ABSTRACT

Title of Document: THE RELATIONSHIP BETWEEN CHILD LABOR AND MICROFINANCE:EVIDENCE FROM RURAL BANGLADESH

Manbar Singh Khadka, Master of Science, 2009

Directed By: Associate Professor, Kenneth L. Leonard, Agricultural and Resource Economics

This paper analyzes the relationship between availability of microfinance and child labor in rural Bangladesh. Using household-level fixed effect in panel data, this paper shows that the stock of women's recent loans negatively impacts child labor. A 10 percent increase in the stock of recent borrowing by women reduces child labor supply by 2.58 percent. By contrast, the paper does not find any significant effect of male credit on child labor.

THE RELATIONSHIP BETWEEN CHILD LABOR AND MICROFINANCE: EVIDENCE FROM RURAL BANGLADESH

By

Manbar Singh Khadka

Thesis submitted to the Faculty of the Graduate School of the
University of Maryland, College Park, in partial fulfillment
of the requirements for the degree of
Master of Science
2009

Advisory Committee:
Associate Professor Kenneth L. Leonard, Chair
Professor Kenneth E. McConnell
Associate Professor Anna Alberini

Table of Contents

I: Introduction

Child labor has persisted as a topical phenomenon for centuries. It existed during Industrial Revolution and continues to exist even today in many parts of the world. Child labor not only 'deprives children of their childhood, their potential and their dignity, but also afflicts them both physically and mentally' (International Labor Organization (ILO), 2004). Although there is a variation in the minimum age for admission to employment and work from country to country, the ILO convention No. 138 has set 15 as the basic minimum age for children to be employed for market wage (ILO, 2004). An estimated 16 percent of 5-14 year-old children are economically active around the world. The incidence of child labor is very high in Sub-Saharan Africa, where the child-labor participation rate is 29 percent (ILO, 2004). The rates are 19 percent and 16 percent in Asia and Pacific and Latin America respectively (ILO, 2004). But since 1950, the trend has been declining worldwide. The decline is more notable in Asia than in Latin America (Basu, 1999). Nevertheless, child labor continues to exist and is a burning issue in many poor and developing nations around the world.

Researchers and economists have argued that one way to eliminate child labor is through the alleviation of poverty in developing nations. The International Program on the Elimination of Child Labor (IPEC) identifies microfinance as an effective means to combat child labor (Doorn and Churchill, 2004). Microfinance has been an

innovative approach in alleviating poverty both at the household level and at the village level (Pitt and Khandker, 1998 and Khandker, 2005). It provides both savings and collateral free group-based credit lending at small scale and medium scale to poor rural households. In Bangladesh and in other parts of the world, 'microfinance operations support mainly the poor and women engaged in informal activities' (Khandker, 2005). A microfinance organization such as Grameen Bank in Bangladesh provides production credit to self-selected groups of five. The bank monitors borrower's activity and maintains a peer pressure among members of the self-formed group for the timely repayment of loans. A loan default by a group member will result into the whole group's ineligibility for future loans (Pitt and Khandker, 1998). The average loan size by Grameen Bank is around $100.[1] The Grameen Bank has served over 7 million borrowers out of which 97 percent were women, and the loan recovery rate for Grameen Bank is approximately 98 percent.[2] Given the relative success of microfinance in poverty alleviation and women's empowerment, an important but under investigated question is if microfinance has a positive impact on child's welfare. Using data from rural Bangladesh, Pitt and Khandker (1998) show that an 'annual household consumption expenditure increases 18 taka for every 100 additional taka borrowed by women from Grameen Bank and two other microcredit programs, compared with 11 taka for men' (Pitt and Khandker, 1998).

[1]For details visit http://www.gdrc.org/icm/grameen-supportgrp.html. Based on 2009 exchange rate, one USD is equivalent to 69.055 taka (taka is the currency of Bangladesh)

[2]For details visit http://www.grameeninfo.org/

Similarly, Pitt, Khandker, and Cartwright (2003) show that 'microcredit program participation leads to women taking a greater role in household decision making, having greater access to financial and economic resources, having greater social networks, having greater bargaining power vis-à-vis their husbands, and having greater freedom of mobility' (Pitt et al., 2003). In yet another study, using the same data set from rural Bangladesh, Pitt, Khandker, Chowdhury, and Millimet (2003) show that 'a 10 percent increase in microcredit provided to females increases the arm circumference of their daughters by 6.3 percent, twice the increase that would be expected from a similar proportionate increase in credit provided to men' (Pitt et al., 2003). Such findings support the claim that microcredit positively impacts child's welfare, thus enhancing child schooling and reducing child labor via income generation and risk management.

But despite such claims and some theoretical analysis, development practitioners know little about the impact of microfinance upon child labor. This is mainly due to paucity of research and ambiguities presented so far on impact analysis. Edmonds (2007) writes that many early studies of child labor used cross-country data from the ILO's LABORSTA database. This database does not have information on hours worked by children within the household (Edmonds, 2007). As such, earlier child labor analyses based on this database have generally understated the extent of child labor (Edmonds, 2007). Hazarika and Sarangi's (2005) empirical study on household access to microcredit and child labor is based on a survey analysis in which children do not work outside household for market wage (Hazarika and Sarangi, 2005). But the reality is such that in many rural areas of the developing

world, poor children labor outside household for market wage. Moreover, Hazarika and Sarangi's (2005) empirical study on household access to microcredit and child labor suffers from time-invariant unobserved heterogeneity, thus biasing the estimation results (Hazarika and Sarangi, 2005).

This paper aims to shed light on the impact of microfinance loans upon child labor using household-level panel data for rural Bangladesh. I first present the OLS regression estimates using cross-sectional data. I then extend my empirical analysis using household-level fixed effect in panel data to assess the actual impact of microcredit on child labor.

The relationship between household access to credit and child labor has been studied, analyzed, and approached with different perspectives by economists. Ranjan (1999) argues that poverty coupled with credit constraints can give rise to child labor in developing nations. She further shows that 'policies such as a child labor ban will further aggravate the welfare of the households intending to send their children to work and hence suggests some alternative policies' (Ranjan, 1999). Baland and Robinson (2000) study the implications of child labor on household's welfare level. They argue that child labor negatively impacts the accumulation of human capital. Child labor is inefficient when parents bestow negative bequests upon children or use them as a substitute for borrowing (Baland and Robinson 2000). Using panel data from Tanzania, Beegle, Dehejia, and Gatti (2006) study the relationship between household income shocks, access to credit, and child labor. They find that child labor significantly increases in households faced with income shocks such as crop loss.

However, households that have an access to credit are reluctant to resort to child labor to cope with income shocks.[3]

In yet another research, using panel data from Vietnam and an instrumental variable strategy, Beegle, Dehejia, and Gatti (2005) evaluate the causal effects of child labor on education, health, and wages. They find that child labor negatively impacts school enrolment. Consequently, children suffer from income loss due to reduced education in their adulthood. Such loss cannot be fully offset by increased labor market experience as a child (Beegle et al., 2005). Hence, the authors put forward two implications to mitigate child labor. First, the households need to have an access to credit. Second, the households need to be forward looking.[4]

Using data from poor rural households in Bolivia, Maldonado and Gonzalez-Vega (2008) study the impact of microfinance on schooling. They examine 'differences in schooling gap between households that have had access to the microfinance institutions for some time versus households that recently joined the program' (Maldonado and Gonzalez-Vega, 2008). Their empirical analysis shows that children from households that have joined microfinance institutions for more than a year have about half a year less schooling gap compared with children from households that have recently joined microfinance institutions (Maldonado and Gonzalez-Vega, 2008).

[3]Emergency loans can act as buffer to the poor and needy households in dire situations such as income shocks.

[4]Households should realize the importance of educating their children today. They need to recognize that the returns to education are much higher.

Using data from rural Malawi, Hazarika and Sarangi (2005) analyze the impact of household access to microcredit upon child work. Their survey analysis 'query respondents over 17 years of age about the maximum amount they might conceivably have borrowed' (Hazarika and Sarangi, 2005). Contrary to popular belief that microcredit positively impacts child's welfare, their empirical analysis shows that an access to microcredit enhances the probability of child work during peak season of the year (Hazarika and Sarangi, 2005).

Although Hazarika and Sarangi's paper is closely related to this paper's subject matter, there are at least three major differences between their work and mine. First, their empirical findings are based upon a cross-sectional data analysis for rural Malawi, whereas this paper's findings are based upon a household-level panel data analysis for rural Bangladesh. Second, their study focuses child work by 7-11 year-old members of the household, whereas this paper analyzes the child work by 10-15 year-old members of the household. Most importantly, the children in their survey analysis do not work outside household for market wage, whereas the survey analysis for Bangladesh has children engaged in both within and outside household work. Their analysis finds significant result between household access to microcredit and child work only for peak season, whereas this paper examines the impact of microcredit on child work for the combined seasons, i.e. not excluding any season of the year in empirical analysis.

II: Theoretical Motivation

While empirical findings show that there is a negative relationship between an access to credit and child labor, Wydick (1999), on the other hand, argues that the relationship can be positive if household capitalization effect dampens family-labor substitution effect. He writes that an increased access to credit enhances the income generating activities of the family. With a boost in the household-level income, the family enjoys more leisure. Subsequently, the family withdraws children from household work and hires outside laborers, thus inducing a negative impact upon child labor. This is the family-labor substitution effect. However, this effect can be seriously negated due to increased 'marginal productivity of family labor as the household enterprise becomes heavily capitalized' (Wydick, 1999). This in turn raises the opportunity cost of schooling. Consequently, the family's investment in schooling decreases and children engage themselves either in farm or non-farm household enterprises. This is the household capitalization effect.

Wydick (1999) proposes a two-period household model of child-schooling investment decision. Wydick (1999) writes that in the first period, the household owns either a farm enterprise or a non-farm enterprise such as a light manufacturing business. This business may possibly include the labor supply of household's children. In the second period, the family retires and the business no longer exists. The family subsequently relies on the income of children as they become adults (Wydick, 1999). He assumes that the family maximizes the utility of income, Y_1 and Y_2 in the first and the second periods respectively.

$$U(Y_1, Y_2) = Y_1 + Y_2$$

subject to:

$$i).Y_1 = \Theta(k, l, 1-h) - wl - rk$$
$$ii).Y_2 = \beta h$$
$$iii).\Psi - wl - rk \geq 0$$

(w=labor wage, r= rental rate of capital, l=hired labor, k=capital)

Wydick (1999) further assumes that the family divides the time endowment of its children between schooling h and family labor (1-h). The family business faces a working capital constraint given by Ψ. β represents the return to schooling realized in the second period and $\Theta(.)$ is 'the production function that is increasing, twice differentiable and concave in all three inputs' (Wydick, 1999). Wydick sets up a maximization problem and derives the following first order conditions:

$$MaxZ = \Theta(k, l, 1-h) - wl - rk + \lambda(\Psi - wl - rk) + \beta h$$
$$\frac{\partial Z}{\partial k} = \Theta_1 - r - \lambda r = 0$$
$$\frac{\partial Z}{\partial l} = \Theta_2 - w - \lambda w = 0$$
$$\frac{\partial Z}{\partial h} = -\Theta_3 + \beta = 0$$
$$\frac{\partial Z}{\partial \lambda} = \Psi - wl - rk = 0$$
$$sign\frac{\partial h}{\partial \Psi} = sign[\Theta_{32}(\Theta_{11} - \Theta_{12}(r/w)) + \Theta_{31}(\Theta_{22}(r/w) - \Theta_{12})]$$

(*Source: Wydick (1999))*
Note: Some notations used in above equations are different from Wydick's (1999) paper.

Wydick writes that the 'magnitude of the family-labor substitution effect is influenced by the value of Θ_{32}, which is the substitutability of hired labor for family labor' (Wydick, 1999). The consequence of the household-enterprise-capitalization

effect is represented by Θ_{31}, which measures the extent of child labor productivity as the household enterprise becomes heavily capitalized (Wydick, 1999).

Hence, following Wydick's theoretical analysis, one can argue that the overall impact of household access to credit on child labor depends upon the net magnitude of labor substitution effect and household capitalization effect. I explore the impact of microcredit upon child work analyzing both the magnitude of labor substitution effect and the household capitalization effect.

III: Econometric Modeling

Previous studies on relationship between microfinance and outcomes of interest (say women's health) have suffered from participant's self-selection into the program and endogeneity of the program placement. The standard empirical strategy and bias that arises from such self-selection and endogeneity can be modeled as:

$$B_{ij} = X_{ij}\alpha_B + V_j\beta_B + \mu_{ij} \quad (1)$$

$$Z_{ij} = X_{ij}\alpha_z + V_j\beta_z + B_{ij}\delta_z + \eta_{ij} \quad (2)$$

(Source: Pitt and Khandker (1998) and Coleman (2000))
Note: Some notations used here are different from original papers.

B_{ij} refers to the borrowing by the *i*th household living in the *j*th village. X_{ij} refers to the household-level characteristics such as age and education of the household head. V_j represents the village-level characteristics such as village electrification, paved road and so forth. μ_{ij} captures the unmeasured determinants of household and village level characteristics that influence the borrowing by a household. Z_{ij} is the outcome of interest (say child labor). δ_z captures the impact of borrowing on child labor and η_{ij} captures the unmeasured determinants of household and village level characteristics that influence the household's consumption level. If μ_{ij} and η_{ij} were uncorrelated, then program impact estimation on outcome of interest will be unbiased and consistent. But microfinance institutions such as Grameen Bank are usually located in areas with high level of poverty incidence (Khandker, 2005). In initiating such programs, nongovernmental organizations (NGO's) and governments in

developing nations choose villages based on their organization and poverty level. Similarly, the participants may self-select in any microfinance institution based on unobserved traits such as entrepreneurial ability and social networking. As such, given the issues of self-selection and endogeneity, μ_{ij} and η_{ij} are very likely to be correlated and hence the program impact estimation on outcome of interest will be biased and inconsistent if OLS is used.

Moffitt (1991) writes that there are three ways to deal with the correlation of μ_{ij} and η_{ij} (Moffitt, 1991). The first approach is the use of an instrumental variable. It is important to identify a set of variables that explains household-level borrowing but does not explain child labor outcome that is conditioned on borrowing. The second approach is the use of panel data set that provides observations on households before and after the availability of treatment for both participants and nonparticipants of microfinance programs. The third approach is the assumption of an error distribution of the outcome variable to be normally distributed (Moffitt, 1991).

Since the household survey analysis in rural Bangladesh is a two-year panel data set, I employ household-level fixed effect in panel data set to assess the impact of microcredit on child labor. The household-level fixed effect not only resolves household-level endogeneity but also resolves village-level endogeneity that can bias the program impact estimation (Khandker, 2005). Hence, this research uses household-level fixed effect in panel data set that controls for time invariant unobserved heterogeneity both at the household-level and at the village-level. The reduced form child labor equation is given by:

$$CL_{ijt} = X_{ijt}\alpha + B_{ijt}\delta + B_{ij(t-1)}\gamma + \eta_{ij} + \varepsilon_{ijt} \quad (3)$$

CL refers to the average hours worked per month by a child in the *i*th household living in the *j*th village in period *t*. X is a vector of household, village, and group level characteristics such as age and gender of household head. α is a vector of unknown parameters to be estimated. δ and γ measure the effects of current and past credit availability. η is the unmeasured determinant of child labor that is time-invariant and fixed within a household level.

The 1991/92 household survey shows that the household borrowing begins from 1984. The 1998/99 household survey has data on loans taken since 1993 until 1999. Since microfinance loans taken span over multiple years, it is important to examine which years' loans impacted the most. As such, I break down the loans into three categories- past, recent, and most recent.[5] Thus, the child labor equation can further be expressed as,

$$CL_{ijt} = X_{ijt}\alpha + RB_{ijt}\beta + MRB_{ijt}\eta + PB_{ij(t-1)}\gamma + \eta_{ij} + \varepsilon_{ijt} \quad (4)$$

RB_{ijt} refers to the stock of recent borrowing by the *i*th household living in the *j*th village in period *t.* β, η, and γ capture the effects of recent borrowing (RB), most recent borrowing (*MRB)* and past borrowing (*PB)* respectively.

[5]In 1991/92, the recent stock of loan comprises loans taken from 1984 to 1989, and the most recent stock of loan comprises loans from 1990 to 1992. The past borrowing is zero in 1991/92 as it is the first data point in the panel (Khandker, 2005). Similarly, in 1998/99, the recent stock of loan is the sum of loans from 1993 to 1997, and the most recent stock of loan comprises loans from 1998 to 1999. The past borrowing in 1998/99 is the cumulative credit in 1991/92.

IV: Data Description and Summary Statistics

This paper employs data from a survey jointly conducted by the Bangladesh Institute of Development Studies (BIDS) and the World Bank in 1991/92. The survey provides data primarily to analyze the impact of three major microcredit programs (Grameen Bank, Bangladesh Rural Advancement Committee (BRAC), and the Rural Development-12 program of the Bangladesh Rural Development Board (BRD)).[6] It covers a total of 1,798 households drawn from 87 villages in 29 thanas.[7] While eight program thanas were drawn randomly from each of those three microfinance project areas, five nonprogram thanas were also drawn randomly from a list of nonprogram thanas.[8] Three villages were then selected randomly from each of those eight program thanas, thus resulting into 72 program villages. Similarly, three villages were selected randomly from each of those five nonprogram thanas, thus resulting into 15 nonprogram villages. Consequently, the survey includes both program and nonprogram villages. In program villages, microfinance institutions have been operating for at least three years (Khandker, 2005). The survey also covers both eligible (targeted) and ineligible (nontargeted) households from both program and nonprogram villages.[9]

[6] (For details, visit: http://go.worldbank.org/E9WWFZIXJ0).

[7] A thana is a sub-district consisting of villages.
(For details, visit: http://go.worldbank.org/E9WWFZIXJ0).

[8] For details, visit:http://go.worldbank.org/E9WWFZIXJ0.

[9] The eligibility criterion to join a microfinance program is based on landholding. Usually all three major credit programs-Grameen Bank, BRAC, and BRD target households that own less than half an acre of land.

Among eligible households, some households join the program while others do not. And there are households that are excluded from program participation based on land based eligibility criteria. Hence, the survey design includes both control groups and treatment groups.

Agriculture is the principal occupation of nearly two-thirds of Bangladeshis. Rice is the main cultivated crop, i.e. sowed and harvested on approximately 10 million hectares (Food and Agricultural Organization (FAO)). The cropping seasons in Bangladesh are classified as *Aman* season (November-February), *Boro* season (March-June), and *Aus* season (July-October). During the *Aman* season, *Aman* rice is cultivated; during the *Boro* season, *Boro* rice, wheat, and pulses are cultivated, and during the *Aus* season, *Aus* rice and jute are cultivated (Zeller et al., 2001). The 1991/92 household survey includes data for these three cropping seasons. The BIDS and the World Bank revisit the survey in 1998/99. In addition to the same households, this survey also adds new households and hence covers a total of 2,599 households.[10] The survey in both the periods provides data for child work from 10 years and above. In order to assess the impact of three major credit programs (Grameen Bank, BRAC, and BRD) on child labor, this paper's cross-sectional data analysis include households that have 10-15 year-old children.[11] However, the panel data analysis tracks households that have 10-15 year-old children in both periods. This restricts the sample size to 578 households in panel data analysis. Summary statistics for cross-sectional and panel data analyses are displayed in Tables 1, 2, and 3.

[10] For details, visit:http://go.worldbank.org/E9WWFZIXJ0

[11] In much child labor literature, 15 is considered as an upper bound.

Table 1: Summary Statistics (1991/92)
Given Sample Means and Standard Deviations in Parentheses

Variables	Participants	Target Nonparticipants	Nontarget Nonparticipants	All Households
Dependent Variable				
Total average hours worked in a month	36.623 (77.162)	45.555 (87.199)	21.698 (57.329)	36.865 (77.916)
Child Attributes				
Male	0.546 (0.498)	0.54 (0.498)	0.54 (0.499)	0.543 (0.498)
Age	12.095 (1.687)	12.172 (1.704)	12.175 (1.767)	12.134 (1.706)
Household Attributes				
Number of members	6.338 (1.958)	6.237 (2.4)	7.342 (2.395)	6.483 (2.223)
Number of 0-9 year-old members	1.623 (1.206)	1.669 (1.389)	1.675 (1.44)	1.647 (1.309)
Number of 10-15 year-old members	1.729 (0.653)	1.698 (0.695)	1.833 (0.739)	1.738 (0.683)
Household head's age in years	43.821 (9.58)	44.676 (9.813)	46.369 (11.736)	44.547 (10.101)
Male Household head	0.947 (0.223)	0.935 (0.245)	0.95 (0.217)	0.944 (0.229)
Landholding (decimals)	105.327 (152.829)	59.445 (103.609)	441.121 (416.029)	
Village Attributes				
Has government food program				0.174 (0.379)
Has non-government food program				0.181 (0.385)
Prevailing daily adult wage rate (taka)				26.933 (6.996)
Key Variables				
Women's recent loans (taka)	2292.26 (4,312.65)	0	0	1,147.96 (3,259.07)
Men's recent loans	1069.63 (3,442.17)	0	0	1,020.54 (2,854.94)
Women's most recent loans	4373.61 (4,941.81)	0	0	2,190.29 (4,123.88)
Men's most recent loans	2037.84 (3,769.88)	0	0	1,020.54 (2,854.94)
Number of observations	629	405	222	1,256

Note: 1 acre equals 100 decimals.
Source: Own calculation based on 1991/92 household survey in Bangladesh.

The summary statistics in Table 1 show some striking results. The total average hours worked in a month by a 10-15 year-old child both within and outside the household in agriculture and non-agriculture sectors are 36.86, which means 9.2 hours per week. This figure signifies that poor rural households in Bangladesh rely on child labor for subsistence. Interestingly, the mean child labor hours for nontargeted and nonparticipating households are 21.69 per month, which are less than that for participating households that have the mean child labor hours of 36.62 per month. This is consistent with the idea that microfinance programs target poor rural households that have very less landholding and no other sources of income. And such households are more likely to rely on child labor to suffice the family needs of food and shelter. For example, the mean landholdings are 105.32 decimals equivalent to 1.05 acres for participating households; whereas the mean landholdings are 441.12 decimals equivalent to 4.41 acres for nontargeted and nonparticipating households (Table 1).

Given the scenario that poor rural women are more disadvantaged than men, one would expect microfinance programs not only to target the poor rural women but also to be placed in areas with high level of poverty incidence. And in such areas, the local governmental bodies and nongovernmental organizations (NGO's) launch food programs that supply food to poor rural women as an incentive for participating in income-generating activities. Table 1 shows that these expectations are borne out in the data. For example, 17.4 percent of the total surveyed villages have a governmental food program and 18.1 percent of the total surveyed villages have a non-governmental food program.

Table 2: Summary Statistics (1998/99) Given Sample Means and SD's in Parentheses

Variables	Participants	Target Nonparticipants	Nontarget Nonparticipants	All Households
Dependent Variable				
Total average hours worked in a month	15.923 (53.176)	20.518 (68.026)	8.267 (43.011)	16.057 (55.291)
Child Attributes				
Male	0.548 (0.497)	0.516 (0.5)	0.483 (0.501)	0.537 (0.498)
Age	12.343 (1.696)	12.291 (1.747)	12.403 (1.722)	12.339 (1.706)
Household Attributes				
Number of members	7.147 (2.481)	6.703 (2.426)	7.951 (3.345)	7.159 (2.573)
Number of 0-9 year-old members	1.38 (1.22)	1.227 (1.209)	1.279 (1.211)	1.345 (1.219)
Number of 10-15 year-old members	1.836 (0.753)	1.633 (0.744)	1.93 (0.863)	1.81 (0.765)
Household head's age in years	47.603 (10.235)	46.053 (10.654)	50.553 (11.587)	47.589 (10.477)
Male Household head	0.912 (0.282)	0.874 (0.331)	0.849 (0.358)	0.9 (0.299)
Landholding (decimals)	75.457 (128.705)	85.882 (154.591)	220.903 (517.067)	89.552 (201.36)
Village Attributes				
Has government food program				0.497 (0.5)
Has non-government food program				0.087 (0.283)
Prevailing daily adult wage rate (taka)				51.453 (13.014)
Key Variables				
Women's recent loans (taka)	12,536.72 (19,641.4)	0	0	1,147.96 (3,259.07)
Men's recent loans	5,540.40 (17,248.8)	0	0	1,020.54 (2,854.94)
Women's most recent loans	7,437.04 (10,790.9)	0	0	2,190.29 (4,123.88)
Men's most recent loans	5,346.06 (18,499.4)	0	0	1,020.54 (2,854.94)
Men's past loans	793.581 (3,656.52)	0	0	591.21 (3,293.459)
Women's past loans	1,641.493 (4,951.46)		0	1,222.89 (4,377.611)
Number of observations	1,636	374	186	2,196

Source: Own calculation based on 1998/99 household survey in Bangladesh.

Table 3: Summary Statistics of Child Labor and Credit Variables (1991/92 base year currency)
Given Sample Means and Standard Deviations in Parentheses

Variables	Participants	Target Nonparticipants	Nontarget Nonparticipants	All Households
1991/92				
Dependent Variable				
Average hours worked in a month per child in a household	36.072 (68.972)	42.428 (74.975)	20.166 (41.976)	35.338 (67.445)
Key Variables (household-level borrowing)				
Women's recent loans (taka)	2,218.95 (4,142,61)	0	0	1,090.28 (3,106.40)
Men's recent loans	1,154.23 (3,738,91)	0	0	567.13 (2,681.42)
Women's most recent loans	4,413.73 (4,950.87)	0	0	2,168.69 (4,110.86)
Men's most recent loans	2,108.8 (3,841,68)	0	0	1,036.16 (2,889.97)
Women's past loans	0	0	0	0
Men's past loans	0	0	0	0
Number of observations	284	191	103	578
1998/99				
Dependent Variable				
Average hours worked in a month per child in a household	20.56 (50.534)	25.157 (61.7)	12.167 (43)	20.457 (54.61)
Key Variables (household-level borrowing)				
Women's recent loans (taka)	12,989.52 (19,106.20)	0	0	7,753.261 (16,071.91)
Men's recent loans	2,478.261 (8,893.19)	0	0	1,479.239 (6,973.676)
Women's most recent loans	7,503.188 (11,499.30)	0	0	4,478.547 (9,612.794)
Men's most recent loans	1,413.043 (5,684.25)	0	0	843.4256 (4,443.479)
Women's past loans	5,459.95 (7,702.06)	0	0	3,258.967 (6,523.209)
Men's past loans	2,686.08 (5,979.19)	0	0	1,603.287 (4,801.372)
Number of observations	345	146	87	578

Note: Average hours worked in a month per child in a household includes hours devoted to both within the household and outside the household doing agricultural and non-agricultural work. In 1991/92, the stock of past loans both for men and women is zero because 1991/92 is the first data point in the panel.
Source: Own calculation based on 1991/92 and 1998/99 household survey in Bangladesh.

Table 2 presents summary statistics for the 1998/99 household survey in Bangladesh, which are comparatively different than those for 1991/92 household survey in Bangladesh. The total average hours worked in a month by a 10-15 year-old child both within and outside the household in agriculture and non-agriculture sectors are 16.05. This statistic is less than that for 1991/92 household survey in Bangladesh, which shows 36.86 as the total average hours worked in a month by a 10-15 year-old child (Table 1). The summary statistics show that the number of governmental food programs has increased over the years. Almost 50 percent of the total surveyed villages have a governmental food program, which is a marked increase from 17.4 in 1991/92 to 49.7 percent in 1998/99. However, the non-governmental food programs have decreased from 18.1 percent in 1991/92 to 8.7 percent in 1998/99. Similarly, the mean prevailing daily adult wage rate has increased from 26.33 taka (Tk) to Tk 51.45 in real terms over the span of seven years. The loan volumes as well have increased over the years, and the increase is more for women than for men (Tables 1 and 2).

Table 3 displays summary statistics for credit and child labor activities for panel households. This research employs a panel data set from household survey design in Bangladesh that includes both control and treatment groups. The treatment groups are microfinance program participants and the control groups are targeted nonparticipants. The nontarget nonparticipating households are also the control groups that were excluded from program participation based on land based eligibility criteria. The child labor activities for both the control and treatment groups are observed over time. In the 1991/92 survey, 49.1 percent of the 578 households were microfinance program participants. Microfinance programs have targeted such poor rural households in Bangladesh that have landholdings of less than or equal to half an

acre of land.[12] The eligible nonparticipating and nontarget households were 33 percent and 17.8 percent respectively. In 1998/99 resurvey, 59.68 percent of the 578 households were program participants. The eligible nonparticipants and nontarget households were 25.26 percent and 15.05 percent respectively. Women's average borrowing has increased over the span of 7 years. The average stock of women's recent loans for participating households has increased from 2,218.95 taka (Tk) to Tk 12,989.52 in real terms. Thus, women have had a considerable increase in borrowing than men.

In sum, taken together, the data suggest that microfinance programs in Bangladesh have targeted poor women in rural households. The labor supply per child in a household has declined from 36.072 mean hours to 20.56 mean hours for program participants. The decline in child labor supply is from 35.338 mean hours to 20.457 mean hours for all households. We now turn to formal regression model in the next section.

[12] For details, visit:http://go.worldbank.org/E9WWFZIXJ0

V: Results

i. Baseline OLS estimation

I first present the OLS regression estimates of the impact of microcredit upon child work using cross-sectional data. The dependent variable is the total average hours worked in a month by a 10-15 year-old child. The explanatory variables include the amount of loan taken, child attributes, household attributes, and community or village-level attributes. As explained above, the amount of microcredit is classified under three categories: the stock of recent, most recent, and past loans. Table 4 shows the OLS regression estimates for two periods 1991/92 and 1998/99 respectively. In both periods, child attributes such as age and gender have positive and statistically significant effects upon child labor. For instance, In 1991/92, child labor increases by 6.8 hours or approximately 18.5 percent in mean hours with age. Household size has a negative and statistically significant effect upon child labor. But, child labor is positively associated with the number of younger children (0-9 years) in the family. This is consistent with what other economists have found in child labor analysis. Generally, in a poor rural household, children spend their time in taking care of their younger siblings. Child labor is significantly less in the male headed household. For instance, in 1998/99, a male-headed household results in the decline in child labor by 8.43 hours or approximately 51 percent in mean hours. The village attributes such as government and nongovernment food programs have a negative and statistically significant effects upon child labor (1991/92, Table3). The regression analyses also

include the prevailing daily adult wage rate in the village and the square of this variable. The statistically significant coefficient estimates on these variables show that child labor declines with increased adult wage rate. This is consistent with Basu's and Van's (1998) theoretical argument and Ersados'(2005) empirical analysis that an effort toward raising adult's education and wage level can help reduce the prevalence of child labor in poor countries.

The impact of microfinance loan upon child work is mixed. The 1991/92 cross-sectional data analysis shows that the stock of women's most recent loans has a positive and statistically significant effect on child labor. A 1 percent increase in the stock of women's most recent loans increases child labor by 0.268 hours. However, the 1998/99 data analysis shows that the stock of men's most recent loans has a negative and statistically significant effect on child labor. A 1 percent increase in the stock of men's most recent loans decreases child labor by 0.207 hours. But, the OLS regression estimates are likely to suffer from unobserved heterogeneity. As such, in order to assess the actual impact of microcredit on child labor, I extend my empirical analysis in panel data using household-level fixed effect that controls for time-invariant unmeasured determinants of child labor.

Table 4
OLS Estimates of the Impact of Microfinance Loan upon Child Work
Dependent Variable: (total average hours worked in a month by a child)

	1991/92		1998/99	
Variables	Coefficients	Robust SE	Coefficients	Robust SE
Constant	-71.25	(140.80)	-36.75	(170.80)
Child Attributes				
Male	36.85***	(3.63)	19.27***	(1.85)
Age	6.799***	(1.19)	5.422***	(0.83)
Household Attributes				
Number of members	-3.192**	(1.48)	-1.274**	(0.59)
Number of 0-9 year-old members	6.248***	(2.31)	1.924*	(1.14)
Number of 10-15 year-old members	3.472	(3.28)	5.506***	(1.71)
Household head's age in years	0.545**	(0.24)	0.174	(0.15)
Male Household head	-24.85**	(11.13)	-8.433*	(4.74)
Household head's education in years			-0.361	(0.31)
Log of household land (decimals)	1.495	(1.37)	0.316	(0.46)
Log of total value of land (taka)	-1.257	(0.91)	-0.0679	(0.33)
Log of total market price of house (taka)			-0.316	(0.24)
Number of non-farm enterprises owned			1.157	(1.73)
Village Attributes				
Primary Coeducation School present	2.936	(5.22)		
Coeducational High School present	-13.34	(10.67)		
Post Secondary School present	-11.82	(22.44)		
Distance to nearest pucca road (km)	-0.336	(0.34)		
Has government food program	-14.83*	(8.17)	-1.079	(4.09)
Has non-government food program	-20.07***	(7.44)	4.063	(7.42)
Village electrification	2.534	(5.59)		
Prevailing daily adult wage rate (taka)	7.972***	(3.02)	1.386	(0.92)
SQofPrevailing daily adult wage rate	-0.135**	(0.06)	-0.0154*	(0.01)
Key Variables				
Log of women's recent loans (taka)	0.006	(0.21)	0.00224	(0.08)
Log of men's recent loans	0.128	(0.27)	0.000916	(0.08)
Log of women's most recent loans	0.268*	(0.15)	-0.0503	(0.02)
Log of men's most recent loans	-0.0146	(0.18)	-0.207***	(0.07)
Log of women's past loans			0.0845	(0.11)
Log of men's past loans			0.0941	(0.14)
Number of observations	1256		2196	
F-statistics (54, 1201)	6.31			
F-statistics (60, 2135)			4.74	

Robust standard errors are in parentheses. * represents significance at 10 percent-level, ** significance at 5 percent-level, and *** significance at 1 percent level.
Note: Regressions also include other household attributes such as type of latrines used and log of other kinds of assets, other village-level attributes such as infrastructure and price variables to capture the effect of time variant changes in local economy.

ii. Household-level fixed effect estimation

In this research, I employ a reduced-form child labor equation analyzing the impact of microfinance loans on child labor supply. But before reaching any conclusion of the effect of microfinance loans on child labor supply, it is important to analyze the effect of microfinance loans on adult labor supply. This is because researchers have argued that improved adult labor market conditions in the developing world enhance adult employment, thereby reducing child employment. For instance, Ersado (2005) argues that increased adult wages and enhanced adult education can reduce the prevalence of child labor (Ersado, 2005). Furthermore, Charles and Fayed (1998) show that child labor and adult female labor are substitutes in production (Charles and Fayed, 1998). Strikingly, using a quasi-experimental survey design in rural Bangladesh, Pitt and Khandker (1998) find that microfinance loans have a positive and statistically significant effect on female labor supply (Pitt and Khandker, 1998). Using the same data set but employing a household fixed-effect in panel households, I find a negative and statistically significant effect of microfinance loans on child labor supply. This is consistent with Charles's and Fayed's (1998) argument that child labor and adult female labor are substitutes in production.

I find statistically significant result for the household fixed-effect estimates of the impact of microfinance loans on child labor. The results show that women's stock of recent borrowing reduces child labor. Since both the dependent variable (average hours worked in a month per child in a household) and the explanatory variable (microfinance loan) are in natural logarithms, the credit estimates are the elasticities

of child labor supply with respect to credit.[13] A 10 percent increase in the stock of recent borrowing by women reduces child labor supply by 2.58 percent (Table 5). Male borrowing has no statistically significant effect on child labor outcome.

In their cross-sectional probit analysis, Hazarika and Sarangi (2005) employ the interaction terms such as 'Household access to microcredit × Area owned land in acres' and 'Household access to microcredit × Number of enterprises owned.' They find statistically significant results for these interaction terms. They explain the negative effect of "microcredit access" upon child work as family-labor substitution effect and the positive effect of "microcredit access × area of land owned" upon child work as household-enterprise capitalization effect. Following Wydick's (1999) theoretical analysis, they argue that the negative impact of microcredit access upon child labor can be dampened by household-enterprise capitalization effect (Hazarika and Sarangi, 2005). Hence, their findings illustrate that 'an access to microcredit raises the probability of child work in households with average landholdings and retail sales enterprises by 0.7 percentage points' (Hazarika and Sarangi, 2005).

Following Hazarika and Sarangi (2005), I employ the interaction terms such as "log of microfinance loan × log of land owned" and "log of microfinance loan × number of enterprises owned," but I find significant effect of only "log of women's recent stock of loans × log of land owned" on child labor outcome. Interestingly, the impact of this interaction term on child labor supply is negative as opposed to positive effect in Hazarika and Sarangi's analysis. As such, there is no household-enterprise capitalization effect in my findings.

[13]Log-log models are used in regression to correct for heteroskedasticity

Thus, a 10 percent increase in the stock of recent borrowing by women with landholdings reduces child labor supply by 2.67 percent (Table 5). The results of this paper confirm the family labor substitution effect explained in Wydick's theoretical analysis.

Table 5
Household Fixed-Effects Estimates of the Impact of Microfinance Loan upon Child Labor
Dependent Variable: (Log of average hours worked in a month per child)

Variables	Coefficient	Robust SE
Log of women's recent loans	-0.258***	(0.008)
Log of men's recent loans	-0.0902	(0.125)
Log of men's most recent loans	0.111	(0.126)
Log of women's most recent loans	0.0161	(0.089)
Log of women's past loans	-0.00219	(0.054)
Log of men's past loans	0.081	(0.073)
Log of women's recent loans X Log of household land	-0.00259*	(0.001)
Log of men's recent loans X Log of household land	-0.00299	(0.002)
F-statistics (37, 541)	4.77	
Prob>F	0.000	
Number of observations	578	
F-statistics (H_0 : parameter of women's recent stock of loans is equal to 0)	9.21	
Prob>F	0.0025	
F-statistics (H_0 : parameter of 'log of women's recent stock of loans X log of land' is equal to 0)	3.52	
Prob>F	0.0613	
F-statistics (H_0 : parameter of men's and women's recent stock of loans are jointly equal to 0)	4.75	
Prob>F	0.009	

Robust standard errors are in parentheses. *** represents significance at 1 percent level or better, * represents significance at 10 percent level or better.
Note: Regression also includes other variables such as age and sex of the household head, log of total land owned (decimals), prevailing adult wage rate in the village, village level infrastructure, and price variables to capture the effect of time variant changes in local economy.
There are many households that report no child labor activities. Since I employ log-log models in panel households, I replace zeros with small number. I try different values like 0.01, 0.001, and 0.0001 and these make no difference on the level of significance.

Table 5 presents statistical tests on the effect of program credit on child labor supply. The null hypothesis that the stock of women's recent loans does not have an effect on child labor supply is rejected at the 0.05 level. I also test the joint significance of men's and women's recent stock of loans. The null hypothesis that the covariates are jointly equal to zero is rejected at the 0.05 level. It is noteworthy that men's borrowing has no statistical significance effect on child labor supply. Such an outcome is plausible because microfinance programs have targeted poor women in rural households. And while men have lagged behind in program participation, women have actively participated in microfinance programs and have increased their loan volume over subsequent years (Table 3 and Khandker, 2005). Interestingly, the stock of women's most recent loans[14] does not have a statistically significant effect on child labor. This may be because an immediate impact of credit either on household consumption or on child labor supply is unlikely to happen. Households use microfinance loans in income generating activities and such activities only flourish with time.

[14]In 1998/99 household survey, most recent loans refer to the stock of loans from 1998 to 1999. Also, the stock of women's past credit does not have a statistically significant effect on child labor. This may be because in my panel data, the stock of women's past credit is relatively less compared to the stock of women's recent credit.

VI: Conclusion

This paper examines the relationship between child labor and microfinance in rural Bangladesh. Researchers and economists have argued that one way to eliminate child labor is through the alleviation of poverty in poor and developing nations. In order to alleviate poverty, microfinance organizations have been serving the poor and women engaged in informal activities through savings and collateral-free group based lending. Using household-level fixed effect in panel data for rural Bangladesh, this paper shows that the stock of women's recent loans reduces child labor supply. A 10 percent increase in the stock of recent borrowing by women reduces child labor supply by 2.58 percent (Table 5). An F-test of the null hypothesis that the stock of women's recent loans does not have an effect on child labor supply rejects the null at the 0.05 level. This confirms the finding of this paper that women's borrowing does negatively impact the child labor supply.

Nevertheless, mere intervention of microfinance programs in poor pocketed areas of the developing world will not be sufficient to boost child schooling and to reduce child labor. In order to work toward eliminating child labor, it is equally important to invest in the village-level infrastructure in many remote areas of the developing world. An improvement in adult labor market conditions such as increased adult wages are necessary to curb child labor.

Given the success of Grameen Bank in Bangladesh, the local governmental bodies and nongovernmental organizations in developing world have given much emphasis on the implementation of microfinance programs. But, success of such

programs have also been measured based on high repayment rates rather than focused on borrower's welfare level. This paper subtly explores the econometric issues related to program impact analysis and shows that women's borrowing does negatively impact the child labor supply. Hence, governments in developing economies should focus microfinance as one of the mechanisms to eliminate child labor.

Bibliography

Baland, J. M. and Robinson, J. A. 2000. "Is child labor inefficient?" *Journal of Political Economy* 108(4): 662-79.

Basu, K., 1999. "Child Labor: Cause, Consequence, and Cure, with Remarks on International Labor Standards." *Journal of Economic Literature* 37 (3): 1083-119.

Basu, K. and Van, P. H. 1998. "The economics of child labor." *American Economic Review 88*(3): 412-27.

Beegle, K., Dehejia, R. H., and Gatti, R. 2006. "Child labor and agricultural shocks." *Journal of Development Economics 81*(1): 80-96.

Beegle, K., Dehejia, R. H., and Gatti, R. 2005. "Why Should We Care about Child Labor? The Education, Labor Market, and Health Consequences of Child Labor ." *World Bank Policy Research Working Paper No.3479.* Available online at http://econ.worldbank.org.

Coleman, B. E., 2000. "The Impact of group lending in Northeast Thailand." *Journal of Development Economics* 60 (1): 105-41

Dehejia, R. H. and Gatti, R. 2002. "Child labor: the role of income variability and access to credit across countries." *World Bank Policy Research Working Paper No. 2767*. Available at SSRN: http://ssrn.com/abstract=634480

Diamond, Charles, and Tammy Fayed. 1998. "Evidence on Substitutability of Adult and Child Labor." *Journal of Development Studies 34*(3):62-70.

Doorn, Judith. V., and Craig Churchill. 2004. "Microfinance Against Child Labor." Social Finance Programme. Geneva: International Labour Organization.

Edmonds, E., 2007. "Child Labor." *in T. P. Schultz and J. Strauss, eds., Handbook of Development Economics Volume 4* (Elsevier Science, Amsterdam, North-Holland), forthcoming.

Ersado, L., 2005. "Child labor and schooling decisions in urban and rural areas: comparative evidence from Nepal, Peru and Zimbabwe." *World Development 33*(3): 455-80.

Food and Agricultural Organization (FAO) of the United Nations. Available online at:http://www.fao.org/teca/content/extended-forecasting-systems-disaster-preparedness-bangladesh

Hazarika, G. and Sarangi, S. 2005. "Household Access to Microcredit and Child Work in Rural Malawi." IZA Discussion Paper No. 1567. Available online at SSRN: http://ssrn.com/abstract=708175.

ILO 2004. Child Labour: A textbook for university students. ILO Publications. Geneva: International Labour Office.

Khandker, Shahidur R. 2005. "Microfinance and Poverty: Evidence Using Panel Data from Bangladesh." *The World Bank Economic Review* 19 (2): 263-86.

Maldonado, J. and Gonzalez-Vega, C. 2008. "Impact of Microfinance on Schooling: Evidence from Poor Rural Households in Bolivia." *World Development 36*(11): 2440-2455.

Moffitt, R., 1991. "Program evaluation with nonexperimental data." *Evaluation Review* 15, 291–314.

Pitt, M. M. and Khandker, S. 1998. "The impact of group-based credit programs on poor
households in Bangladesh: does the gender of participants matter?" *Journal of Political Economy* 106(5): 958-96.

Pitt, M., Khandker, S., and Cartwright, J. 2003. "Does Microcredit Empower Women? Evidence from Bangladesh." *World Bank Policy Research Working Paper No.2998.* Available online at SSRN: http://ssrn.com/abstract=636360

Pitt, M., Khandker, S., Chowdhury, O., and Millimet, D. 2003. "Credit Programs for the Poor and the Health Status of Children in Rural Bangladesh." *International Economic Review 44*(1): 87-118.

Ranjan, P. 1999. "An economic analysis of child labor." *Economic Letters 64*(1): 99-105.

Wydick, B. 1999. "The effect of microenterprise lending on child schooling in Guatemala." *Economic Development and Cultural Change 47*(4): 853-69.

Zeller, M., Sharma, M., Akhter, A., and Rashid, S. 2001. "Group-Based Financial Institutions for the Rural Poor in Bangladesh: An Institutional- and Household- Level Analysis." *International Food Policy Research Institute: Research Report* 120.