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Graduate School of International  
Cooperation Studies  
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**Hours Supplied of Cambodian Child Labor and School Enrolment:  
Simple Theoretical and Empirical Evidence for Policy Implications**

By

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## Abstract

This paper aims to seek the determinants of hours supplied of child labor in Cambodia. On the basis of simple theoretical and empirical model building from existing literatures, we have estimated the latent decision of parents on hours supplied of their children. Because this hours supplied are censored at zero hours and depend on the enrolment status of each individual child, therefore, we use simultaneous tobit and probit to find the determinants of hours supplied and enrolment of children by the Maximum Likelihood estimate. Given a structure of our model, it allows us to estimate marginal effects of latent status of children which is rarely discussed in literature and it enable us to see dynamics of child labor in Cambodia. We found that only after completing primary education, thus parents' education has impact on the probability of child's schooling and reduce hours worked of the child. Increasing household's income does increase the human capital formation of the child. Importantly child labor (except worse form of child labor) does help increasing human capital formation of the child in the context of developing economy like Cambodia.

*Key words: hours supplied, child labor, human capital formation, Cambodia.*

*JEL Classification Codes: J22, D10, C29, I20*

## I. Introduction

### 1) Background

One of the major constraints in Cambodia's development and its challenges ahead is the lack of human capital development. The enrollment rate has not been picking up fast and education index placed Cambodia at 0.69, the lowest in the region, except Lao People's Democratic Republic that ranks lower at 0.66 (Human Development Report, 2005). A recent SWOT<sup>1</sup> analysis of Cambodia (UNDP-Cambodia, 2005) raises concern about poor education and health as one of the major threat to Cambodia. The present low enrolment rate at lower secondary education as low as 19 percent (MoEYS, 2002) where the proportion of female is only 16 percent if compared to male 21 percent, shows the formidable challenges and difficulties ahead, though the Royal Government of Cambodia is committed to its agenda of Education for All (EFA). If Cambodia is going to achieve its commitment of universal nine-year basic education (CMDG, 2005), there shall be discussions on the issues of child labor, which is seen as a hindering factor to achieving its goal by 2015.

Besides low enrolment, there is a problem of frequent drop out and the survival rate from grade 1-9 is only 33 percent (MoEYS, 2002). The human capital formation of children will be guaranteed unless school infrastructure and teaching staff (Table 1) are equipped. As shown in table 1, almost 10 percent of schools are classified as disadvantage schools which may deny access to many pupils in rural areas. Even though, schools are available, ours data show that most children in Cambodia are used to combine work and study at the same time. Therefore, there must be important factors that make Cambodian's children to carry both work and study. If they are doing so, what the major determinants of their hours worked and their human capital formation are. We will explore this hypothesis through out this study and reflect the results to some stylized fact of the previous studies.

**Table 1:** Number of schools, classes, students, and teaching staff in Cambodia

| Particulars          | Nb. of Schools | Disadv. Schools | Nb. of Classes | Classes in Pagoda | Enrollment |           | Repeaters |         | Teaching Staff |        | Non-Teaching Staff |        |
|----------------------|----------------|-----------------|----------------|-------------------|------------|-----------|-----------|---------|----------------|--------|--------------------|--------|
|                      |                |                 |                |                   | Total      | Girl      | Total     | Girl    | Total          | Female | Total              | Female |
| Whole Kingdom        | 6,449          | 574             | 57,547         | 1,144             | 2,447,235  | 1,083,438 | 536,180   | 230,179 | 62,647         | 22,562 | 10,879             | 2,899  |
| By Area of Location: |                |                 |                |                   |            |           |           |         |                |        |                    |        |

<sup>1</sup> SWOT stands for Strength, Weakness, Opportunities, and Threats.

|                                   |       |     |        |     |           |         |          |         |        |        |       |       |
|-----------------------------------|-------|-----|--------|-----|-----------|---------|----------|---------|--------|--------|-------|-------|
| Urban Area                        | 10,94 | 39  | 16,255 | 211 | 718,415   | 316,044 | 122,967  | 51,158  | 21,337 | 10,246 | 4,954 | 1,935 |
| Rural Area                        | 4,605 | 417 | 37,602 | 831 | 1,576,190 | 699,177 | 371,1556 | 160,221 | 38,727 | 11,965 | 5,720 | 956   |
| Remote Area                       | 750   | 118 | 3,690  | 102 | 152,630   | 68,217  | 41,657   | 18,800  | 2,583  | 351    | 205   | 8     |
| By Type of School & Edu.          |       |     |        |     |           |         |          |         |        |        |       |       |
| Pre-School                        | 806   | 32  | 14,14  | 61  | 45,068    | 22,186  | 0        | 0       | 1,793  | 1,777  | 190   | 173   |
| Primary Sch                       | 51,56 | 532 | 48,370 | 958 | 2,094,000 | 956,084 | 514,363  | 224,892 | 43,530 | 16,148 | 5,870 | 1,284 |
| College                           | 355   | 10  | 3,506  | 125 | 127,247   | 42,186  | 10,102   | 2,412   | 8,114  | 2,015  | 2,221 | 572   |
| Lycee                             | 132   | 0   | 4,257  | 0   | 180,920   | 62,982  | 11,715   | 2,875   | 9,210  | 2,622  | 2,598 | 870   |
| Lower Second                      | 480   | 10  | 5,903  | 125 | 226,057   | 77,714  | 19,327   | 4,729   | 13,769 | 3,820  | 3,813 | 1,109 |
| Upper Second                      | 132   | 0   | 1,860  | 0   | 82,110    | 27,454  | 2,490    | 558     | 3,555  | 817    | 1,006 | 333   |
| Disadvantaged school (All Levels) | 574   | 574 | 3,090  | 73  | 126,019   | 57,370  | 32,745   | 14,582  | 2,773  | 800    | 265   | 41    |

*Source: Education Statistics and Indicators, EMIS Center, Department of Planning, MoEYS, 1999*

Literally, the search for determinants of child labor and its trade-off with human capital formation has been widely discussed both theoretically and empirically (Basu, 1999; Rosati and Tzannatos, 2000; Basu and Tzannatos 2003; Lee and Westaby, 1997; Nielsen, 1998, Kim and Zepeda, 2004, Blunch et al, 2002; Khanam, 2003; Christiaan and Ravi 1995; Chao and Alper, 1998; Duryea and Arends, 2001; Blunch and Verner, 2000). However, almost no attention has been paid to the labor supply in terms of hours worked of children (Rosati and Rossi, 2003). Beside these, it is not clear whether child labor substantially displace schooling because most children in rural setting of developing countries are found in the activity of combined work and study (Beegle et al., 2003).

Building from these existing literatures and with a growing numbers of data of child labor available in Cambodia, especially the national survey on the child labor in 2001, this paper seeks to understand the labor supply of children and its relationship with human capital formation in the context of transitional economy like Cambodia. The pre-assumption of this study is that traditional agriculture based economy like Cambodia must rely heavily on the labor force and with large proportion of population live below poverty line<sup>2</sup>, there must be an inevitable to send children to school alone without combining school and work.

By using the model of simultaneous decision of working hours and school enrollment (Rosati and Rossi, 2003), we try to observe the joint decision of schooling and working and further obtain marginal

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<sup>2</sup> According to CSES 1999, there is 36 percent of population living below national poverty line equivalent of 0.47 USD per person per day.

effects conditioning on the “latent status” of children to attend school or to work. Our empirical findings indicated that: both male and female children tend to work at the younger age regardless they are enrolled or not, children who enroll in secondary school work fewer hours than those children who not enroll, additional number of babies and children in each household increase the probability of children to work more hours, household with more adult-workers tend to reduce the hours worked of children, both mother’s and father’s education have impact on the probability of child’s enrolment and reduce hours worked of the child, except that mother’s education for children who perform combined economic and non-economic activity, household’s income has positive impact on human capital formation and reduces hours worked of children.

This paper and the earlier paper on “underlying root causes of child labor, the case of Cambodia” (Han, 2005), would help stakeholders, especially policy makers in Cambodia to better understand dynamics of child labor in Cambodia. Knowing the causes of child labor is very fundamental to tackle its problem at its root. However, child labor is not an end in itself, since some child labor perform more hours or less than the others. Therefore, the search for determinants of hours worked of children are continued to be strategic in policy formulation toward balancing child labor and their human capital formation.

## **2) Objective of the study**

The right to a nine-year basic education is guaranteed to every Cambodian child in the country’s constitution, however, there continues to be a considerable gap between official policy and reality. Impediments to basic education continue to exist throughout the country, especially in remote areas. The causes underlying this situation can best be understood as a complex social and market interaction (Han, 2005), including teacher shortages, low educational parents, restrictive access due to direct and indirect costs, and other factors.

Without losing our specificity, the objective of this study is to analyze the determinants of school enrolment and hours worked of children by using the model of maximum likelihood of simultaneous estimation of school enrolment decision and hours worked of children.

## **3) Organization of this paper**

This paper is organised as follows. In Section 2 we present literature review on relationship between child labor and/or hours worked of children with their human capital formation and other related determinants used in our below model specifications. In Section 3 we present a simple theoretical and empirical specifications based on existing literatures on the parents’ choice of hours supplied of children and human capital formation. In Section 4 we discuss result estimates on the hours supplied of child labor and school enrolment by using simultaneous tobit and probit function. Section 5 is the conclusion. We present summary and further studies. We have summarised findings and their consistency with previous research. We also proposed some further studies, which are yet to be uncovered

from this particular study. Finally, Annex A contains the table of correlation among covariates used in our specification function.

## **II. Literature Review:**

### **1) Relationship between child labor and/or working hours with schooling**

In recent decade, the study on negative relationship between child labor and human capital formation has been wisely presumed (Basu 1998, 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 the negative relationship between hours worked of children and 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 correlation 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 and Fukui, 2005).

Unlike the above studies on the negative relationship 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 (Rosati 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.

## **2) Social Infrastructure, Parent's Education, Occupations, Age and Gender**

Ranjan Ray (2000) also points out in the result of his studies of empirical evidence for Peru and Pakistan that the provision of good schools can do a lot to reduce child labor in South Asia and to break the strong link between poverty and hours of child labor. In Peru rising men's wages significantly reduce the labor hours of girls, while in Pakistan rising women's wages have a large and significantly positive impact on girls' labor hours. Both countries agree that increasing adult education, especially mothers' education, can positively influence child labor and schooling. The size and significance of the impact of adult education on both child labor and schooling are considerably higher in Pakistan than in Peru. Evidence by Jongsoong Kim and Lydia Zepeda (2004) found that the higher the parents' education level, the higher the probability children will work but the fewer hours they will work. Sonia Bhalotra and Christopher Heady (2003), beside the wealth effect, also found that child age in Pakistan has positive effect on hours worked, which is much larger for boy than for girls, and children of the household head are more likely than other children in the household to be at work on the farm. Moreover, children of the female-headed households in Pakistan work significantly more and the effect is bigger for boys and girls. There is a significant effect of father's secondary education that is restricted to girls. Mothers' education to the level of middle or secondary school has a huge negative effect on child work for both genders, in contrast to Ghana where mothers' education reduces the work of boys but not girls.

Rasheda Khanam (2003), in the study of child labor and school attendance by using Bangladeshee data, indicated a positive gender coefficient that girls are more likely than boys to combine schooling with work in Bangladesh. Furthermore, education of parents significantly increases the probability that school-age child will specialize in study. And parent occupation is very important in determining of children's activity such in this study that if the father employed in a vulnerable occupation, for example, day labor or wage labor, it raises the probability that child will work full time or combine work and study. Niels.H. Blunch., Sudharshan C., Sangeeta G. (2002) also confirmed the positive link between parent's education and the likelihood of a child attending school only, and similarly a negative link between parent's education and the likelihood of a child working only. Similarly, P. Deb and F. Rosati (2004) found in the study about fertility, child labor and schooling that children of better educated parents, especially better educated mother are more likely to attend school. Girls are more likely than boys to work and to be idle. Social infrastructure, especially the increasing primary and secondary school in rural areas does increase school attendance and reduces the probability that a child works or is idle.

### III. Theoretical and Empirical Analysis: Examination of the above Mentioned Hypotheses

#### 1) Theoretical model

This paper is based on earlier work of household production model (Becker, 1965), and the two axioms of Basu and Van (1998) to locate parents' decisions on activities of the child schooling, child working, both, or idle. From this end, the model of hours supplied and school enrolment is fashioned to examine the determinants of children's working hours and its relationship with their human capital formation.

Considering altruistic parents, the resource they inherit and labour earnings are spent either on household's consumption, on the cost rearing children, or on transfers to children of human capital. If a child is sent to school, s/he will be educated and later on work as a skilled labor and this human capital accumulation is an increasing function of schooling. In contrast, if child engages in a labor force only, s/he will earn income of unskilled labor, which has less potential earning in the future. However, schooling of the child is trade-off with child labor. Therefore, the human capital productions function,  $H$ , of the child and current consumption of the household,  $C_1$  (if the child is sent to school), and  $C_2$  (if child work only) are:

$$H = h(h_L, h_S) \quad ; \quad \begin{cases} h(h_L, h_S) > 0 & \text{iff } h_S > 0 \\ h(h_L, h_S) = 0 & \text{iff } h_S = 0 \end{cases} \quad \text{Eq. (1)}$$

$$C_1 = c(y_p, y_c, l_p, l_c) \quad ; \quad \begin{cases} C_1 = y_p + y_c - S_c \\ y_c = \lambda w_A h_L; \quad 0 < \lambda < 1 \end{cases} \quad \text{Eq. (2)}$$

$$C_2 = c(y_p, y_c, l_p, l_c) \quad ; \quad \begin{cases} C_2 = y_p + y_c \\ y_c = \lambda w_A h_L; \quad 0 < \lambda < 1 \end{cases} \quad \text{Eq. (3)}$$

where  $h_L, h_S, y_p, y_c, S_c$ , and  $\lambda w_A$  are the hours worked of the child, school hours of the child, income of parents, income of the child, child wage subject to adult equivalent rate. We assumed that human capital is accumulated by sending children to school. Therefore, the future consumption of child of schooling is  $K+H$ , and future consumption of child labor is  $K$  only, where  $K$  is the exogenous endowment

of human earning capacity, and  $H$  is the attached multiplier acquired through human capital formation of the child.

It is worth noting the two axioms of Basu and Van<sup>3</sup> that the two regimes (C1, C2) can happen only if wage rate of parents above or below certain exogenously fixed subsistence level,  $s$ . Thus, each individual household would make supply of labor (parents, or child or both) to the market if:

$$C_1 \equiv \frac{w_A}{2} \quad \text{if} \quad w_A \geq 2s, \quad H_L = 0 \quad \text{Eq. (4)}$$

$$C_2 \equiv \frac{w_A + \lambda w_A}{2} \quad \text{if} \quad w_A < 2s, \quad H_L > 0 \quad \text{Eq. (5)}$$

Given the rationale behaviour for future returns and considering the absence of formal credit available (imperfection of credit market), the parents maximise their utilities with comparable advantages of sending or not sending children to school, subjected to parents' choice of hours worked of the child are.

$$\text{Max}[\bar{U}_S(h_L), \bar{U}_L(h_L)] \quad \text{Eq. (6)}$$

$$\bar{U}_S = \text{Max}_{h_L} [(y_p + y_c - S_c), (K + H), l_p, l_c, Z_i] \quad \text{Eq. (7)}$$

$$\bar{U}_L = \text{Max}_{h_L} [(y_p + y_c), K, l_p, l_c, Z_i] \quad \text{Eq. (8)}$$

The total derivative with respect to hours worked of the child for equation (7) and (8), give us the following propositions:

$$\frac{d\bar{U}_S}{dh_L} = \frac{\partial \bar{U}_S}{\partial C_1} \frac{dC_1}{dh_L} + \frac{\partial \bar{U}_S}{\partial H} \frac{dH}{dh_L} + \frac{\partial \bar{U}_S}{\partial l_p} \frac{dl_p}{dh_L} + \frac{\partial \bar{U}_S}{\partial l_c} \frac{dl_c}{dh_L} \quad \text{Eq. (9)}$$

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<sup>3</sup> Basu and Van (1998) based the child labor model on the (a) The Luxury Axiom: A family will send the children to the labor market only if the family's income from non-child labor sources drop very low, and (b) The Substitution Axiom: From the firm's point of view, adult labor and child labor are substitutes.

$$\frac{d\bar{U}_L}{dh_L} = \frac{\partial\bar{U}_L}{\partial C_2} \frac{dC_2}{dh_L} + \frac{\partial\bar{U}_L}{\partial l_p} \frac{dl_p}{dh_L} + \frac{\partial\bar{U}_L}{\partial l_c} \frac{dl_c}{dh_L} \quad \text{Eq. (10)}$$

From equation 9 and 10, parents compare the marginal utility under the two regimes and select the one that yield the highest welfare. Assuming that “child’s schooling” is a normal good, meaning that as income or consumption expenditure increase leads to increase on enrolment of the child. Total time of the child is fixed and marginal rate of substitution (MRS) between schooling and working of the child is simply represented by the price ratio of commodity “schooling” and commodity “working”. Divide equation 9 by equation 10, give us the following proposition:

$$\begin{aligned} \frac{d\bar{U}_S}{d\bar{U}_L} &= \frac{\partial\bar{U}_S \partial C_2 (dC_1 \partial H \partial l_p \partial l_c + dH \partial C_1 \partial l_p \partial l_c + dl_p \partial C_1 \partial H \partial l_c + dl_c \partial C_1 \partial H \partial l_p)}{\partial\bar{U}_L \partial C_1 \partial H (dC_2 \partial l_p \partial l_c + dl_p \partial C_2 \partial l_c + dl_c \partial C_2 \partial l_p)} \\ &= \frac{\partial\bar{U}_S \partial C_2 (X)}{\partial\bar{U}_L \partial C_1 \partial H (Y)} \end{aligned} \quad \text{Eq. (11)}$$

From equation 11, it becomes clear that the MRS between child’s schooling and working is the slop of the price ratio between schooling and working. Important finding from equation 11 is the denominator of partial derivative on human capital formation “ $\partial H$ ” which indicates that all parents’ decision on the child’s schooling is very much depending on the “rate of return from human capital of child in the future” if each household could manage the consumption  $C_1 = C_2$ .

Therefore, the optimal decision regarding school enrolment,  $S^* > 0$ , if parents’ choice of marginal utility of child’s schooling is greater than child’s working. Again, from parents to parents, the choice is varying and depending on variable of individual household’s consumption, leisure time, expectation of return from child’s education in the future earnings and other community variables.

## 2) Empirical model

The decision of schooling and working are simultaneous, and the hours worked supplied by children depend also on their enrolment status. Therefore, we model hours worked and enrolment status as following:

$$S_i^* = Z' \gamma + u_i \quad \text{Equation (9)}$$

$$h_i^* = X' \beta + \alpha S_i^* + \varepsilon_i = X' \beta + \alpha (Z' \gamma + u_i) + \varepsilon_i \quad \text{Equation (10)}$$

Supposed that we have  $X''\beta' = X'\beta + \alpha Z'\gamma$  and  $\eta = \gamma u_i + \varepsilon_i$ , we can rewrite the equation (10) of our interest as following:

$$h_i^* = X''\beta' + \eta \quad \text{Equation (11)}$$

In fact, the variable  $S_i^*$  is not observed, but we observe if the individual child enrolls or not in the way that:

$$S=1 \text{ (child is enrolled) if } S_i^* > 0$$

$$S=0 \text{ (child is not enrolled) if } S_i^* \leq 0$$

And the hours worked of the children are censored at zero. Therefore the observed hours worked of the children are described by Tobit model:

$$\begin{aligned} h_i &= h_i^* \quad \text{if } h_i^* > 0 \\ h &= 0 \quad \text{if } h_i^* \leq 0 \end{aligned}$$

So the joint decision of working and studying is described by simultaneous equation model that combine a Tobit and a Probit model with correlated error terms  $\rho$  and  $\varepsilon_i$  and  $u_i$  follow the bivariate normal distribution with zero mean and variance covariance matrix. More specifically, each observation belongs to one of the four possible regimes:

- (a) Working hours>0, enrolled
- (b) Working hours=0, enrolled
- (c) Working hours>0, not enrolled
- (d) Working hours=0, not enrolled

The model is estimated by Maximum Likelihood, where the log likelihood function L, for estimation of the parameters is:

$$L = \sum_{i \in 1} \ln p(S = 1, h_i^* > 0) + \sum_{i \in 2} \ln p(S = 1, h_i^* \leq 0) + \sum_{i \in 3} \ln p(S = 0, h_i^* > 0) + \sum_{i \in 4} \ln p(S = 0, h_i^* \leq 0)$$

Where the probabilities associated to each of the regime are:

$$\Pr(1) = P(h_i^* > 0) * P(S = 1 | h_i^* > 0) = \phi(h_i^* - X''\beta', \sigma) \Theta \left( \frac{Z'\gamma + \rho\sigma^{-1}(h_i^* - X''\beta')}{\sqrt{1-\rho^2}} \right)$$

$$\Pr(2) = P(S = 1, h_i^* \leq 0) = \Theta 2(-X''\beta' / \sigma, Z'\gamma, -\rho)$$

$$\Pr(3) = P(h_i^* > 0) * P(S = 0 | h_i^* > 0) = \phi(h_i^* - X''\beta', \sigma) \left( 1 - \Theta \left( \frac{Z'\gamma + \rho\sigma^{-1}(h_i^* - X''\beta')}{\sqrt{1-\rho^2}} \right) \right)$$

$$\Pr(4) = P(S = 0, h_i^* \leq 0) = \Theta 2(-X''\beta' / \sigma, -Z'\gamma, \rho)$$

Note that  $\phi, \Theta, \Theta 2$  are respectively the univariate density function, univariate cumulative function, and the bivariate cumulative function.

### 3) Data used in this study

Cambodia Child Labor Survey (CCLS) 2001 is a nationwide sample survey designed to collect data on the demographic and socio-economic characteristics of working children with ages 5 to 17 years old. It was undertaken by the National Institute of Statistics under the Ministry of Planning. It has 12,000 sample households selected from 600 sampling units (villages). It is sampled to provide information on child labor forces and research on condition of child labor in the various field of social and economics. Survey estimates were produced for three super strata: 1-Phnom Penh, 2-Other Urban with 11 sub-strata and 3-Rural area with 11 sub-strata. The result of General Population Census of Cambodia 1998 was taken for using as based of sampling design of this survey. The sample for CCLS 2001 was a stratified sample selected in two stages. At the first stage, the village (primary sampling unit or PSU's) were selected from the list of villages for every stratum within the domains listed in order of: province/city, district, commune and village. The method of circular systematic sampling with the probability of inclusion of a village proportional to its size (CSS-PPS) was used to select the villages. At the second stage of selection, for each sample village or PSU, a field listing operation was undertaken in order to sketch out map of PSU, so that we can make sure that all housing units in which the households reside were accounted for. Finally a fix sample size of 20 households was selected in each PSU by using the circular systematic random sampling with a random start (CSS).

This large survey is attempted to provide more reliable quantitative and qualitative data to the Royal Government of Cambodia, International Organization, Non-governmental Organization, and researchers in promoting an understanding the children's work, so that enable them to efficiently provide targeted interventions. CCLS 2001 includes information on three different types of questions which reflected in three separate forms. Form 1 focuses on demographic characteristics of all household member,

migration status of the household in the past 5 years, housing conditions, household's income and expenditures, usual economic activity of household members 5 years old and over during the last 12 months, current economic activity of household members 5 years and over during the past 7 days, earnings and hours of work of household members 5 years old and over who work according to the main activity during the past 7 days and other activities during the past 7 days. Form 2 were addressed by parents/guardians on children activity focusing on the housekeeping activities/ household chores of children 5 to 17 years old, children who were idle during the past 7 days, health and safety of children who had work at any time, children working as employees for someone else for payment in cash or in kind or without payment, and the perception of parents/guardians or other relatives with whom the working children usually reside. Form 3 addressed directly to children 5 to 17 years of age on hours actually worked, economic activities, age started to work for the first time, currently or usually worked, health and safety of working children, working conditions and perception of working children.

Unlike the CSES1999 that provided only narrow definition of child labor-meaning working children in only economic activity, the CCLS2001 enriches us with detailed information on the children performing both in the economic and non-economic activity. As the result, they allow us to analyse deeper into the issue of working children such as the impact of working hours of the child on their human capital formation. Taking into account the adopted new labor code in 1997 by Cambodia National Assembly which sets the minimum age of employment at 15 (Article 177), we consider working children in the age group of 5-14 years to be our sample in this study. We have, therefore, 21153 children breaking down into 10824 male and 10329 female contain in the sample. Table 2 give detail of sample size breaking down by domain. Table 3 presents children enrolment status by age and sex. Table 4 and 5 show hours worked of children by age, sector and sex for two separate category of combined work of economic and non-economic activity, and the economic activity only. Table 6 give the incidence of child labor by age and category.

**Table 2:** Number of villages and Households and Number of CCLS Sampled in 2001

| Domain         | Number of village | Total Number of households | No.of household in Sampled villages | No. villages Sampled CSSPPS | No. households Sampled CSSEQP |        |
|----------------|-------------------|----------------------------|-------------------------------------|-----------------------------|-------------------------------|--------|
|                |                   |                            |                                     |                             | Per village                   | Total  |
| 1- Phnom Penh  | 637               | 173,678                    | 69,554                              | 128                         | 20                            | 2,560  |
| 2- Other Urban | 907               | 224,950                    | 115,961                             | 280                         | 20                            | 5,600  |
| 3- Rural       | 11,862            | 1,790,035                  | 48,064                              | 192                         | 20                            | 3,840  |
| Total          | 13,406            | 2,188,663                  | 233,579                             | 600                         | 20                            | 12,000 |

*Source: MOP/ILO 2002*

**Table 3:** Children enrolment status by age and sex

| Age   | Children enrolled |        | Children not enrolled |        | Total  |
|-------|-------------------|--------|-----------------------|--------|--------|
|       | Male              | Female | Male                  | Female |        |
| 5     | 129               | 115    | 674                   | 660    | 1,578  |
| 6     | 374               | 332    | 614                   | 549    | 1,869  |
| 7     | 640               | 651    | 412                   | 376    | 2,079  |
| 8     | 859               | 785    | 264                   | 266    | 2,174  |
| 9     | 906               | 844    | 135                   | 125    | 2,010  |
| 10    | 1,148             | 1,138  | 129                   | 121    | 2,536  |
| 11    | 986               | 956    | 82                    | 95     | 2,119  |
| 12    | 1,076             | 1,052  | 104                   | 107    | 2,339  |
| 13    | 1,041             | 986    | 132                   | 135    | 2,294  |
| 14    | 958               | 784    | 161                   | 252    | 2,155  |
| Total | 8,117             | 7,643  | 2,707                 | 2,686  | 21,153 |

*Source: Author's calculation*

**Table 4:** Hours worked of children in the past 7 days by age, sector and sex (economic and non-economic activity)

| Age   | Urban    |          |          | Rural    |          |          |
|-------|----------|----------|----------|----------|----------|----------|
|       | Male     | Female   | Total    | Male     | Female   | Total    |
| 5     | 1.985158 | 1.996094 | 1.990485 | 1.92803  | 1.882129 | 1.905123 |
| 6     | 3.120536 | 3.268502 | 3.189146 | 4.31962  | 4.016667 | 4.172078 |
| 7     | 5.428969 | 5.926694 | 5.678695 | 7.179641 | 7.1875   | 7.183385 |
| 8     | 7.941253 | 8.03662  | 7.987127 | 10.21008 | 8.964809 | 9.601719 |
| 9     | 9.699571 | 11.00595 | 10.3399  | 10.52632 | 12.47138 | 11.43036 |
| 10    | 13.08807 | 13.84041 | 13.45871 | 16.73421 | 15.60825 | 16.16537 |
| 11    | 15.08604 | 15.8637  | 15.47155 | 18.93036 | 18.26836 | 18.60168 |
| 12    | 15.97448 | 18.94987 | 17.42036 | 21.40056 | 21.73491 | 21.57317 |
| 13    | 19.74906 | 20.5683  | 20.15321 | 24.28192 | 24.02609 | 24.1595  |
| 14    | 21.01169 | 23.70889 | 22.33532 | 26.6447  | 28.45918 | 27.47434 |
| Total | 11.83085 | 12.98726 | 12.39593 | 14.77606 | 14.72482 | 14.75108 |

*Source: Author's calculation*



**Table 5:** Hours worked of children in the past 7 days by age, sector and sex (economic activity)

| Age   | Urban    |          |          | Rural    |          |          |
|-------|----------|----------|----------|----------|----------|----------|
|       | Male     | Female   | Total    | Male     | Female   | Total    |
| 5     | .8738405 | .7734375 | .8249286 | 1.026515 | .7908745 | .9089184 |
| 6     | 1.464286 | 1.946644 | 1.687949 | 2.772152 | 2.25     | 2.517857 |
| 7     | 2.905293 | 2.757953 | 2.831367 | 4.191617 | 3.453947 | 3.840125 |
| 8     | 4.272846 | 4.205634 | 4.240515 | 6.257703 | 5.510264 | 5.89255  |
| 9     | 5.467811 | 5.595238 | 5.53027  | 7.192983 | 7.89899  | 7.521127 |
| 10    | 7.613155 | 7.681975 | 7.647059 | 11.41842 | 9.427835 | 10.41276 |
| 11    | 8.990127 | 8.816356 | 8.903983 | 12.79387 | 12.38983 | 12.59327 |
| 12    | 9.599028 | 12.04756 | 10.78888 | 14.9888  | 14.3727  | 14.67073 |
| 13    | 12.55207 | 12.59021 | 12.57088 | 18.30319 | 16.28116 | 17.33565 |
| 14    | 14.11948 | 15.90701 | 14.99669 | 18.89971 | 20.67687 | 19.71229 |
| Total | 7.119756 | 7.653498 | 7.38057  | 10.19278 | 9.603306 | 9.905387 |

*Source: Author's calculation*

**Table 6:** Child labor by age and category

| Age   | Child Labor (economic and non-economic activity) |        |        | Child Labor (economic activity) |        |       |
|-------|--|--------|--------|---------------------------------|--------|-------|
|       | Male   | Female | Total  | Male                            | Female | Total |
| 5     | 143  | 152    | 295    | 51                              | 52     | 103   |
| 6     | 316  | 289    | 605    | 121                             | 109    | 230   |
| 7     | 508  | 538    | 1,046  | 214                             | 207    | 421   |
| 8     | 696  | 643    | 1,339  | 327                             | 283    | 610   |
| 9     | 735  | 740    | 1,475  | 342                             | 375    | 717   |
| 10    | 1,059  | 1,078  | 2,137  | 614                             | 594    | 1,208 |
| 11    | 919  | 942    | 1,861  | 574                             | 546    | 1,120 |
| 12    | 1,072  | 1,100  | 2,172  | 674                             | 738    | 1,412 |
| 13    | 1,106  | 1,076  | 2,182  | 778                             | 734    | 1,512 |
| 14    | 1,070  | 1,011  | 2,081  | 760                             | 720    | 1,480 |
| Total | 7,624  | 7,569  | 15,193 | 4,455                           | 4,358  | 8,813 |

*Source: Author's calculation*

#### IV. Results of Empirical Estimates

The Maximum Likelihood results of simultaneous estimates of hours supplied and school enrolment of the children in Cambodia is presented in table 8 and 9. The main equation in our estimates is hours worked of children in the past 7 days. The showed explanatory variables in table 7 for the enrolment equation and main equation<sup>4</sup> are: age, age squared, a dummy variable taking value of one if female, 0 otherwise (female child), child' education (child'edu), number of babies aged 0-4 (Nb. Of babies), number of children aged 5-14 (Nb. Of children), household size (HHsize), a dummies variables taking value of one if the father's education (Father's edu) or mother's education (Mother's edu) are higher than primary school, logarithm of household income (HH Income), and a dummy variable taking value of one if the household resides in a rural area, 0 otherwise (Rural). Because of data availability, it allows us to do estimation of this simultaneous equation in two types of children's category. Table 8 presents the equation of hours worked of children in the past 7 days for the category of children performing economic and non-economic activity<sup>5</sup>. Table 9 presents the equation of hours worked of children in the past 7 days for those who performing economic activity only. For simplicity, we are describing the results of table 8 in details and proceeding to table 9 for highlighting some points in case they are different from the table 8.

We are trying to interpret the result of table 8 of simultaneous equations, so that we can understand the complex dynamics of hours supplied of child labor and their enrolment status. The marginal effects on the latent status of children (enrol or not; working or not) are very important because they give us information on the effects of exogenous variables differentiated by latent group of children. According to Rosati and Rossi (2003), this kind of techniques is rarely discussed in the literature, and in fact, they are very useful for policy intervention based on the selected groups. The coefficients and marginal effects

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<sup>4</sup> The main equation is hours worked of children in the past 7 days. As usual, the explanatory variables enter into this equation includes all variable in the enrolment equation plus "enrolment variable" itself. However, we do not show the coefficient of enrolment variable in the main equation because we are interested in the marginal effect conditioning on children enrolls or not.

<sup>5</sup> Note that children in the category of hours worked in (economic and non-economic activity) are obtained from the sum of hours worked of children in the economic activity and non-economic activity. As usual the non-economic activity is referred to household chores.

conditioning on the enrolls or not enrol for hours worked equation, and conditioning on work or not work for enrolment equation are described for the following: the supplies of child labor in terms of hours worked and their enrolment is a non-linear function of age. Most children tend to enrol and work few hours at the younger age regardless of their activities. Once children grow up to 14 years old, they tend to leave school and work more hours, but if some children do not leave school, they tend to reduce hours worked. Being a female child reduces a probability of enrolment regardless of their activities, and increases hours worked even at home or/and outside-work. Children's education has positive impact on enrolment and reduces their hours worked. The presence of a small baby in the household does reduce the probability of child's enrolment, and increase hours worked of the child. Number of children age 5-14 years in the household tend to reduce the probability of enrolment and increase hours worked of children regardless of their activities. Household size has positive impact on enrolment and reduce hours worked of children, which means that increasing household size, especially the adults workforce leads to ease the hours worked of children. Only after completing primary education, thus, father's education tends to reduce the hours worked of children; however, once a child does not enrol in school, he/she would work more hours unlike the one who is enrolled. Mother's education after completing primary education does not have direct impact on hours worked of children, but it has direct impact on the probability of children's enrolment regardless of they work or not. Household's income plays significant role in increasing the probability of child's enrolment and reduces hours worked of the child. Children reside in rural area tend to reduce the probability of enrolment and increase hours worked regardless they are enrol or not enrol.

The results in table 9 does not significantly different from the result in table 8, except, the coefficient on children's education on the hours worked is not significant, indicating that children's education for those who work for economic activity does not have direct impact on their hours worked, but it has impact on probability of enrolment. Importantly, we found that children at the older age up to 14 years old tend to work more hours for economic activity if they are enrolled. This indicated that children do use their income to pay for school or help their family directly.

**Table 7:** Descriptive statistics (sample consists of children aged 5-14)

| <b>Variable</b> | <b>Definition</b>  | <b>Mean</b> | <b>Std. Dev.</b> |
|-----------------|--|-------------|------------------|
| Hours7DENE      | Hours worked of the child in the past 7 days for both economic and non-economic activity | 13.14201    | 14.24304         |
| Hour7DE         | Hours worked of the child in the past 7 days for economic activity                       | 8.1804      | 12.46596         |
| Enrolment       | =1 if child enrolls in school  | .745048     | .4358445         |
| Wage7D          | Wage rate of the child in the past 7 days (Riels)  | 20637.23    | 34419.42         |
| work7DENE       | =1 if child works in the past 7 days for both economic and non-economic activity         | .7182433    | .449866          |
| Ework7DE        | =1 if child works in the past 7 days for economic activity                               | .4166312    | .4930123         |
| Age of child    | Age in year  | 9.732331    | 2.783275         |
| Age of child^2  | Age in year^2  | 102.4645    | 53.96477         |
| Female child    | =1 if child is female  | .4882995    | .4998749         |
| Child's edu     | =1 if child's education higher than primary school                                       | .0212263    | .1441414         |
| Nb. babies      | Number of babies in the household (0-4 years old)  | .5647426    | .738297          |
| Nb. children    | Number of children in the household (5-14 years old)                                     | 2.908193    | 1.387854         |
| HHsize          | Number of household size   | 7.42013     | 3.077704         |
| Father's edu    | =1 if father's education is higher than primary school                                   | .3054886    | .4606249         |
| Mother's edu    | =1 if mother's education is higher than primary school                                   | .1692431    | .3749754         |
| HHincome        | Logarithm of monthly household's income  | 12.45322    | .9290395         |
| Rural           | =1 if rural  | .3167872    | .4652347         |

*Source: Author's calculation*

Total observation: 21153

**Table 8:** Maximum Likelihood estimates of enrolment and hours worked for children performing both economic and non-economic activity

| Variables                 | Enrolment of the Child |         |                         |                             | Hours Worked of the Child<br>(Economic and Non-economic Activity) |         |                             |                                 |
|---------------------------|------------------------|---------|-------------------------|-----------------------------|---|---------|-----------------------------|---------------------------------|
|                           | Coefficient            | P Value | Marginal effect working | Marginal effect not working | Coefficient   | P Value | Total Marginal effect enrol | Total Marginal effect not enrol |
| Age of child              | 1.512756               | 0.000   | .3388652                | .59034                      | 1.52943   | 0.000   | 2.871013                    | 4.019889                        |
| Age of child <sup>2</sup> | -.0682452              | 0.000   | -.0152873               | -.0266321                   | .0548222  | 0.002   | -.0057009                   | -.057530                        |
| Female child              | -.0611975              | 0.005   | -.0137105               | -.0238895                   | .7319274  | 0.000   | .6776282                    | .6311914                        |
| Child's edu               | .4761532               | 0.000   | .0822303                | .1706329                    | -4.482694   | 0.000   | -4.127848                   | -3.67169                        |
| Nb. babies                | -.1534732              | 0.000   | -.0343788               | -.0598916                   | 1.221513  | 0.000   | 1.085406                    | .9688493                        |
| Nb. children              | -.1256018              | 0.000   | -.0281355               | -.049015                    | .4562607  | 0.000   | .3448711                    | .2494817                        |
| HHsize                    | .0261636               | 0.000   | .0058608                | .0102101                    | -.297894  | 0.000   | -.2746909                   | -.254821                        |
| Father's edu              | .3378197               | 0.000   | .0704244                | .1292189                    | -.5482742   | 0.008   | -.2625121                   | .0136013                        |
| Mother's edu              | .2861034               | 0.000   | .0577092                | .1086231                    | -.2286686   | 0.355   | .0082297                    | .2494302                        |
| HHincome                  | .2279942               | 0.000   | .0510719                | .0889728                    | -1.212018   | 0.000   | -1.009822                   | -.836669                        |
| Rural                     | -.0436755              | 0.077   | -.0098667               | -.0170718                   | 1.289882  | 0.000   | 1.250933                    | 1.218076                        |
| Constance                 | -9.598547              | 0.000   |                         |                             | 6.660673  | 0.002   |                             |                                 |

*Source: Author's calculation*

Report of statistics:

Number of observation =21153                      Wald chi2(12) = 7508.25  
 Log likelihood = -91564.693                      Prob > chi2 = 0.0000  
 Sigma error =0.0648527                      (P-value: 0.000)  
 Covariance errors = 0.0281863                      (P-value 0.000)  
 LR test of indep. eqns. (rho = 0):              chi2(1) = 33.06 Prob > chi2 = 0.0000

Note that the dependent variable: hours worked of the child

**Table 9:** Maximum Likelihood estimates of enrolment and hours worked for children performing economic activity

| Variables                 | Enrolment of the Child |         |                         |                             | Hours Worked of the Child<br>(Economic Activity) |         |                             |                                 |
|---------------------------|------------------------|---------|-------------------------|-----------------------------|--|---------|-----------------------------|---------------------------------|
|                           | Coefficient            | P Value | Marginal effect working | Marginal effect not working | Coefficient                                      | P Value | Total Marginal effect enrol | Total Marginal effect not enrol |
| Age of child              | 1.513724               | 0.000   | .3342269                | .4899609                    | .4876301   | 0.143   | 1.50123                     | 2.368528                        |
| Age of child <sup>2</sup> | -.0683164              | 0.000   | .0150841                | .0221126                    | .0738472   | 0.000   | .0281021                    | -.011040                        |
| Female child              | -.0613833              | 0.004   | -.0135587               | -.0198794                   | .1393224   | 0.369   | .0981998                    | .0630604                        |
| Child's edu               | .4774349               | 0.000   | .0809657                | .1293229                    | -4.773113  | 0.000   | -4.50459                    | -4.15929                        |
| Nb. babies                | -.1525225              | 0.000   | .0336766                | .0493683                    | .8754289   | 0.000   | .7732988                    | .6859101                        |
| Nb. children              | -.1241205              | 0.000   | .0274055                | .0401752                    | .5674501   | 0.000   | .4843381                    | .4132225                        |
| HHsize                    | .0259749               | 0.000   | .0057352                | .0084075                    | -.2580058  | 0.000   | -.2406128                   | -.225730                        |
| Father's edu              | .3360751               | 0.000   | .0683056                | .1043201                    | -.6050668  | 0.001   | -.3903613                   | -.183196                        |
| Mother's edu              | .282877                | 0.000   | .0558958                | .0859162                    | -.7350545  | 0.001   | -.558057                    | -.378329                        |
| HHincome                  | .2276711               | 0.000   | .0502693                | .0736924                    | -.9144251  | 0.000   | -.761975                    | -.631529                        |
| Rural                     | -.0459879              | 0.062   | .0102172                | .0149839                    | 1.522545   | 0.000   | 1.491571                    | 1.465484                        |
| Constance                 | -9.598662              | 0.000   |                         |                             | 7.231192   | 0.000   |                             |                                 |

*Source: Author's calculation*

Report of statistics:

Number of observation =21153                      Wald chi2(12) = 4715.37  
 Log likelihood = -89802.402                      Prob > chi2 = 0.0000  
 Sigma error =0.0576161                      (P-value: 0.000)  
 Covariance errors= 0.0261002                      (P-value 0.000)  
 LR test of indep. eqns. (rho = 0):              chi2(1) = 26.70 Prob > chi2 = 0.0000

Note that the dependent variable: hours worked of the child

## V. Conclusion

### 1) Summary

In this paper we have tried to bring an understanding whether child labor in fact has harmful consequence for their human capital formation in the case of developing economy like Cambodia. We also showed in our introduction and literature review that many literatures focuses on the trade-off between child labor and their human capital formation, but almost no attentions has been paid to the hours supplied of child labor. Building from the existing literatures, we have estimated the model of child labor supplies in terms of hours worked in the past 7 days. Because the decision of hours worked is simultaneously related to the decision of schooling, and hours worked itself is censored at 0 hours, then we estimated our model by simultaneous tobit and probit. Our findings feed into existing literatures one way or another as following:

(i) We found that only after completing primary education, thus, mother's and father's education have positive impact on the probability of child's enrolment and reduce the hour worked of the child. This findings somehow support earlier works, for instance, Ray (2000), Deb and Rosati (2004), Niels et.al (2002), Bhalotra and Heady (2003), and Khanam (2003), showed 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.

(ii) We found that household's characteristics, especially income, plays significant role in increasing the probability of child's enrolment and reduce hours worked of the child. 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).

(iii) The presence number of babies and children in each household tend to increase the probability of children to work more hours. However, household with more adult-workers tend to reduce the hours worked of the children. Being a female child tend to reduce the probability of schooling and work more hours. This findings are consistent with previous studies, for instance, Rosati and Rossi (2003), Ray and Lancaster (2004).

(iv) We also found that children at the older age up to 14 years old tend to work more hours for economic activity if they are enrolled, which means that children who combined work and study do use their income to pay for school or help their family directly. This indicates that child labor (except the worse form of child labor) is rather increase human capital formation of the child in developing economy like Cambodia. 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.

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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)    | (7)    | (8)    | (9)    | (10)   | (11)   |
|------|---------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| (1)  | Age of child              | 1.0000 |        |        |        |        |        |        |        |        |        |        |
| (2)  | Age of child <sup>2</sup> | 0.9914 | 1.0000 |        |        |        |        |        |        |        |        |        |
| (3)  | Female child              | 0.0030 | 0.0022 | 1.0000 |        |        |        |        |        |        |        |        |
| (4)  | Child’s edu               | 0.2038 | 0.2255 | -0.001 | 1.0000 |        |        |        |        |        |        |        |
| (5)  | Nb. Babies                | -0.144 | -0.144 | -0.001 | -0.068 | 1.0000 |        |        |        |        |        |        |
| (6)  | Nb. children              | 0.0034 | 0.0004 | -0.008 | -0.028 | 0.1350 | 1.0000 |        |        |        |        |        |
| (7)  | HHsize                    | 0.0553 | 0.0530 | -0.014 | -0.001 | 0.2883 | 0.3039 | 1.0000 |        |        |        |        |
| (8)  | Father’s edu              | -0.034 | -0.033 | -0.009 | 0.0754 | 0.0218 | 0.0137 | 0.1022 | 1.0000 |        |        |        |
| (9)  | Mother’s edu              | -0.018 | -0.017 | 0.0053 | 0.0700 | -0.008 | -0.021 | 0.0560 | 0.3756 | 1.0000 |        |        |
| (10) | HHincome                  | 0.0738 | 0.0735 | 0.0023 | 0.1102 | -0.047 | 0.1309 | 0.2990 | 0.2355 | 0.1866 | 1.0000 |        |
| (11) | Rural                     | -0.012 | -0.012 | -0.001 | -0.048 | -0.025 | -0.095 | -0.186 | -0.175 | -0.149 | -0.392 | 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.*