000	-4.480022	0.000
Nb. children	-1.059521	0.039	-2.503401	0.000
HH size	-.0355552	0.895	.2328687	0.239
Gender of HH	-4.517386	0.004	-2.635444	0.019
Age of HH	.1038723	0.052	.1405723	0.001
Rural	-1.68885	0.117	-3.875371	0.000
Constance	-169.3098	0.000	-210.6505	0.000
			Test: Ho: difference in coefficients not systematic	
			$\chi^2 = 93.32$	
			P-value =0.0000	

Source: Author's calculation

(a) Report of goodness of fit of IV (2SLS)

Number of obs = 21153 F(15, 21137) = 464.43 Prob > F = 0.0000
R-squared = 0.2479 Adj R-squared = 0.2474 Root MSE = 49.58

(b) Report of goodness of fit of OLS

Number of obs = 21153 F(15, 21137) = 464.69 Prob > F = 0.0000
R-squared = 0.2480 Adj R-squared = 0.2475 Root MSE = 49.576

Table 5: Regression coefficient estimates of years of child's schooling

Variable	**Years of Child's Schooling (2SLS)**		**Years of Child's Schooling (OLS)**	
	Coefficient	P-value	Coefficient	P-value
Hours worked	.1063454	0.002	.0069966	0.000
Hours worked ^2	-.0034727	0.000	-.0003655	0.000
School's expenditure	.0009415	0.000	.0012866	0.000
Age of child	-.2446881	0.029	.109714	0.000
Age of child ^2	.0474344	0.000	.022574	0.000
Female Child	.1150977	0.000	.0661064	0.000
Father's education	.2836705	0.000	.3318609	0.000
Mother's education	.2182237	0.000	.2477488	0.000
Poverty status	.1862674	0.000	.3139334	0.000
Nb. babies	-.1221705	0.000	-.206469	0.000
Nb. children	-.0422106	0.018	-.1095649	0.000
HH size	-.011032	0.238	.0075814	0.162
Gender of HH	-.2892669	0.000	-.2310626	0.000
Age of HH	.0049743	0.008	.0067386	0.000
Rural	-.0959373	0.011	-.2220468	0.000
Constance	-.1169926	0.796	-1.438611	0.000
			Test: Ho: difference in coefficients not systematic	
			$\chi^2 = 200.13$	
			P-value =0.0000	

Source: Author's calculation

(a) Report of goodness of fit of IV (2SLS)

Number of obs = 21153 F(15, 21137) = 2125.50 Prob > F = 0.0000
R-squared = 0.6013 Adj R-squared = 0.6011 Root MSE = 1.3465

(b) Report of goodness of fit of OLS

Number of obs = 21153 F(15, 21137) = 2073.76 Prob > F = 0.0000
R-squared = 0.5954 Adj R-squared = 0.5951 Root MSE = 1.3564

Table 6: Probit coefficient estimates of school enrolment of children

Variable	**School Enrolment (IV-Probit) (a)**		**School Enrolment (Probit) (b)**	
	Coefficient	P-value	Coefficient	P-value
Hours worked	.0985252	0.000	.0207169	0.000
Hours worked ^2	-.0030438	0.000	-.0006054	0.000
School's expenditure	.0007898	0.000	.0010068	0.000
Age of child	1.2118	0.000	1.455255	0.000
Age of child ^2	-.0486726	0.000	-.0648379	0.000
Female Child	-.0334007	0.133	-.0624023	0.005
Father's education	.2061171	0.000	.243085	0.000
Mother's education	.1795028	0.000	.2079206	0.000
Poverty status	.2826279	0.000	.36099	0.000
Nb. babies	-.0809765	0.000	-.1368654	0.000
Nb. children	-.0616109	0.000	-.1112591	0.000
HH size	-.0026983	0.698	.0103991	0.124
Gender of HH	-.1257405	0.001	-.0814646	0.020
Age of HH	.0039754	0.002	.0050388	0.000
Rural	.0322485	0.208	-.0428556	0.085
Constance	-6.287457	0.000	-7.186792	0.000
			Test: Ho: difference in coefficients not systematic	

	$\chi^2 = 221.84$
	P-value =0.0000

Source: Author's calculation

(a) Report of goodness of fit of probit-IV (2SLS)

Number of obs = 21153 LR chi2(17) = 7591.75 Prob > chi2 = 0.0000
Log likelihood = -8212.9045 Pseudo R2 = 0.3161

(b) Report of goodness of fit of Probit

Number of obs = 21153 LR chi2(15) = 7412.79 Prob > chi2 = 0.0000
Log likelihood = -8302.3822 Pseudo R2 = 0.3086

V. Conclusion and Policy Implications

Only a few studies focuses on the trade-off between hours worked of children with their human capital formation. By careful reviews on these existing literatures, there is yet to develop a theoretical model that can give a proposition of hours worked of children and its schooling outcomes trade-off. Empirical model had been developed to answer this hypothesis, but there is no consistent use of the techniques and assumptions. Lancaster and Ray (2004) employed several techniques by allowing endogeneity of hours worked of children, but still the results among the four different types of schooling outcomes yields inconsistency in terms of direction and correlation of working hours and schooling outcomes, i.e., the regression of child schooling "years of schooling" and "ability to read and write" showed that the more hours children work, the better of schooling outcomes, while the regression of "SAGE" and "school attendance" showed a contrary to the earlier. Therefore, this study aimed to provide consistent estimation with further techniques deployed to the model. This study, off course, is the further extension from Lancaster and Ray (2004) in terms of empirical estimation by providing different flavor in terms of flexibility, for instance., (i) by allowing salient independent variables to enter the schooling outcomes equation, especially the school's expenditure and household poverty status, it helps make the results even more interesting in terms of the calculating U-shape of hours worked and schooling trade-off and its consistency of results among regression results. The school's expenditure is not available in the dataset itself, but we have estimated it from Socio-economic survey with appropriate techniques as explained in the model; (ii) we employ probit model to estimate a binary outcome of school enrolment rather than OLS; (iii) the U-shape calculation turn out different result in terms of the trade-off point.

Besides these mentioned differences, we have estimated the rate of return to child labor because it turn out to be important if child wage rate will endogenously help smoothening children's households' consumptions, and thus leads to the balance decision of child schooling and working at the same time. Now the results under our estimation are summarized as follow:

(i) Even though they are child labor, their education do play significant role in their wage rate determinant. We found that, in general, the rate of return to education of child laborers is about 14 percent considerably high and comparable to the Mincer's model estimation of American adult labor of non-farm men in 1954 (Mincer, 1974). This result indicates the importance of logic behind the household's decision-making of allowing children to carry both work and study at the same time because child's education even though among the child laborers are proved to be significant in generating incomes, thus help parents to investing more on their children's education.

(ii) We found parents' education is very important in the determinant of schooling outcomes of their children. However, this education has a positive impact only for parents whose education had at least completed primary school or higher. This finding provides consistency in the earlier works though the yardstick of measurement may have different techniques such as allowing a unit change in parents' schooling rather that a completion of primary, or secondary school. The similarity to Lancaster and Ray (2004), Rossati and Rossi (2001), Ray (2000), Deb and Rosati (2004), Niels et.al (2002), Bhalotra and Heady (2003), and Khanam (2003), is that there exists positive link between parent's education and the likelihood of a child attending school, and similarly a negative link between parent's education and the likelihood of a child working.

(iii) The probability of children to enroll in school is higher among the non-poor households. However, this does not meant that the poor households did not send their children to school. However, the evidence by Han (2006) and child labor survey report (2002) show that most children in Cambodia like to combine both work and study, which indicated that majority of Cambodia population live around poverty line. This finding is also consistent with the previous theoretical and empirical works such as the work of Basu and Van (1998), Rosati and Rossi (2003), Ray and Lancaster (2004), Basu and Tzannatos (2003), Lee and Westaby (1997), Saupe and Bentley (1994), Kim and Zepeda (2004), Chakraborty and Das (2004), Christiaan and Ravi (1995), Chao and Alper (1998), Duryea and Arends (2001), Basu, Arnab K., and Nancy H. Chau (2003), and Blunch and Verner (2000).

(iv) Generally, hours worked of Cambodian children stay below the threshold level hours of 3.10. This indicates that child labor is rather increase human capital formation of the child in developing economy like Cambodia and it supports our hypothesis in this study. Also, this finding tends to reinforce the theory of Fan (2004), which states that a small increase in child labor may not be trade-off with human capital investment, since the positive impact of increased financial resources on education may outweigh the negative impact of reduced time of study. This is simply that children's labor market participation raises the financial resources and spent on their education.

(v) The presence number of babies and children in each household do have negative impact on schooling outcomes of children. Of course, this is rather simple to understand though we have not included this view in the theoretical model. This indicates that the more babies in the family will reduce time of schooling.

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Annex A: Tables

Table A.1: Matrix of correlation of independent variables of model specification 1

		(1)	(2)	(3)	(4)	(5)	(6)
(1)	Hours worked	1.0000					
(2)	Experience	0.1774	1.0000				
(3)	Experience^2	0.1479	0.9344	1.0000			
(4)	Child's Edu	0.0654	0.2234	0.1788	1.0000		
(5)	Female Child	0.0204	-0.0043	-0.0045	0.0312	1.0000	
(6)	Rural	-0.0038	0.0308	0.0280	-0.1164	-0.0003	1.0000

Table A.2: Matrix of correlation of independent variables of model specification 2

		(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
(1)	Hours worked	1.0000									
(2)	Hours worked ^2	0.8991	1.0000								
(3)	School's expenditure	-0.042	-0.055	1.0000							
(4)	Age of child	0.4909	0.3380	0.0553	1.0000						
(5)	Age of child ^2	0.4876	0.3431	0.0534	0.9914	1.0000					
(6)	Female Child	0.0271	0.0208	0.0035	0.0030	0.0022	1.0000				
(7)	Father's education	-0.067	-0.062	0.3890	-0.034	-0.033	-0.009	1.0000			
(8)	Mother's education	-0.048	-0.045	0.3021	-0.018	-0.017	0.0053	0.3756	1.0000		
(9)	Poverty status	-0.051	-0.048	0.1849	0.0495	0.0481	0.0023	0.1328	0.0957	1.0000	
(10)	Nb. babies	-0.021	-0.007	0.0121	-0.144	-0.144	-0.001	0.0218	-0.008	-0.032	1.0000
(11)	Nb. children	-0.006	0.0082	0.1249	0.0034	0.0004	-0.008	0.0137	-0.021	0.1143	0.1350
(12)	HH size	-0.020	-0.013	0.2501	0.0553	0.0530	-0.014	0.1022	0.0560	0.1995	0.2883
(13)	Gender of HH	-0.024	-0.029	0.3240	-0.038	-0.038	0.0037	0.1860	0.0018	0.0733	0.1028
(14)	Age of HH	0.0412	0.0234	-0.011	0.1852	0.1846	-0.015	-0.033	-0.039	0.1370	-0.178
(15)	Rural	0.0769	0.0671	-0.206	-0.012	-0.012	-0.001	-0.175	-0.149	-0.286	-0.025

Continued:

		(11)	(12)	(13)	(14)	(15)
(11)	Nb. children	1.0000				
(12)	HH size	0.3039	1.0000			
(13)	Gender of HH	0.1389	0.1677	1.0000		
(14)	Age of HH	0.0608	0.3399	-0.089	1.0000	
(15)	Rural	-0.095	-0.186	0.0053	-0.117	1.0000

Note: The coefficients of the matrix correlations indicate that the model is secured from the multi-co linearity. Technically, if coefficient is greater than four and smaller than eight, one can draw assumption that there is weak correlation, but it does not suffer the model. However, if the coefficient is greater than eight, one shall omit that variable or combine both variables into one.