CHILD LABOR AND FOREST RESOURCE COLLECTION: VARIATION IN INDIVIDUAL'S FERTILITY PREFERENCES IN NEPAL

Prem Bhandari, Sundar. S. Shrestha and Nalini Chhetri[1]

INTRODUCTION

Although fertility transition has already initiated in Nepal, the total fertility rate (TFR) is still high at 4.5 (PRB, 2003). As reducing fertility to a replacement level (2.1 children) remains a high government priority (NPC, 2003), understanding factors governing fertility continues to be of utmost importance. The contribution of children in household production activities is one of the factors that determine fertility behaviors of the adults.

Becker (1981) states that as the cost of children increases the preference for them decreases. This relationship is further explained by the quality-quantity trade-off of children. This trade-off reflects the choice that individuals make between fewer but quality children for higher expected benefits in the long run and more children as labor contributors in the short run. Both expectations are equally important in deciding parents' fertility goals in many developing countries. In this study, we believe that the use of child labor in household production activities such as forest resources collection might have an important effect on fertility behaviors of individuals and could be an important dimension in understanding the relationship between individual fertility behavior and environmental resources consumption.

There have been a limited number of studies at the micro-level examining the relationship between natural resource consumptions and human fertility. These studies have

[1] Prem Bhandari, Doctoral Candidate, Rural Sociology and Demography, E-mail: pbb115@psu.edu. Sundar Shyam Shrestha, Doctoral Candidate, Agricultural, Environmental, and Regional Economics & Demography, E-mail: sss190@psu.edu, both in the Department of Agricultural Economics and Rural Sociology and The Population Research Institute. Nalini Chhetri, Doctoral Candidate, Educational Theory and Policy and Comparative and International Education, Department of Educational Policy Studies, E-mail: nxc178@psu.edu, The Pennsylvania State University, University Park, Pennsylvania.

mainly focused on the "vicious circle" argument that resources scarcity increases human fertility (Filmer and Pritchett, 1997; Loughran and Pritchette, 1997; Biddlecom et al., 2000). The vicious circle argument conceptualizes that as a result of natural resource scarcity, time to collect these resources increases. Such an increase in collection time increases the demand for more labor in a household. Increase in demand for additional labor increases the value of child labor, and ultimately the preferences for more children.

One of the assumptions made by these studies is that child labor is widely used in households that are engaged in natural resources collection. This assumption may be based on the findings that report substantial labor contribution of children in natural resource collection in developing countries (Filmer and Pritchett 1997; Loughran and Pritchette 1997; Kumar and Hotchkiss 1988; Karan and Ishii, 1996; Chitrakar 1990; Bhandari, et al. 1995). However, in this study, we argue that not all households that collect natural resources such as firewood and fodder necessarily utilize child labor. As discussed earlier, some households may prefer to invest in the development of human capital of children (e.g. schooling) rather than using them in household production activities. Therefore, our first argument is that fertility goals of individuals who live in a household that uses child labor in production activities may differ from those who live in a household that does not use such labor.

Women are primarily responsible for performing household activities including the collection of forest resources (Kumar and Hotchkiss 1988; Jackson, 1995; Karan and Ishii, 1996; Chitrakar 1990; Bhandari, et al. 1995). However, men's and children's contribution to these activities is substantial. Specifically, children take part in performing household activities that women are mainly responsible for. Therefore, we expect that females tend to prefer larger family sizes compared to males.

We consider that the child labor use in household production activities and gender are two important dimensions in understanding the relationship between individual's fertility behaviors and natural resources consumption in developing countries. Therefore, in this study, we attempt to answer two questions using data from the Chitwan Valley of Nepal. 1) *Does the use of child labor in forest resources collection, particularly the firewood and the fodder, contribute to individual's fertility preferences?* 2) *Does the use of child labor in collecting these resources shape different fertility preferences of men and women?*

THE FRAMEWORK

Becker (1981) argued that children's contribution to family income by performing household chores, working in a family business or working in the market place increases benefits of children and reduces their raising costs. The labor services provided by children in a household increases their value and hence the desire for additional children.

In a subsistence economy, a household is both a production and a consumption unit. This makes the household production and maintenance a complex system. Child labor is commonly used to perform daily reproduction or maintenance activities including the collection of forest resources such as firewood for energy and fodder for livestock. The use of child labor not only contributes to the production of household goods and services but also substitutes for time of other members of a household who were previously engaged in the household production process. Children's participation in household work, thus, helps release adults from a specific labor and allows them to be involved in other productive activities.

But, there are other households that do not use child labor in household production process. For these households, investing in children's human capital development such as education can be a strategy to obtain long term higher benefits from children. As investment in education is costly, individuals belonging to these households may prefer fewer children. In this context, we argue that individuals belonging to households that use child labor in household production activities particularly for forest resources collection prefer significantly larger family sizes than those belonging to households that do not use them for such purposes.

The next issue we investigate is whether any gender differential in fertility is apparent within and between these two types of households. Mason and Taj, (1987) reported that there may be differences in fertility goals by gender under certain conditions. One of the important conditions is the women's and men's social or economic relationship to children. As the collection of forest resources, firewood and fodder, is the primary responsibility of women, such relationships can be attributed to the issue of labor substitution between adults (men and women) and children. We assume that children's participation in forest resources collection mainly substitutes for females' time. Therefore, we argue that females prefer larger family sizes than males.

THE SETTING

The Western Chitwan Valley, the setting for this study, is situated in the southern plain of Nepal (Figure 1). Before the 1950s, the Valley was mainly inhabited by indigenous Tharu. It was covered with dense forests and was infamous for malarial infestation. After the government's initiation of rehabilitation program during 1950s, the valley has witnessed a rapid inflow of migrants of varied ethnic groups from neighboring districts. Chitwan's central location and

relatively well developed transportation network has been a catalytic force for it becoming a hub for business and tourism. There has been a rapid proliferation of government services, businesses, and wage labor jobs in the area (Shivakoti et al., 1999).

Farming is the main source of livelihood of the people in the valley. Although agriculture is experiencing rapid modernization, it is largely subsistence in nature. A great majority of farmers practice mixed farming with highly integrated crop and livestock production system. The Chitwan Valley Family Study conducted in 1996 indicated that over 80 percent of the households were growing some crops and about three-fourths of them were keeping livestock such as cattle, buffalo, sheep and goats.

Forest is an integral part of the farming household. Firewood for household energy consumption, fodder for livestock feed, and other resources such as timber directly come from the forest. Extraction of forest resources occur mainly from the Royal Chitwan National Park, and the adjoining forests of Barandabar, Kalaban and community forests.

Collection of firewood and fodder demand a substantial amount of time for the households. As markets for household activities like firewood and fodder collection are virtually nonexistent in the valley, most households adopt a sustenance strategy by mobilizing labor from within the households.

Regardless of whether children attend schools or not[2], most school-aged children are likely to be involved in some form of household activities. However, the extent of child labor use varies by households.

[2] Elementary schooling in Nepal is free but not mandatory. Though more children are going to schools, …..not all households are likely to send their children to schools.

DATA

The data used in this study is drawn from the Chitwan Valley Family Study (CVFS) and the Population and Environment Study conducted by Population and Ecology Research Laboratory (PERL) in 1996. The studies were conducted in the Western Chitwan Valley of Nepal. Barber et al. (1997) have described the sampling procedure used for these studies in detail. In brief, information was collected from a total of 1,805 households living in 171 neighborhoods. At the individual level, information was collected from a total of 5,271 individuals aged between 15 and 59 years and their spouses living in the sample households. For this study, we used both individual and household level data.

The unit of analysis in this study is: (i) the currently married individuals of (ii) ages between 15-59 years (iii) with at least one living child, and (iv) living in a household that collected firewood and/ or fodder during the survey year. Within this specification, there are 2,677 individuals who belong to the households that collected firewood. Of this total, 1,211 are males and 1,466 are females. Slightly over 13 percent of the 2,677 individuals belonged to the households that used children for firewood collection. Similarly, a total of 2,733 individuals belonged to the households that kept livestock and collected fodder. Of these, 1,499 are females and 1,234 are males. About 34 percent belonged to households that used children for fodder collection.

MODEL SPECIFICATION

The description of variables included in the model is presented below.

Dependent variable – Individual fertility preference: An ideal family size is the commonly used measure of fertility preference. This type of measure provides fertility preference in terms of integer numbers. It is argued that this measure of fertility preference is the less accurate predictor of subsequent fertility behaviors in that it does not provide the variation in the intensity of desire among those who desire the same number of children (Coombs, 1974; Farooq, 1985; Thompson and Brabdreth, 1995). Moreover, it has a flat modal value of preference function. Hence, we used the Coombs-scaled measure of fertility preference that approximates an ordinal-level measure of fertility preference and provides a unique modal value of preference function.

The Coombs scaled measure of fertility was measured by asking a series of questions. The first question being, "People often do not have exactly the number of children they want to have. If you could have exactly the number of children you want, how many children would you want to have?" After getting the response of this question, further question was asked, "If you could not have ----- (number of children from the above question) children, would you want to have ----- (one number lower than the first response) or ------- (one number higher than the first response)?" Based on the response of the second question, next question was asked "If you could not have ----- (number of children from the second question) children, would you want to have ------ (one number lower than the second response) or ------- (one number higher than the second response)?" The responses thus recorded were converted to the Coombs scale ranging from 1 to 25. The value 1 represents the lower bound of fertility preference and the value 25 represents the upper bound of an individual's fertility preference.

Independent variables - (a) Child labor use in forest resource collection: Our measure of independent variable is whether or not a household used child labor for the collection of firewood and/ or fodder. This variable is dichotomously coded: 1 if a household used child labor in collecting firewood and/or fodder and 0 if otherwise. To examine the independent effect of child labor use on fertility preferences, we have controlled for variables including the effects of adult male and female labor participation in firewood and fodder collection. The participation by male and female in a household is also dichotomously coded as 1 if a household used male or female labor in collecting firewood and/ or fodder and 0 if otherwise.

(b) Gender: Although not conclusive, reproductive goals vary by gender (Mason and Taj, 1987). We expect that the number of children an individual wants is governed by what an individual perceives about the potential benefits and costs of having children. Because of differential gender roles and responsibilities, the costs and benefits of children that a mother perceives can be different than what a father does. Similarly, the services that parents obtain from children can be different when we compare between the mother and father. Therefore, we include gender variable in the model to examine its effect for the preference of number of children. This variable is dichotomously coded as 1 for female and 0 for male.

Controls

Other factors influence an individual's fertility preferences. To net out the effects of the use of child labor and gender on fertility preferences, we have controlled the effects of other individual and household level factors in the analysis. The mechanism of how these variables affect individual fertility goals and their specification is described briefly below.

Age: Age of individual is closely associated with activities such as marriage, divorce, and frequency of intercourse that affect fertility behavior of an individual (Simmons, 1985). Age is one of the important proximate determinants of fertility (Davis and Blake, 1956; Bongaarts, 1978). To a married couple or an individual, increase in age increases the likelihood of an individual in sexual union. Therefore, a positive effect of age on fertility behavior is expected. Since age is highly correlated with the number of children ever born to an individual (parity) we have included only the age variable to address the multicollinearity problem. In this study, we use the age of an individual as measured in years.

Education: Education has a negative association with fertility (Becker, 1981; Easterlin and Crimminis, 1985). Moreover, the studies conducted in the Chitwan Valley setting have also found a negative association between education and fertility preferences (Pearce, 2000; Gajurel, 2001). An individual's education is measured as the number of years of schooling at the time of survey.

Employment: Employment of an individual also influences individual fertility behaviors. The opportunity cost of time of employed individuals, for example, in salaried job is greater than those of unemployed. Therefore, children tend to be costlier for employed individuals than for unemployed. Particular to females, labor force participation is an indicator of status of autonomy that negatively affects fertility (Mason, 1987; Waite and Stolzenberg, 1976). In this study, employment status of an individual is measured on whether or not an individual ever had a salaried job. This variable is dichotomously coded as '1' referring to ever had a salaried job and '0' as 'never'.

Child raising cost: Child raising costs negatively affect fertility behavior of individuals (Becker, 1981; Robinson, 1997). In this study, we have used the perception of individuals about

the cost of raising a child. In the survey, it was measured by asking a question, "Raising children is cheap these days". Responses were recorded as highly agree, agree, disagree and highly disagree. For the purpose of analysis, we recoded this variable as '1' referring to raising children is expensive and '0' if otherwise.

Incidence of child mortality: Child mortality is one of the important issues associated with high fertility in developing countries. Individuals may want to replace a child who has already died or may wish to increase the number of children as future insurance (Preston, 1978). As a result, if an individual has experienced death of a child in his or her life time, we expect that his or her fertility preference should be greater than those who have not experienced any. Acharya (1998) reported a significant and a positive relationship between child mortality and recent fertility in Nepal. In our study, child mortality experienced by an individual herself/himself has been measured as '1' if any child had died in her/his life and '0' if otherwise.

Exposure to mass media: It is reported that exposure to mass media such as listening to family planning messages on radio or TV significantly influenced reproductive behaviors of individuals in Pakistan, India, and Bangladesh (Westoff, 1999; Olenic, 2000). For example, currently married women who were exposed to media were more likely to use contraceptives than those who were not exposed to it. This variable is measured dichotomously as '1' if ever listened to family planning programming on radio and '0' if never listened to it.

Household socio-economic status: Collecting data on socio-economic status particularly income is difficult in many developing countries. In this context, availability of toilet facility at home is also used as a proxy for socio-economic status of a household (Pebley et al., 1996; Montgomery et al., 2000). In the Chitwan Valley, generally, relatively well-off households tend to have such facilities at home. Considering that individuals of higher socio-economic status tend

to have fewer children, individuals living in a household with toilet facility are expected to desire less number of children than individuals of households without toilet facility. This variable is measured by asking a question, "Do you have a toilet?" The response was measured as "1=yes" and "0=no".

Organization of agriculture: In a farming society, the organization of agriculture such as the land ownership and the access to cultivated landholding size influence human fertility (Stokes, 1984, 1995; Stokes and Schutjer, 1984; Stokes et al., 1986; Thomas, 1991; Gajurel, 2001). The land-labor demand hypothesis suggests that households with relatively more access to land require more labor to cultivate the land. Therefore, individuals living in a household with a large amount of cultivated land demand more children. Tuladhar et al., (1982) and Gajurel (2001) also provide evidence of the land-labor demand hypothesis from Nepal. In our analysis, the access to the cultivated landolding is measured in *kattha*, a local unit (30 *kattha* = 1 hectare).

Ethnicity: Previous studies in this same research setting observed a variation in fertility behaviors of individuals by ethnicity (Axinn and Barber, 2001; Pearce, 2000; Biddlecom et al., 2000; and Gajurel, 2001). As used in these studies, we categorize ethnicity into high caste Hindu, low caste Hindu, Newar, Hill Tibeto Burmese, and indigenous Terai or Terai Tibeto-Burmese groups. We treat Terai-Tibeto-Burmese as the reference group.

Proximity to school: Axinn and Barber (2001) have argued that the availability and proximity of schools encourages individuals toward fertility limitation. Households located in closer proximity to schools are more likely to send their children for schooling. Therefore, we expect that greater distance to school is associated with larger family size preferences. This variable is measured in time taken to walk (in minutes) to the nearest school from the neighborhood.

Proximity to urban center: Individuals who live in urban areas have lower fertility than those who live in rural areas (Cochrane, 1985; DHS/Nepal, 2002). We also expect that individuals living in rural areas prefer larger family sizes compared to those who live in urban areas or in market towns. Based on the relative access to market center the study area has been divided into 3 strata, with households located nearest to the market center as stratum 1 and the farthest away as stratum 3. This variable is used as three category dummy variables considering stratum 1 as the reference category.

ANALYTIC STRATEGY

We have analyzed data using descriptive as well as inferential statistical tools. As our dependent variable is continuous we have used the Ordinary Least Square (OLS) technique. We performed two separate sets of analyses using: 1) individuals who belong to the households that collected *firewood*; and 2) individuals that belong to the households that collected *fodder*. Within each set, to examine the gender effect we further disaggregated our analysis among users and non-users of child labor. The three models that we have run for each set is specified below. Model I is represented in the following equation as:

$$Child_i = a_0 + \beta_1 Chlab_i + \beta_2 Fem_i + \alpha_1 Age_i + \alpha_2 Ed_i + \alpha_3 Job_i + \alpha_4 CED_i + \alpha_5 Cost_i + \alpha_6 Land_i + \alpha_7 Toilet_i + \alpha_8 HCH_i + \alpha_9 LCH_i + \alpha_{10} HTB_i + \alpha_{11} Newar_i + \alpha_{12} FL_i + \alpha_{13} ML_i + \alpha_{14} Med_i + \alpha_{15} DSch_i + \alpha_{16} StratII_i + \alpha_{17} StratIII_i + \mu_i$$

i= 1, 2,.. n

Where,

Child = Coombs-scaled value of family size preferences
Chlab= Dummy for child labor user household (Yes =1 and No =0)
Fem = Dummy for gender (Female =1 and male =0)
Age= Age of the individual in years
Ed = Years of schooling of individual in years
Job= Dummy for salaried job (Yes =1 and otherwise =0)
CED = Dummy for child ever died (Yes =1 and No =0)
Cost=Dummy for cost of children (Expensive=1 and Otherwise=0)
Land = Cultivated size of land holding (*kattha*)
Toilet= Dummy for socio-economic status (Yes =1 and No =0)
HCH = Dummy for HCH (Yes =1 and otherwise =0)
LCH= Dummy for LCH (Yes =1 and otherwise =0)
HTB = Dummy for HTB (Yes =1 and otherwise =0)
Newar= Dummy for Newar (Yes =1 and otherwise =0)
FL = Dummy for female labor use (1 if yes and 0 if no)
ML==Dummy for male labor use (Yes =1 and No =0)
Med = Dummy for exposure to media (1 if yes and 0 if no)
DSch= Distance to school in minutes
StratII = Dummy for Stratus-II (Yes =1 and otherwise =0)
StratIII= Dummy for Stratus-III (Yes =1 and otherwise =0)

This model includes both of the independent variables, child labor use and gender. In the model, βs are unknown parameters for independent variables and αs are unknown parameters for independent control variables. μ_i is the error term, which is assumed to be independently and identically distributed with mean zero and constant variance.

In Model II and Model III, the analysis is disaggregated by gender. These models include child labor used as the independent variable. Model II compares the effect of child labor use among females, while Model III compares the effect of child labor use among males. The control variables included in both the models are same.

RESULTS AND DISCUSSION

Firewood and Fodder Collection

Firewood is the primary source of household energy in Nepal. In 1991, Denholm reported that firewood contributed about 95 percent of the cooking energy requirements of households (South Asia Women Studies of Nepal, http://www.lib.washington.edu/Southasia/Women/ nepal.html). A similar observation was found in our study area, the Western Chitwan Valley. Household survey conducted in 1996 showed that of the total 1,805 sample households about 92 percent were currently using firewood for energy. Among them, a large majority of these households (about 82 percent) reported that they partly or wholly collected firewood from the public and private forests and common lands. Among the firewood collecting households, 86 percent used women. The percentage of households with men's and children's participation in firewood collection was respectively 70 percent and 12 percent

Livestock keeping is dependent on forest resources primarily for fodder. According to the same 1996 survey, of the total sample households, three-fourths of them raised livestock. Almost all of these households (98 percent) collected all or a part of the fodder required for their animals from forest and common lands. For fodder collection, the survey documented that over 95 percent of the households used female labor as compared to the 55 percent of the households that used male labor. Child labor was used by about one-thirds of the households. This result also indicates that in both activities, women are the main source of labor followed by men and children.

Uni-variate and Bi-variate Analyses

The descriptive statistics of the variables used in the analysis for firewood and fodder collections are provided in Table 1 and Table 2, respectively. For both firewood and fodder collection activities, in general, individuals living in households that used child labor were older, relatively less educated and relatively more proportion of them had experienced child mortality in their lives as compared to those who had not used child labor. Moreover, relatively less proportion of these individuals were exposed to family planning programming on radio, fewer households had toilet facilities at home, and were from households with a large average size of cultivated land holding. Gender disaggregated analysis showed that women were younger with lower average number of schooling, and relatively less proportion of them were exposed to the family planning program on radio than were men.

(Table 1 and Table 2 about here)

The results from One-way ANOVA show that individuals living in a household that collected forest resources using child labor were found to have significantly larger family size preferences than those who lived in a household that did not use child labor (mean preference in Coombs scale =7.76 vs. 6.93; $p<.001$ for firewood and mean preference in Coombs scale = 7.39 vs. 6.77; $p<.001$ for fodder). By gender, for both of these activities, women preferred slightly larger family size as compared to men (mean preference in Coombs scale =7.16 for women vs. 6.89 for men, $p<.05$ for firewood collection and mean preference in Coombs scale = 7.07 for women vs. 6.86 for women; $p<.05$ for fodder collection).

Multivariate Analysis

Effect of Child Labor Use in Shaping Individual Fertility Preferences

Table 3 and Table 4, provide the unstandardized Ordinary Least Square Regression estimates for predicting the effect of child labor use in firewood and fodder collection on fertility preferences respectively of currently married individuals of age 15-59 years with at least one living children controlling for the effects of other factors.

For both firewood and fodder collection activities, the use of child labor significantly and positively shaped larger family size preferences among individuals who lived in a household that used child labor compared to those who lived in a household that did not use child labor (Model I of Table 3 and Table 4). Compared to individuals who lived in a households that did not use child labor for firewood collection, those who lived in a household that used children in firewood collection had about 0.30 ($p<.05$) points higher level of preference for children in the Coombs scale adjusting for the effects of other factors. Similarly, in fodder collection, net of other factors,

the use of child labor contributed 0.34 ($p<.000$) points higher level of preference for children than those who did not use child labor. The results provide evidence in support of our argument that the individuals who lived in a household that did use child labor for forest resource collections preferred greater number of children than those who lived in a household that did not use child labor for forest resource collection.

(Table 3 and Table 4 about here)

A separate analysis was done by disaggregating gender to examine whether the overall relationship is consistent within the same sex groups. For example, a comparison was made between individuals of the same sex group (between males or between females) belonging to households that used child labor for collecting forest resources versus those who belonging to the households that did not use child labor (Model-II and Model-III in Table 3 and Table 4). This allows us to understand whether the effect of child labor in shaping fertility preferences is consistent among males as well as among females or if it is just a differential effect for males and for females.

The results are interesting and surprising. In Model II, for firewood collection, among the two groups of females, though the effect of child labor use in shaping family size preferences is in expected direction, it is not statistically significant. However, in Model III, the use of child labor significantly and positively contributed to desire for larger family size among males. Males who lived in households that used child labor preferred significantly larger family sizes (0.46 points in Coombs scale; $p<.05$) than males who lived in households that did not. This result indicates that the larger family size desire among individuals who used child labor is particularly

due to the differences in desire for children among males rather than females. From the results, it seems that females' desire for larger family size is mediated by males' labor force participation (.503; p<.000), whereas males' larger family size desire is mediated by females' (.514; p<.05) *as well as* children's participation (.460; p<.05).

For fodder collection, the results of the Model I are consistent with the results of the Model I of firewood collection. However, for other models, the results are in contrast to firewood collection in terms of the significance of the effect of child labor use. The effect of child labor use, among females, was positive and statistically significant. The preference for children by females who lived in households that used child labor was greater by 0.43 points in the Coombs scale (Model –II, Table 4) as compared to the females that did not use child labor, net of other factors. Among males the effect was positive but not statistically significant.

Given the fact that performance of household activities in Chitwan Valley is the responsibility of the women, we expected that child labor mainly substitutes for the labor activities that require her time. Hence females would have a significantly larger fertility preference than those of males. For example, in fodder collection activity, females who lived in a household that collected firewood have a significantly larger family size desire than those who lived in a household that did not use child labor. Results reveal that the effect of child labor has a clear positive effect on an individual's fertility preference. However, the extent to which this relationship holds is dependent upon the types of activities an individual performs, and to the extent child labor is able to substitute for the work of males and females. This suggests the significance of intra-household labor dynamics in shaping individual fertility preferences.

Effect of Gender in Shaping Individual Fertility Preferences

We also examined whether fertility preferences of individuals living in forest resources collecting households varies by gender. Our framework suggests that as firewood and fodder collection activities are the primary responsibilities of females, child labor mainly substitutes for the female labor. Therefore, we expected that in a household that collected forest resources using child labor, females should have a significantly larger family size desire compared to males. However, the results indicate that for both firewood and fodder collection activities, net of other factors, women preferred larger family sizes compared to their male counterparts. But the results are not statistically significant (Model-I, Table 3 and Table 4).

CONCLUSIONS

We investigated the effect of child labor use in forest resources: firewood and fodder collection in shaping individual fertility preferences. We also observed the effect of child labor use on family size desires by disaggregating gender to understand whether the relationship holds true within same sex groups for both males and females. Further, we examined the effect of gender. The findings suggest that net of other factors, (i) individuals living in a household that used child labor in firewood and fodder collection preferred significantly larger family sizes than those who lived in a household that did not use child labor, (ii) males living in a household that used child labor for firewood collection preferred significantly larger family sizes than the males who lived in a household that did not; iii) whereas for fodder collection, contrasting to firewood collection, the effect was significantly different among females but not among males; and (iv) there is no strong effect of gender on family size preferences.

Based on the findings, we conclude that the use of child labor by households for short term benefits seems to be an important factor in determining fertility preferences of individuals of the Chitwan Valley of Nepal. Our findings suggest that in agrarian society where child labor plays an important role in household economy, one of the ways to address high fertility problems may be to reduce their involvement in household activities. Creating an environment for using alternative energy sources and livestock feed may be an important step towards this goal. Similarly, emphasis on children's education might have a considerable contribution to address the problem of high fertility in developing countries.

Further, a comprehensive study addressing the question of why some households use child labor in certain household activities and others do not might provide a better insight into the crux of the fertility problem. Such a study should focus on the intra-household labor dynamics, for example, labor allocation decisions and labor substitution in various activities that seem to have an important effect in shaping family size desires. The data on household labor allocation, including household labor budget for firewood and fodder collection would provide avenues for further analysis of intra- household labor dynamics and fertility preference.

TABLES

Table 1: Descriptive Statistics of Variables Used in Models of Firewood Collection

Variables	Used Child Labor (n=355)		Did not use Child labor (n=2322)		Total (n=2677)	
	Mean	SD	Mean	SD	Mean	SD
Dependent Variable						
Fertility preference (Coombs scale)[#1]	7.76***	3.21	6.93	2.65	7.04	2.75
Independent Variables						
Child labor used (ref=non-use)	1.00	0.00	0.00	0.00	0.13	0.47
Gender (Female=1)	0.53	0.50	0.55	0.50	0.55	0.49
Individual Characteristics						
Age (in years)	39.65	9.36	36.44	10.87	36.86	10.74
Education (number of years of schooling)	2.11	3.47	3.26	4.21	3.11	4.14
Ever had a salaried job (Yes=1)	0.25	0.43	0.28	0.45	0.28	0.49
Child ever died (Yes=1)	0.37	0.48	0.30	0.46	0.31	0.47
Perceived child raising cost (Expensive=1)	0.68	0.47	0.68	0.47	0.68	0.46
Socio-economic status						
Cultivated size of holding (Kattha)	30.42	30.11	26.56	25.59	27.07	26.26
Toilet facility at home (Yes=1)	0.55	0.50	0.64	0.48	0.63	0.48
Ethnicity						
Upper caste Hindu	0.40	0.49	0.60	0.49	0.58	0.49
Lower caste Hindu	0.11	0.31	0.14	0.34	0.13	0.34
Hill Tibetoburmese	0.19	0.39	0.16	0.36	0.16	0.37
Newar	0.04	0.19	0.04	0.21	0.05	0.21
Terai Tibetoburmese	0.36	0.48	0.19	0.39	0.21	0.41
Alternative (adult) labor use						
Female labor (Used =1)	0.90	0.29	0.87	0.34	0.87	0.45
Male labor (Used =1)	0.75	0.43	0.73	0.44	0.73	0.22
Modernization Variables						
Listened to family planning programming (Yes=1)	0.70	0.46	0.77	0.42	0.76	0.42
Distance to school (Minutes)	9.15	6.77	10.00	8.09	9.89	7.93
Proximity to Market Center						
Household in Strata 1	0.22	0.41	0.17	0.37	0.18	0.38
Household in Strata 2	0.37	0.48	0.40	0.49	0.40	0.49
Household in Strata 3	0.41	0.49	0.43	0.50	0.43	0.50

#1: One-way ANOVA result between child labor users and non-users: *** = p<.001; F=28.52

Table 2: Descriptive Statistics of Variables Used in Models of Fodder Collection

Variables	Used Child Labor (n=924)		Did not Use Child Labor (n=1809)		Total (n=2733)	
	Mean	SD	Mean	SD	Mean	SD
Dependent Variable						
Fertility preference (Coombs scale) [#1]	7.39***	2.83	6.77	2.64	6.98	2.72
Independent Variables						
Child labor (Used=1)	1.00	0.00	0.00	0.00	0.34	0.47
Gender (Female=1)	0.54	0.50	0.55	0.50	0.55	0.50
Individual Characteristics						
Age (in years)	38.74	9.02	36.44	11.33	37.22	10.66
Education (number of years of schooling)	2.71	3.90	3.67	4.43	3.34	4.28
Ever had a salaried job (Yes=1)	0.27	0.44	0.28	0.45	0.28	0.45
Child ever died (Yes=1)	0.32	0.47	0.29	0.46	0.30	0.46
Perceived child raising cost (Expensive=1)	0.68	0.47	0.46	0.47	0.68	0.47
Socio-economic status						
Cultivated size of holding (Kattha)	31.83	29.86	27.64	24.06	29.05	26.23
Toilet facility at home (Yes=1)	0.64	0.48	0.69	0.46	0.67	0.47
Ethnicity						
Upper caste Hindu	0.54	0.50	0.64	0.48	0.61	0.49
Lower caste Hindu	0.12	0.33	0.12	0.32	0.12	0.32
Hill Tibetoburmese	0.18	0.39	0.15	0.36	0.16	0.37
Newar	0.05	0.23	0.04	0.20	0.05	0.21
Terai Tibetoburmese	0.22	0.41	0.16	0.37	0.18	0.38
Alternative (adult) labor use						
Female labor (Used =1)	0.94	0.23	0.95	0.22	0.95	0.45
Male labor (Used =1)	0.57	0.50	0.59	0.49	0.58	0.22
Modernization Variables						
Listened to family planning programming (Yes=1)	0.77	0.42	0.79	0.40	0.79	0.41
Distance to school (Minutes)	9.27	8.59	9.75	7.27	9.59	7.74
Proximity to Market Center						
Household in Strata 1	0.17	0.38	0.19	0.40	0.19	0.39
Household in Strata 2	0.40	0.49	0.41	0.49	0.41	0.49
Household in Strata 3	0.43	0.50	0.40	0.48	0.41	0.49

#1: One-way ANOVA result between women and men: *** = p<.001; F=32.64

Table 3. Unstandardized OLS Regression Estimates Predicting the Effect of Child Labor Use in Firewood Collection on the Fertility Preferences of Currently Married Individuals of Age 15-59 Years with at least One Living Child

Variables	Total (N=2677)	Within sex group comparison	
		Female (n=1466)	Male (n=1211)
	Model I	Model II	Model III
Independent Variable			
Child labor use (Used=1)	0.297*	0.149	0.460*
Gender (Female=1)	0.132	-	-
Individual Characteristics			
Age (in Years)	0.051***	0.047***	0.056***
Education (number of years of schooling)	-0.072***	-0.073**	-0.062**
Ever had a salaried job (Yes=1)	-0.100	-0.437	-0.111
Child ever died (Yes=1)	0.307**	0.501**	0.068
Perceived child raising cost (Expensive=1)	-0.184+	-0.124	-0.292+
Socio-economic status			
Cultivated size of holding (Kattha)	0.003	0.005+	0.001
Toilet facility at home (Yes=1)	-0.347**	-0.392*	-0.317+
Ethnicity (Ref=Terai Tibetoburmese)			
Upper caste Hindu	-1.096***	-0.932***	-1.351***
Lower caste Hindu	0.344*	0.096	0.683**
Hill Tibetoburmese	-0.894***	-0.669**	-1.198***
Newar	-1.002***	-0.981**	-1.056**
Alternative (adult) labor use			
Female labor (Used = 1)	0.083	-0.289	0.514*
Male labor (Used = 1)	0.375***	0.503***	0.192
Modernization Variables			
Listened to family planning programming (Yes=1)	-0.265*	-0.229	-0.282
Distance to school (Minutes)	0.009	0.006	0.011
Proximity to Market Center (Ref= Strata 1)			
Household in Strata 2	-0.210	0.018	-0.481*
Household in Strata 3	-0.101	0.023	-0.256
Intercept	6.130***	6.308***	6.124***
Model F	25.802	14.209***	14.194***
Regression Degrees of freedom	19	18	18
Residual Degrees of freedom	2652	1444	1190
Adjusted R-square	15.6%	15.0%	17.7%

*** = p<.001; ** = p<.01; * = p<.05; + = p<.10

Table 4: Unstandardized OLS Regression Estimates Predicting the Effect of Child Labor Use in Fodder Collection on the Fertility Preferences of Currently Married Individuals of Age 15-59 Years with at least One Living Child

Variables	Total (N=2733)	Within sex group comparison	
		Female (n=1499)	Male (n=1234)
	Model I	Model II	Model III
Independent Variable			
Child labor use (Ref=Non-use)	0.339***	0.428**	0.230
Gender (Female=1)	0.097	-	-
Individual Characteristics			
Age (in Years)	0.052***	0.050***	0.057***
Education (number of years of schooling)	-0.052***	-0.054*	-0.039+
Ever had a salaried job (Yes=1)	-0.078	-0.445	-0.029
Child ever died (Yes=1)	0.393***	0.558***	0.138
Perceived child raising cost (Expensive=1)	-0.286**	-0.277*	-0.299+
Socio-economic status			
Cultivated size of holding (Kattha)	0.003	0.006*	0.000
Toilet facility at home (Yes=1)	-0.386***	-0.320*	-0.500**
Ethnicity (Ref=Terai Tibetoburmese)			
Upper caste Hindu	-1.052***	-0.738***	-1.471***
Lower caste Hindu	0.328+	0.041	0.708**
Hill Tibetoburmese	-0.857***	-0.545*	-1.231***
Newar	-1.031***	-0.860**	-1.225**
Alternative (adult) labor use			
Female labor (Used = 1)	0.013	-0.340	0.424
Male labor (Used = 1)	0.185+	0.190	0.167
Modernization Variables			
Listened to family planning programming (Yes=1)	-0.387**	-0.339*	-0.455*
Distance to school (Minutes)	0.010	0.011	0.008
Proximity to Market Center (Ref= Strata 1)			
Household in Strata 2	-0.198	-0.019	-0.423+
Household in Strata 3	-0.127	0.059	-0.370+
Intercept	6.315***	6.214***	6.490***
Model F	24.925***	15.667***	11.869***
Regression Degrees of freedom	19	18	18
Residual Degrees of freedom	2207	1476	1213
Adjusted R-square	14.9%	16.0%	15.0%

*** = p<.001; ** = p<.01; * = p<.05; + = p<.10

REFERENCES

Acharya, Laxmi Bilas. 1998. "Determinants of Fertility in the 1970s and 1990s in Nepal." *Contribution to Nepalese Studies,* 25 (Special Issue): 95-108.

Axinn, William G. and Jennifer S. Barber. 2001. "Mass Education and Fertility Transition." *American Sociological Review,* 66:481-505.

Barber, J. S, G. Shivakoti, W. G. Axinn, and K. Gajurel. 1997. "Sampling Strategies for Rural Settings: A Detailed Example from the Chitwan Valley Family Study, Nepal." *Nepal Population Journal 6: 193-203.*

Becker, Gary S. 1981. A Treatise on the Family. Mass: Harvard University Press.

Bhandari, P., M.R. Kolachchhapati, N.R. Devkota, P. Bhatt, M.Kharel, K. Basnet, M. Sharma and D. Baral. 1996. "Farming-Forestry and Environment: Socio-economic Study of Makalu Barun Conservation Area along Genderlines." A Research Report submitted to the Makalu Barun Conservation Project (MBCP), Kathmandu, Nepal.

Biddlecom, Ann E., William G. Axinn, and Jennifer S. Barber. 2000. Environmental Effects on Reproductive Preferences: A Case Study in Nepal. Paper presented at the Annual Meeting of the Population Association of America, Los Angeles, CA, March 23-25, 2000.

Bongaarts, John. 1978. "A Framework for Analyzing the Proximate Determinants of Fertility." *Population and Development Review,* 4(1):105-132.

Chitrakar, P.L. 1990. *Planning, Agriculture and Farmers: Strategies for Nepal.* Publisher: Mrs. Ganesh Devi Chitrakar, Kathmandu, Nepal.

Cochrane, Susan H. 1983. "Effects of Education and Urbanization on Fertility." In Rodolfo A. Bulatao and Ronald D. Lee (eds.) Determinants of Fertility in Developing Countries. Volume 2 Fertility Regulation and Institutional Influences. New York: Academic Press. Pp. 587-627.

Coombs, Lolagene C. 1974. "The Measurement of Family Size Preferences and Subsequent Fertility." *Demography* 11(4):587-611.

Davis, Kingsley and Judith Blake. 1956. "Social Structure and Fertility: An Analytic Framework." *Economic Development and Cultural Change,* 4 (4):211-235.

DHS. 2002. *Nepal Demographic and Health Survey 2001.* Calverton, Maryland, USA: Family Health Division, Ministry of Health; New Era; and ORC Macro.

Easterlin, Richard S. and Eileen M. Crimmins. 1985. The Fertility Revolution. Chicago, London: The University of Chicago Press.

Farooq, Ghazi M. 1985. "The Definition of Fertility: Measurement Issues." In *Fertility in Developing Countries: An Economic Perspective on Research and Policy Issues* in Ghazi M. Farooq and George B. Simmons (Eds.), New York: St. Martin';s Press. Pp. 125-148

Filmer, Deon and Lant Pritchett. 1997. "Environmental Degradation and the Demand for Children: Searching for the Vicious Circle." *World Bank Policy Research Paper Number 1623.* World Bank. Washington, D.C.

Gajurel, Kishor. 2001. Organization of Agricultural Production and Human Fertility. Unpublished Ph. D. Dissertation, The Pennsylvania State University, Pennsylvania.

Karan, Pradyumna and H. Ishii., 1996. Nepal: A Himalayan Kingdom in Transition. United Nations, University Press.

Kumar, Shubh K. and David Hotchkiss. 1988. *Consequences of Deforestation for Women's Time Allocation, Agricultural Production, and Nutrition in Hill Areas of Nepal.* International Food Policy Research Institute. Research Report 69, Washington, D.C.

Jackson, Cecile. 1995. "Environmental reproduction and gender in the Third World." In Morse, Stephen and Michael Stocking (eds.) People and Environment. University of Columbia, British Columbia: UBC Press. Pp. 109-130.

Jolly, Carole L. 1994. "Four Theories of Population Change and the Environment." *Population and Environment,* 16(1):61-90.

Loughran, David and Lant Pritchett. 1997. "Environmental Scarcity, Resource Collection, and the Demand for Children in Nepal." World Bank.

Mason, K. O. 1987. "The Impact of Women's Social position on Fertility in Developing Countries". *Sociological Forum*, 2:718-745.

Mason, Karen Oppenheim and Taj, Anju Malhotra. 1987. Differences between Women's and Men's Reproductive Goals in Developing Countries." *Population and Development Review,* 13(4):611-638.

Montgomery, Mark R., Michele Gragnolati, Kathleen A. Burke, and Edmundo Paredes. 2000. Measuring Living Standards with Proxy Variables. *Demography,* 37: 155-174.

NPC, 2003. The Tenth Plan: Poverty Reduction Strategy Paper 2—2-2007. Summary. His Majesty's Government of Nepal, National Planning Commission, Kathmandu, Nepal.

Olenic, I. 2000. "Women's Exposure to Mass Media is Linked to Attitudes toward Contraception in Pakistan, India and Bangladesh". *International Family Planning Perspectives,* 26:48-50.

Pearce, Lisa D. 2000. The Multidimensional Impact of Religion on Childbearing Preferences and Behavior in Nepal. Unpublished Ph.D. Dissertation. Pennsylvania State University, USA.

Pebley, Anne R., Noreen Goldman, and German Rodriguez. 1996. Prenatal and delivery care and childhood immunization in Guatemala: Do family and community matter? *Demography 33*: 231-247.

Population Reference Bureau, 2003. 2003 World Population Data Sheet of the Population Reference Bureau. The Population Reference Bureau, Washington, D.C.

Preston, Samuel. 1978. "Introduction." In Samuel Preston (ed.) The Effects of Infant and Child Mortality on Fertility, New York: Academic Press. Pp. 1-18

Robinson, Warren C. 1997. "The Economic Theory of Fertility over Three Decades." *Population Studies* 51:63-74.

Shivakoti, Ganesh P., William G. Axinn, Prem Bhandari and Netra B. Chhetri. 1999. "The Impact of Community Context on Land Use in an Agricultural Society" *Population and Environment* 20(3): 191-213.

Simmons, George B. 1985. "Research on the Determinants of Fertility." In Fertility in Developing Countries: An Economic Perspective on Research and Policy Issues In Ghazi M. Farooq and George B. Simmons (Eds.). New York: St. Martin's Press. Pp. 67-106.

Stokes, C. S. and W. A. Schutjer. 1984. "Access to Land and Fertility in Developing Countries." In Schutjer and Stokes (eds.), *Rural Development and Human Fertility*, New York.

Stokes, C. Shannon, Wayne A. Schutjer and Rodolfo A. Bulatao. 1986. "Is the Relationship Between Landholding and Fertility Spurious? A Response to Cain." *Population Studies,* 40:305-311.

Stokes, Shannon C. 1984. Access to Land and Fertility in Developing Countries. In Wayne A. Schutjer and C. Shannon Stokes (eds.). Rural Development and Human Fertility. New York: Macmillan. Pp. 195-215.

Stokes, Shannon C. 1995. "Explaining the Demographic Transition: Institutional Factors in Fertility Decline." *Rural Sociology*, 60(1):1-22

Thomas, Neil. 1991. "Land, Fertility, and the Population Establishment." *Population Studies,* +- 45:379-397.

Thomson, E. and Y. Brandreth. 1995. "Measuring Fertility Demand." *Demography,* 32:80-90.

Tuladhar, J. M. et al. 1982. "Differential fertility in rural Nepal." *Population Studies,* 36(1):85

Waite, Linda J. and Ross M. Stolzenberg. 1976. "Intended Childbearing and labor force participation of young women: insights from non-recursive models." *Amreican Sociological Review,* 41:235-252.

Westoff, C. F. and Bankole, A. 1999. "Mass Media and Reproductive behavior in Pakistan, India, and Bangladesh, *Demographic and Health Surveys Analytic Report,* Calverton, MD, USA: Macro International, No. 10.

Acknowledgement
We would like to thank Dr. William G. Axinn, Professor of Sociology, University of Michigan for providing the data used in this study. We would also like to thank the Population Research Institute, Pennsylvania State University and the Population Reference Bureau, Washington, D.C. for providing fund to attend the 2004 PAA Meeting in Boston, Massachusetts.

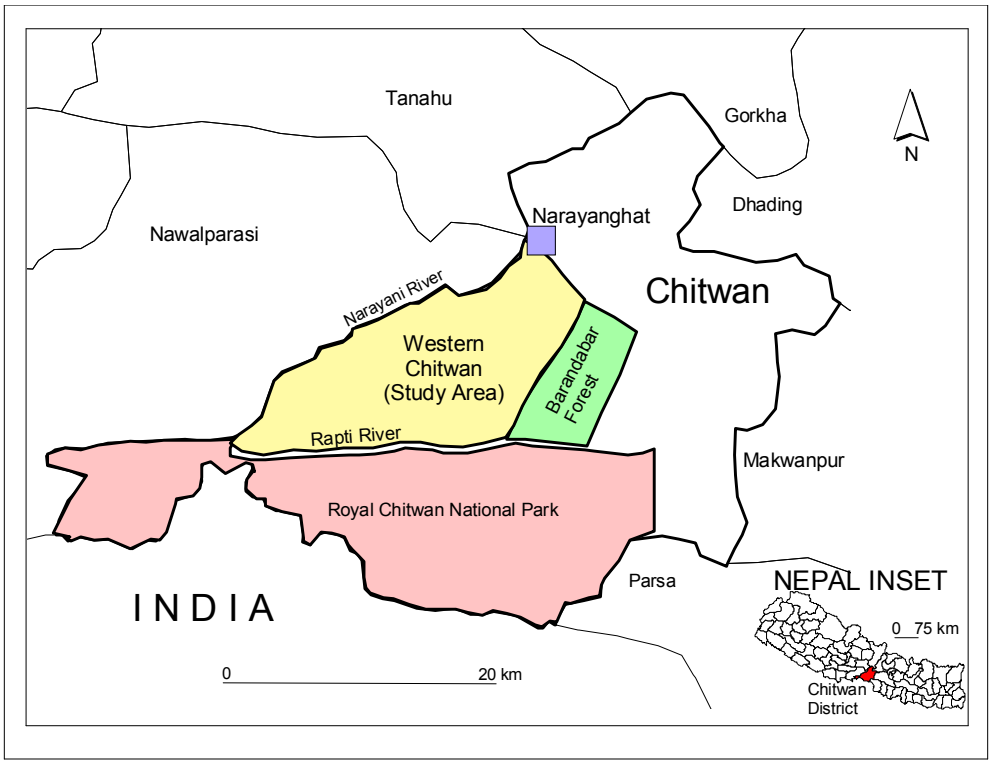

Figure 1: Map of Chitwan Valley Family Study Area in Nepal