Son-Preference, Gender Differentials in Child Labor and Schooling, and Efficiency

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Abstract

This paper studies the effects of *son-preference* by parents on child labor and schooling in a model with *bilateral altruism* between parents and children. The results suggest that son-preference leads to a gender differential in child labor with female children working more than male children. But, it does not lead to a gender differential in schooling. Only when parents cannot give bequests, female children receive less schooling than male children. Binding bequest constraint results in an inefficiently high level of child labor and a low level of schooling. Reverse transfers (transfers from children to parents) in the second period result in inefficiently high level of schooling and low level of child labor, a result which is in contrast to models of Baland and Robinson (2000) and Horowitz and Wang (2004). The empirical evidence from rural areas of Bangladesh shows that son-preference is an important factor explaining the observed gender differential in child labor.

Keywords: gender bias, son-preference, earnings function bias, schooling, child labor, efficiency, bequests, MICS, Bangladesh

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1 Introduction

Empirical evidence suggests that son-preference (parental gender bias in favor of sons) is wide-spread in many regions of the world, particularly in Asia and the Middle-East (Boserup 1970, Williamson 1976, Behrman 1988). In recent years, especially due to the spread of sex-selection techniques, a large literature has emerged which studies the socio-economic determinants and consequences of this bias. Previous works on son-preference have studied its effects on fertility and sex-ratio (Ben-Porath and Welch 1976, Bloom and Grenier 1983, Leung 1991, Clark 2000), excess mortality among female infants (Das Gupta 1987, Sen 1990), and differential access to health (Chen et. al. 1982, Pande 2003), nutrition (Sen and Sengupta 1983, Behrman 1988, Hazarika 2000) and education (Behrman, Pollak, and Taubman, 1982, 1986, Davis and Zhang 1995, Alderman and King 1998, Orazem and King 2007).

Empirical evidence also shows that the incidence and the intensity of child labor is higher for female children than male children.[1] Edmonds and Pavcnik (2005) using UNICEF MICS (Multiple Indicator Cluster Survey) data find that the incidence of child labor of female children (72.1 percent) is much higher compared to male children (64.8 percent). They also find that female children are more likely to work long hours than male children. Allais (2009) using SIMPOC survey data for sixteen countries finds similar evidence. Our own analysis using MICS data for rural Bangladesh suggests that the labor force participation by female children are higher than male children.

In this paper, I develop a model to study the effects of son-preference by parents on child labor, schooling, and welfare. Using MICS data of rural Bangladesh for 2005-06, I provide evidence that son-preference is an important factor in explaining the gender differential in child labor. While the main contribution of this paper is to study the implications of son-preference, I also analyze the effects of gender differential in the earnings functions on child labor and schooling. This issue has been addressed by other papers most notably by Horowitz and Wang (2004). However, I derive important new results.

In the model, there are two periods. A family consists of parents and two children – one male and one female. Both parents and children are

[1]Child labor includes market and domestic work. But if we take only market work then the incidence of child labor is higher among male children than female children (see Edmonds 2007 for a thorough discussion).

altruistic. The parents' utility depends not only on their own consumption, but also on the utility enjoyed by their children. Similarly, the children's utility depends not only on their own consumption and leisure, but also on the utility enjoyed by their parents. Children are endowed with one unit of time in the first period, which can be allocated among three activities: labor, schooling, and leisure. Children incur disutility from both child labor and schooling. A higher level of schooling in the first period leads to a higher level of human capital (earnings) in the next period. While parents care about both children, they may put more weight on the utility of their male children. Parents choose levels of child labor, schooling, bequests and savings to maximize their utility. Children can also give transfers to parents (reverse transfer) in the second period.

I distinguish between two cases: *a pure son-preference case* and *a pure earnings function bias towards male case*. In the pure son-preference case, I assume that parents put more weight on the utility of male children, but earnings functions are identical for both male and female adults. In the pure earnings function bias towards male case, parents care equally about both male and female children, but male adults have a superior earnings function. This case is similar to one analyzed by Horowitz and Wang (2004).

In the model, I derive the following main results. Firstly, when parents can give bequests, both male and female children receive an equal amount of schooling, but female children work more than male children in the son-preference case. In the case of the earnings function bias, not only male children work less, but also receive more schooling than female children. Secondly, when the parents cannot give bequests, in the son-preference case, male children receive more schooling than female children and work less. However, in the case of the earnings function bias male children can receive more or less schooling than female children and can also work more or less than female children. Thirdly, in the son-preference case time allocated to leisure for female children is lower than male children. Alternatively, total time allocated to labor and schooling to female children is higher than for male children. On the other hand, in the earnings function bias case, the time allocated to leisure or total time allocated to labor and schooling is the same for both male and female children. This implication is robust to whether bequest constraint binds or not. Finally regarding efficiency, allocations are efficient when parents can give positive bequests. When parents cannot give bequests to one or both the children, child labor is inefficiently high and schooling is inefficiently low for children who do not receive bequests.

The issue of whether reverse transfer by children to parents in the second period can restore efficiency, when parents cannot give bequests, has received a great deal of attention in the literature (e.g. Baland and Robinson 2000, Bommier and Dubois 2004, Horowitz and Wang 2004). In the model developed, whether reverse transfer can restore efficiency depends on whether parents receive transfers from both types of children or only one type. In the case where parents receive transfers from both types of children, reverse transfers do not restore efficiency. In fact, reverse transfers lead to an inefficiently *low* level of child labor and an inefficiently *high* level of schooling regardless of the source of gender bias.

In the model, the choice of schooling imposes a *positive externality* on parents. An increase in schooling for one type of children not only increases transfers from them to parents in the second period, but also increases transfers from children of the other type. This positive externality induces parents to choose inefficiently high level of schooling. However, in the case where parents receive transfers in the second period from only one type of child, reverse transfer leads to efficient allocations. The reason is that parents no longer face a positive externality from their choice of schooling of one type of child.

Using data drawn from the rural samples of the Bangladesh MIC survey for 2005-06, I empirically examine the relative importance of the two types of gender biases in explaining the gender differentials in the number of hours worked as child labor. I find that son-preference is a significant factor in explaining the observed gender differential in child labor. I also find that a father living in the house and the house having a water connection have a significant negative effect on child labor. A mother living in the house has a significant negative effect on female child labor, but not on male child labor.

This paper most directly relates to Horowitz and Wang (2004) who extend the model of Baland and Robinson (2000) to analyze the effects of the earnings function bias on child labor and schooling. They do not analyze the effects of son-preference. In their model there is no labor-leisure choice and thus they do not derive the effects of gender bias on the labor-leisure choice. Finally, they find that reverse transfers restore efficiency even when parents receive transfers from both children, while in this model reverse transfers do not restore efficiency. This paper also relates to theoretical literature which examines the effects of gender bias on human capital investment (e.g. Davies and Zhang 1995 and Alderman and King 1998). These studies do not examine the effects gender bias on child labor and efficiency.

This paper also relates to a large empirical literature which examines the effects of gender bias on the gender differentials in schooling and labor force participation by children (see Bhalotra 2003, Orazem and King 2007, Edmonds 2007 for a review). This literature finds that both the parental attitude and the earnings functions bias are important determinants of the gender differentials in schooling and labor force participation by children. Most of this literature focuses on labor force participation rather than the numbers of hours worked, which is the focus of this paper.

The remainder of this paper is structured as follows. Section 2 presents the model. Section 3 analyzes the case in which children receive transfers (bequests) from parents. Section 4 analyzes the reverse case in which children make transfers to their parents. Section 5 examines the empirical significance of gender biases in explaining the gender differential in child labor in Bangladesh. Section 6 concludes the paper.

2 Model

There are two periods, $t = 1, 2$. The economy consists of a large number of households and firms. Each household consists of parents and two children: one male and one female. Parents and children live for both periods. Parents are endowed with A units of labor in each period. Throughout the paper, I measure labor in efficiency units.

Firms are owned by other types of agents, who live for two periods and do not have children. Firms produce goods using labor. They hire labor in a competitive labor market. Assume that firms have linear technology. Linear technology and the competitive labor market imply that wages (or the marginal product of labor) per efficiency unit of labor are constant. I normalize wages per efficiency unit to one.

In both periods, parents supply their labor inelastically. In the first period, children are endowed with one unit of time, which can be used for work, schooling (education), and leisure. Children incur disutility from both schooling and work.[2] Schooling in the first period increases the human capital or labor endowment of children in efficiency units (earnings) in the next

[2]In Baland and Robinson (2000) and Horowitz and Wang (2004), there is no disutility from either schooling or work. Also parents face a direct trade-off between schooling and child labor. The separation between schooling and child labor is more in accord with the large empirical literature which suggests that there is no direct trade-off between schooling and child labor (see Bhalotra 2003 and Edmonds 2007 for a review).

period.

Let l^m and l^f be the labor supplied by male and female children respectively. Assume that human capital acquired by the *ith* child next period or his/her earning depends on the time spent on schooling, s^i. The earnings/human capital function, $h^i(s^i)$ for $i = m, f$ is assumed to be a strictly increasing and concave function of s^i. Assume that $h^i(0) > 0$.

Both parents and children are altruistic. Parental utility depends not only on their own consumption but also on the utility levels of children. Though parents care about both male and female children, they may prefer male children over female children. The parental utility function is given by

$$W^p = U(c_1^p) + U(c_2^p) + \delta^m W^m + \delta^f W^f \tag{2.1}$$

where function $U()$ is the period utility function and W^m and W^f are utility functions of male and female child respectively defined below. $U()$ is a twice continuously differentiable, strictly increasing, and concave function of consumption. c_t^p is the consumption by parents in period $t = 1, 2$. Parameters $0 < \delta^i < 1$ for $i = m, f$ measure the degree of altruism.

Children are also altruistic and their utility depends not only on their own consumption, c^i for $i = m, f$ and the disutility incurred from child labor and schooling, but also on the utility of their parents. The utility functions for male and female children are as follows:

$$W^m = U(c^m) + V(1 - l^m - s^m) + \lambda W^p \ \& \tag{2.2}$$

$$W^f = U(c^f) + V(1 - l^f - s^f) + \lambda W^p. \tag{2.3}$$

where $V(1 - l^i - s^i)$ is an increasing and concave function of leisure $(1 - l^i - s^i)$. λ captures the degree of altruism by children towards their parents.[3] Combining (2.1), (2.2), and (2.3), I have the following expressions for W^i for $i = p, m, f$.

$$W^p = \frac{\sum_{t=1}^{2} U(c_t^p) + \sum_{i=m,f} \delta^i [U(c^i) + v(1 - l^i - s^i)]}{1 - \lambda(\delta^m + \delta^f)}; \tag{2.4}$$

[3]One can easily allow for different degrees of altruism by male and female children. The results of the paper do not depend on whether children have identical or different levels of altruism.

$$W^m = \frac{(1-\lambda\delta^f)[U(c^m) + v(1-l^m - s^m)] + \lambda[\sum_{t=1}^{2} U(c_t^p) + \delta^f[U(c^f) + v(1-l^f - s^f)]]}{1-\lambda(\delta^m + \delta^f)} \; \& \tag{2.5}$$

$$W^f = \frac{(1-\lambda\delta^m)[U(c^f) + v(1-l^f - s^f)] + \lambda[\sum_{t=1}^{2} U(c_t^p) + \delta^m[U(c^m) + v(1-l^m - s^m)]]}{1-\lambda(\delta^m + \delta^f)}. \tag{2.6}$$

For well-defined utility functions to exist, I impose the condition that parameter values are such that $1 > \lambda(\delta^m + \delta^f)$.

Parents choose their consumption for both periods, savings, child labor, time spent in schooling, and bequests for both children. I normalize the rate of return on savings to one. Parents give bequests, $b^i \geq 0$ for $i = m, f$, to their children in the second period. Children can also give transfers, $\tau^i \geq 0;\ i = m, f$, to their parents in the second period of their lives.

Let k be the savings in the first period. The budget constraints faced by parents and children are

$$c_1^p + k = A + l^m + l^f; \tag{2.7}$$

$$c_2^p + b^m + b^f = A + k + \tau^m + \tau^f; \tag{2.8}$$

$$c^m = b^m - \tau^m + h^m(s^m); \tag{2.9}$$

$$c^f = b^f - \tau^f + h^f(s^f). \tag{2.10}$$

Since τ^i is similar to negative transfers from parents to children, what is important for the analysis and the decision making by parents and children are the net transfers between parents and children. If one interprets b^i & τ^i as net transfers, then when $b^i > 0$, $\tau^i = 0$. Similarly, when $\tau^i > 0$, $b^i = 0$.

I distinguish between two cases: *the pure son-preference case* and *the pure earnings function bias towards male case.* In the *pure son-preference case*, I assume that parents care more about the welfare of male children than female children, $\delta^m > \delta^f$, but the earnings functions are identical, $h^m() \equiv h^f() \equiv h()$. In the *pure earnings function bias towards male case*, I assume that there is no son-preference, $\delta^m \equiv \delta^f \equiv \delta$, but the earnings functions are heterogeneous $h^m(s^m) \neq h^f(s^f)$. This is the case which is similar to one analyzed by Horowitz and Wang (2004). In particular, I assume that male children have a superior earnings function.[4] For any $s^m = s^f$, $h^m(s^m) > h^f(s^f)$ and $h^m_s(s^m) > h^f_s(s^f)$.[5] Thus male children have higher total as well as marginal return on the time spent in schooling.

3 Parents to Children Transfer

Now I analyze the case in which there is a transfer from parents to children, $b^i > 0,\ \tau^i = 0$, for $i = m, f$. The parental optimization problem is

$$\max_{c_1^p, c_2^p, l^m, l^f, s^m, s^f, b^m, b^f, k} \frac{\sum_{t=1}^{2} U(c_t^p) + \sum_{i=m,f} \delta^i [U(c^i) + v(1 - l^i - s^i)]}{1 - \lambda(\delta^m + \delta^f)}$$

subject to the budget constraints 2.7-2.10. In the rest of the paper, I will assume an interior solution for child labor, i.e. $0 < l^m, l^f < 1$. The first order conditions associated with the optimal choices are

$$l^i: \ U_c(c_1^p) = -\delta^i V_l(1 - l^i - s^i), \ \text{for } i = m, f; \tag{3.1}$$

$$s^i: \ U_c(c^i) h^i_s(s^i) = -V_s(1 - l^i - s^i), \ \text{if } s^i > 0, \text{for } i = m, f; \tag{3.2}$$

$$s^i: \ U_c(c^i) h^i_s(s^i) < -V_s(1 - l^i - s^i), \ \text{if } s^i = 0, \ \text{for } i = m, f; \tag{3.3}$$

$$b^i: \ U_c(c_2^p) = \delta^i U_c(c^i), \ \text{if } b^i > 0, \ \text{for } i = m, f; \tag{3.4}$$

$$b^i: \ U_c(c_2^p) > \delta^i U_c(c^i), \ \text{if } b^i = 0, \ \text{for } i = m, f \ \& \tag{3.5}$$

$$k: \ U_c(c_1^p) = U_c(c_2^p). \tag{3.6}$$

[4] There is a large literature which documents wage differentials in favor of males in a wide range of countries.

[5] Throughout the paper, for any function $F(x)$, $F_x(x)$ and $F_{xx}(x)$ denote first and second derivatives respectively.

The LHS of (3.1) is the marginal benefit of child labor and the RHS is its marginal cost. One additional unit of child labor increases parental utility by $U_c(c_1^p)$ in the first period. But it reduces the utility enjoyed by the *ith* child by $-\delta^i V_l(1 - l^i - s^i)$.

Similarly, (3.2) equates the marginal cost of the time spent in schooling to its marginal benefits. An increase in the time spent in schooling increases the earnings of the *ith* child next period by $h_s^i(s^i)$. But it reduces the utility enjoyed by the *ith* child by $-\delta^i V_s(1 - l^i - s^i)$. In this case, the marginal cost of the time spent in schooling exceeds its marginal benefit, $s^i = 0$. (3.3) characterizes this condition.

(3.4) equates the marginal cost of giving bequest to the *ith* child with its marginal benefit. An additional unit of bequest reduces the utility of parents by $U_c(c_2^p)$ in the second period. At the same time, it increases the utility of parents by $\delta^i U_c(c^i)$. If the marginal cost of bequest to the *ith* child exceeds the marginal benefit, then parents will not give any bequest to the *ith* child. (3.5) characterizes this condition.

(3.6) equates the marginal cost of savings (LHS) with its marginal benefit (RHS). The marginal cost of savings is the loss in the utility by having to consume one unit less in the first period. One unit of savings increases income by one unit in the next period, the value of which is $U_c(c_2^p)$.[6]

(3.1) implies that

$$\delta^m V_l(1 - l^m - s^m) = \delta^f V_l(1 - l^f - s^f). \tag{3.7}$$

Proposition 1: Son-Preference ($\delta^m > \delta^f$) leads to male children having a higher amount of leisure than female children and

$$l^m + s^m < l^f + s^f. \tag{3.8}$$

In the absence of son-preference, both male and female children have the same amount of leisure and $l^m + s^m = l^f + s^f$.

(3.8) shows that differences in the earnings functions do not affect the amount of leisure enjoyed by male and female children, but son-preference does. Next, I characterize levels of child labor, time spent in schooling, consumption of children, and bequest pattern under different conditions. I

[6] One can easily analyze the case where savings are at the corner.

begin with the case in which the time spent in schooling and bequests are interior ($s^m, s^f, b^m, b^f > 0$). I call this case **unconstrained equilibrium**.

3.1 Unconstrained Equilibrium

Since, $V_l(1 - l^i - s^i) = V_s(1 - l^i - s^i)$, (3.1) and (3.2) imply that

$$\delta^m U_c(c^m) h_s^m(s^m) = \delta^f U_c(c^f) h_s^f(s^f). \tag{3.9}$$

Then equations (3.2), (3.4), (3.6), and (3.9) imply that

$$h_s^m(s^m) = h_s^f(s^f) = 1. \tag{3.10}$$

Parents choose the levels of the time spent in schooling such that their marginal rate of return equals the rate of return on savings which is unity. Equation (3.10) also characterizes the efficient levels of the time spent in schooling.[7]

Pure Son-Preference

Equation (3.10) implies that $s^m = s^f$. Thus, both male and female children acquire the same level of human capital. The preference for sons does not lead to gender differentiation in earnings and schooling.

However, from (3.8) it follows that $l^m < l^f$. Also (3.4), (2.9) and (2.10) imply that $c^f < c^m$ and $b^f < b^m$. Female children work more as child laborers, have lower consumption, and receive lower bequests. Parents are able to provide higher consumption to male children by giving them a higher level of bequests. Higher consumption and leisure levels of male children imply that they have higher utility than female children.

Pure Earnings Function Bias Towards Males

From (2.9), (2.10), (3.4), (3.8), and (3.10), it follows that $s^m > s^f$, $l^m < l^f$, and $c^m = c^f$. Male children have higher human capital and lower child labor levels than female children. But both male and female children have the same amount of consumption. Bequests to the male children can be higher or lower than female children. Unlike son-preference, in this case both male

[7]The model has three types of agents: parents, children, and firms. The allocations are efficient in the sense that one cannot increase welfare of one type of agents without reducing welfare of other types.

and female children have the same level of utility. These results are similar to ones derived in Horowitz and Wang (2004).

Proposition 2: In the unconstrained equilibrium case ($s^m, s^f, b^m, b^f > 0$),

(i) The time spent in schooling for both male and female children are at an efficient level regardless of the form of gender bias.

(ii) *Pure Son-Preference*: The time spent in schooling for both male and female children is equal, $s^m = s^f$. But male children have higher utility and consumption, $c^m > c^f$, receive greater bequests, $b^m > b^f$, and have lower child labor levels, $l^m < l^f$.

(iii) *Pure Earnings Function Bias Towards Male*: Both male and female children have the same levels of utility and consumption $c^m = c^f$. But male children have a higher level of time spent in schooling, $s^m > s^f$, and have a lower child labor level, $l^m < l^f$.

(3.10) shows that the time spent in schooling is independent of parental income and gender bias towards sons in the unconstrained case. The result that time spent in schooling is independent of parental income is also derived by Baland and Robinson (2000) and Horowitz and Wang (2004). But in their model, it also implies that child labor is independent of parental income. However, in this model from equations (2.7) and (3.1) it follows that a higher parental income reduces child labor, $\frac{dl^i}{dA} < 0$. Also, changes in parental income have a differential impact on the child labor of male and female children.

Next, I analyze the equilibrium in which either the bequests or the time spent in schooling are at the corner.

3.2 Pure Son-Preference

Binding Bequest Constraints

Throughout this sub-section, I assume that the time spent in schooling is interior, $s^i > 0, \ \forall \ i = m, f$. In this case, (3.9) continues to hold. I first consider the case in which bequests to female children are at the corner, $b^m > 0, \ b^f = 0$. This case can arise, if the earnings of parents A are low and parents put a small weight on the welfare of the female children. In this case, using the first order conditions (3.1, 3.2, 3.5, and 3.6), one can easily show that

$$h_s(s^f) > h_s(s^m) = 1. \tag{3.11}$$

(3.11) shows that $s^m > s^f$. In addition, s^m continues to be at an efficient level, but s^f is inefficiently low. Given that $b^m > 0$ & $b^f = 0$, (2.9), (2.10) and (3.11) imply that $c^m > c^f$. Also, from (3.7) it follows that $l^f > l^m$ and female children work relatively more than male children compared to the unconstrained case.

Next, I consider the case in which bequests to both male and female children are at the corner $b^m,\ b^f = 0$. This case can arise, if either the earnings of parents A is low or parents put relatively less weight on the welfare of children. In this case, the first order conditions imply that

$$h_s(s^m) \ \& \ h_s(s^f) > 1. \tag{3.12}$$

Thus, for both male and female children, the time spent in schooling is inefficiently low. Given $b^m,\ b^f = 0$, (2.9) and (2.10) imply that $c^i = h(s^i)$ for $i = m, f$. Then, (3.1) and (3.8) imply that $c^m > c^f$, $s^m > s^f$ and $l^f > l^m$. Male children have higher consumption and schooling levels and lower child labor levels than female children.

Finally, in this model one cannot have $b^f > b^m = 0$. The proof is straightforward. If $b^m = 0$ and $b^f > 0$, then $h_s(s^m) > 1$ and $h_s(s^f) = 1$. Thus, $s^f > s^m$. But then it would imply that $c^m < c^f$, which contradicts (3.9).

No Schooling

Empirical evidence in many developing countries suggests that many children do not go to school. In the model, the parents can choose not to send their children to school either when the marginal return on the earnings function is too low or the bequest constraints are binding. In particular, one can show that when the bequest constraints are not binding, $b^i > 0$, then $s^i = 0$ only when $h_s(0) < 1$. This can be shown as follows.

Suppose that $b^i > 0$, then (3.1), (3.4), and (3.6) imply that

$$U_c(c^i) = -V_l(1 - l^i). \tag{3.13}$$

Since, $V_l(1 - l^i) = V_s(1 - l^i)$, for (3.3) to hold, it must be the case that

$$h_s(0) < 1. \tag{3.14}$$

Now suppose that $h_s(0) > 1$. In that case, it can be shown that $s = 0$ can occur only for the children whose bequest constraint is binding. To show this, suppose that $b^f = 0$ and $b^m > 0$. Then, for (3.3) to hold for female children, one requires that

$$U_c(c^f)h_s(0) < -V_s(1 - l^f). \tag{3.15}$$

Since $h_s(0) > 1$ by assumption, (3.15) can hold only if $U_c(c^f) < -V_s(1 - l^f)$. As $V_l(1 - l^i) = V_s(1 - l^i)$, (3.1), (3.5), and (3.6) imply that it can happen only when $b^f = 0$. This also implies that $c^m > c^f$ and $l^f > l^m$.

Similarly, one can show that if $h_s(0) > 1$ one can have $s^m = s^f = 0$ only when $b^m = 0$ and $b^f = 0$. Thus, the binding bequest constraints can lead to under-investment in human capital to the point where parents make no human capital investment. Also (3.7) implies that $l^f > l^m$. This case is quite interesting in the sense that (2.9) and (2.10) imply that $c^m = c^f$. Thus, in this particular case the son-preference does not lead to a differential level of consumption. The above analysis shows that even when the bequest or schooling constraint binds, male children have higher utility than female children, since $c^m \geq c^f$ and they have more leisure.

Proposition 3: (*Pure Son-Preference Case*)

(i) *Binding Bequest Constraints*: The time spent in schooling is inefficiently low for the children whose bequest constraint is binding. If bequests to either female children or both male and female children are at the corner, then the time spent in schooling for female children is lower than for male children, $s^f < s^m$, they consume less, $c^f < c^m$, and female children work more as child laborers, $l^f > l^m$. It is not possible to have $b^f > b^m = 0$.

(ii) *No Schooling*: If the bequest constraints are not binding, then the time spent in schooling is zero ($s^m = s^f = 0$) only if the marginal rate of return on the earnings function is very low, $h_s(0) < 1$. When the bequest constraints are binding then the time spent in schooling can be zero ($s^m = s^f = 0$) even if the marginal rate of return on the earnings function is relatively high, $h_s(0) > 1$. In the case of no schooling, female children work more than male children, $l^m < l^f$.

3.3 Pure Earnings Function Bias Towards Males

Binding Bequest Constraints

In this case, unlike the son-preference case, if the bequest constraint binds for only one type of child it must bind for male children. It cannot happen that $b^m > 0$ & $b^f = 0$. This can be shown as follows. (3.4) and (3.5) imply that this case can arise only if $c^m < c^f$. But, if $b^m > 0$ & $b^f = 0$ then $h_s^m(s^m) = 1$ and $h_s^f(s^f) > 1$, which requires that $s^m > s^f$. But then (2.9) and (2.10) imply that $c^m > c^f$, which is a contradiction.

Next, I consider the case in which $b^m = 0$ & $b^f > 0$. In this case, (3.4) and (3.5) imply that that $c^m > c^f$. The first order conditions imply that

$$h_s^f(s^f) = 1 < h_s^m(s^m). \tag{3.16}$$

(3.16) shows that the time spent in schooling for female children is at an efficient level, but the time spent in schooling for male children is inefficiently low.

(3.16) also shows that the binding bequest constraint leads to a more egalitarian distribution of human capital compared to the efficient level. The issue that whether the children with a superior earnings function can have a lower time spent on schooling (*reverse specialization*) and in particular whether they can have lower human capital has been an important issue in the literature (Horowitz and Wang 2004). The later case is known as the *absolute reverse specialization.* (3.16) shows that male children who have a superior earnings function can have a higher or a lower time spent in schooling than female children (i.e. there can be reverse specialization). But since, $c^m > c^f$, there cannot be absolute reverse specialization. Male children must have higher human capital. From (3.7) it follows that $l^m \lesseqgtr l^f$.

Next I consider the case, when both the bequest constraints are binding, $b^m = b^f = 0$. In this case, the first order conditions imply that

$$h_s^m(s^m) \;\&\; h_s^f(s^f) > 1. \tag{3.17}$$

Thus, the time spent in schooling for both male and female children is inefficiently low. In this case, (3.9) implies that $c^m \gtreqless c^f$ depending on whether $h_s^m(s^m) \lesseqgtr h_s^f(s^f)$. If the consumption of male children is higher than that of female children, the marginal rate of return on the earnings function for the male children must be higher and *vice-versa.*

(3.9) and (3.17) show that male children can have a higher or a lower consumption level than female children. This implies that there can be absolute reverse specialization. This case can arise when the gap between the earnings functions is relatively large. This result is different from the case in which the bequest constraint is binding for male children. In the case of absolute reverse specialization, (3.7) implies that $l^m > l^f$. These results are similar to ones derived by Horowitz and Wang (2004).

No Schooling

Similar to the pure son-preference case, one can show that if $b^i > 0$, $s^i = 0$ can arise only when $h_s^i(0) < 1$. In the case $h_s^i(0) > 1$, $s^i = 0$ only when $b^i = 0$. Now suppose that $b^m = 0$ & $b^f > 0$. As previously shown in this case $c^m > c^f$ and $h_s^f(s^f) = 1$. From (3.7) it follows that $l^m > l^f$. Next, I consider the case when both $b^m = b^f = 0$. In this case, since $h^m(0) > h^f(0)$, $c^m > c^f$. There cannot be absolute reverse specialization. Also (3.7) implies that $l^m = l^f$. The above analysis suggests that in the case of a binding bequest or a schooling constraint, male and female children may have different levels of utility as they have the same amount of leisure, but different levels of consumption.

Proposition 4: (*Pure Earnings Function Bias Towards Male*)

(i) *Binding Bequest Constraints*: If the bequest constraint binds for only one type of child, it must bind for male children. Male children may have a higher or a lower amount of time spent in schooling and child labor compared to female children. But there cannot be absolute reverse specialization. Male children have a higher consumption level and higher human capital. If the bequest constraint binds for both male and female children, there may be absolute reverse specialization and male children may have a lower amount of time spent in schooling and lower consumption and a higher child labor level than female children.

(ii) *No Schooling*: If the bequest constraints are not binding, then the time spent in schooling is zero ($s^m, s^f = 0$) only if the marginal rate of return on the earnings function is very low, $h_s^i(0) < 1$. When the bequest constraints are binding then the time spent in schooling can be zero ($s^m, s^f = 0$) even if the marginal rate of return on the earnings function is relatively high, $h_s^i(0) > 1$. In the case of no schooling for both male and female children, both male and female children work the same amount, $l^m = l^f$, but male children have a higher consumption level than female children, $c^m > c^f$.

A comparison of the pure son-preference case and the pure earnings functions bias towards male case reveals a number of important differences. Firstly, in the pure son-preference case, female children receive either the same amount of schooling or less schooling than male children. But, in the pure earnings function bias towards male case, female children can receive more or less schooling than male children. Secondly, in the pure son-preference case, it is always the case that male children work less than female children. But, in the case of the pure earnings function bias towards male, male children can work more or less than female children. Finally, in the pure son-preference case, male children enjoy more leisure, while in the second case both male and female children have the same amount of leisure.

3.4 Dowry

In many societies, dowries are widely prevalent. In this section, I analyze the effects of dowries on the time spent in schooling and child labor. For concreteness assume that parents have to pay a dowry for female children in the second period.[8] This case can be analyzed as follows.

Suppose that $b^f \geq M > 0$, but the lower bound for b^m continues to be zero. I only consider the case in which $b^f = M$. In this case, it is easy to show that $h_s^f(s^f) > 1$. If $b^m > 0$ then $h_s^m(s^m) = 1$. Male children will have a higher time spent in schooling and a lower level of child labor. (3.4) and (3.5) imply that in the pure earnings function bias towards male case, $c^m < c^f$. But in the pure son-preference case, the consumption of male children can be higher or lower than that of female children. (3.7) also implies that female children will be working more as child laborers relative to the efficient level. In that sense, they will be partly financing their dowry.

If $b^m = 0$, then both $h_s^m(s^m)$ & $h_s^f(s^f) > 1$. Then from (3.9), it follows that consumption and schooling of male children can be higher or lower than that of female children.

[8] The case where male children have to pay a bride-price can be analyzed in an analogous manner.

4 Children to Parents Transfer

Now I consider the case in which parents receive transfers from their children in the second period. I first consider the case in which parents receive transfers from both children, $\tau^i > 0,\ b^i = 0$ for $i = m, f$. This problem can be modeled as a two-period transfer game between parents and children. For time-consistency one needs to solve this problem recursively starting in the second period. With $\tau^i > 0,\ b^i = 0$ for $i = m, f$, the second period problem of a male child is

$$\max_{\tau^m} \frac{(1-\lambda\delta^f)[U(c^m) + V(1-l^m-s^m)] + \lambda[U(c_1^p) + U(c_2^p) + \delta^f[U(c^f) + v(1-l^f-s^f)]]}{1-\lambda(\delta^m+\delta^f)}$$

subject to budget constraints (2.9)-(2.10). The first order condition is:

$$(1-\delta^f\lambda)U_c(h^m(s^m) - \tau^m) = \lambda U_c(A + k + \tau^m + \tau^f). \tag{4.1}$$

The analogous first order condition for a female child is

$$(1-\delta^m\lambda)U_c(h^f(s^f) - \tau^f) = \lambda U_c(A + k + \tau^m + \tau^f). \tag{4.2}$$

(4.1) and (4.2) together imply that

$$(1-\delta^f\lambda)U_c(c^m) = (1-\delta^m\lambda)U_c(c^f). \tag{4.3}$$

(4.3) shows that, in the case of son-preference, $c^m > c^f$. Male children have a higher consumption level than female children. In the absence of son-preference, one has $c^m = c^f$.

Differentiating, (4.1) and (4.2) with respect to s^i and k for $i = m, f$, I have

$$\frac{d\tau^i}{ds^i} = \frac{(1-\delta^j\lambda)U_{cc}(c^i)h_s^i(s^i)}{(1-\delta^j\lambda)U_{cc}(c^i) + \lambda U_{cc}(c_2^p)} > 0,\ \forall i \neq j = m, f; \tag{4.4}$$

$$\frac{d\tau^i}{ds^j} = \frac{(1-\delta^i\lambda)U_{cc}(c^j)h_s^j(s^j)}{\lambda U_{cc}(c_2^p)} > 0,\ \forall i \neq j = m, f\ \& \tag{4.5}$$

$$\frac{d\tau^i}{dk} = -\frac{\lambda U_{cc}(c_2^p)}{(1-\delta^j\lambda)U_{cc}(c^i) + \lambda U_{cc}(c_2^p)} < 0,\ \forall i \neq j = m, f. \tag{4.6}$$

(4.4)-(4.6) show that a higher level of the time spent in schooling increases transfers by children to parents, but a higher savings level reduces the transfers by children. A higher amount of time spent in schooling increases the income and the consumption of children in the second period, which induces children to increase their transfers to parents. A rise in savings, on the other hand, increases the consumption of parents in the second period, which reduces the need for transfers from children. (4.5) shows that an increase in the time spent in schooling imposes a *positive externality* on parents. An increase in the time spent in schooling for one type of child increases transfers by the other type of child as well.

Turning to the parents' problem, they take into account the effects of their choices on transfers by children to them. Parents' problem in the first period is

$$\max_{l^m,l^f,s^m,s^f,k} \frac{\sum_{t=1}^{2} U(c_t^p) + \sum_{i=m,f} \delta^i [U(c^i) + v(1-l^i-s^i)]}{1-\lambda(\delta^m+\delta^f)}$$

subject to (2.7)-(2.10), (4.1) and (4.2).

The first order condition for l^i continues to be given by (3.1). The other first order conditions are

$$s^i : U_c(c_2^p)\left[\frac{d\tau^i}{ds^i} + \frac{d\tau^j}{ds^i}\right] + \delta^i U_c(c^i)\left[h_s^i(s^i) - \frac{d\tau^i}{ds^i}\right] - \delta^i V_s(1-l^i-s^i) =$$

$$\delta^j U_c(c^j)\frac{d\tau^j}{ds^i};\ \forall\ i \neq j = m, f; \tag{4.7}$$

$$k:\ U_c(c_1^p) + \delta^m U_c(c^m)\frac{d\tau^m}{dk} + \delta^f U_c(c^f)\frac{d\tau^f}{dk} = U_c(c_2^p)\left[1 + \frac{d\tau^m}{dk} + \frac{d\tau^f}{dk}\right]. \tag{4.8}$$

To show whether transfers by children to parents lead to efficient outcomes, one has to show that $h_s^i(s^m) = h_s^i(s^f) = 1$ solves (4.7) and (4.8). Since $V_l(1-s^i-l^i) = V_s(1-s^i-l^i)$ combining (3.1), (4.7) and (4.8), I get

$$[U_c(c_2^p) - \delta^i U_c(c^i)h_s^i(s^i)] + [U_c(c_2^p) - \delta^i U_c(c^i)]\left[\frac{d\tau^i}{dk} - \frac{d\tau^i}{ds^i}\right] =$$

$$-[U_c(c_2^p) - \delta^j U_c(c^j)]\left[\frac{d\tau^j}{dk} - \frac{d\tau^j}{ds^i}\right];\ \forall\ i \neq j = m, f. \tag{4.9}$$

Now note that (4.4) and (4.6) imply that

$$\frac{d\tau^i}{dk} - \frac{d\tau^i}{ds^i} = -\frac{\lambda U_{cc}(c_2^p) + (1 - \delta^j \lambda) U_{cc}(c^i) h_s^i(s^i)}{(1 - \delta^j \lambda) U_{cc}(c^i) + \lambda U_{cc}(c_2^p)}, \ \forall i \neq j = m, f. \tag{4.10}$$

(4.10) implies that

$$\left| \frac{d\tau^i}{dk} - \frac{d\tau^i}{ds^i} \right| \gtreqless 1 \text{ for } h_s^i(s^i) \gtreqless 1. \tag{4.11}$$

Suppose that $h_s^i(s^i) = 1$, then (4.11) implies that (4.9) can hold either when

$$U_c(c_2^p) = \delta^m U_c(c^m) = \delta^f U_c(c^f) \text{ or } \frac{d\tau^j}{dk} - \frac{d\tau^j}{ds^i} = 0. \tag{4.12}$$

But then (4.12) implies that either $b^i > 0$ for $i = m, f$, which is a contradiction or $\frac{d\tau^j}{dk} - \frac{d\tau^j}{ds^i} = 0$ (i.e. the choices of the time spent in schooling of one type of child and savings do not affect the transfers from the child of other type).

Now, I show that the time spent in schooling is not only at an inefficient level, but it is *more than* than the efficient level. Note that the right hand side of (4.9) is strictly positive. Thus, for any s^i for $i = m, f$, which solves (4.9), the left hand side of (4.9) should also be strictly positive i.e.

$$[U_c(c_2^p) - \delta^i U_c(c^i) h_s^i(s^i)] > -[U_c(c_2^p) - \delta^i U_c(c^i)] \left[\frac{d\tau^i}{dk} - \frac{d\tau^i}{ds^i} \right]. \tag{4.13}$$

Then (4.11) implies that (4.13) can hold only when $h_s^i(s^i) < 1$, for $i = m, f$. Thus, in the case of reverse transfers from both children, the time spent in schooling is inefficiently high.

The reason for the inefficiently high levels of the time spent in schooling is that its choice imposes a positive externality on parents. A higher level of time spent in schooling for one type of child not only increases transfers from that type of child but also from the other type of child. In order to increase their second period consumption and transfers from children, parents choose inefficiently high levels of time spent in schooling in the first period.

This result that reverse transfers do not lead to efficient allocations even in the case of the pure earnings function bias towards male is in contrast to results derived in Horowitz and Wang (2004). They show that in a model with a pure earnings function bias towards male, $h_s^m(s^m) = h_s^f(s^f)$ and claim that reverse transfers lead to efficiency (see their equation 19 on pp. 639 and the discussion following that). However, the efficiency condition has two parts. Not only should the marginal returns on the earnings function be equalized, but also they should be equal to one.[9] Horowitz and Wang (2004) also ignore the effects of choice of k on reverse transfers (see their equation 16 on pp. 639).

One can show that in the pure earnings function bias towards male case, $h_s^m(s^m) = h_s^f(s^f)$. Using (3.7) and the condition that $V_s(1 - l^i - s^i) = V_l(1 - l^i - s^i)$, (4.7) can be written as

$$u_c(c_2^p)\left[\frac{d\tau^m}{ds^m} + \frac{d\tau^f}{ds^m} - \frac{d\tau^f}{ds^f} - \frac{d\tau^m}{ds^f}\right] + \delta^m U_c(c^m)\left[h_s^m(s^m) - \frac{d\tau^m}{ds^m} + \frac{d\tau^m}{ds^f}\right]$$

$$-\delta^f U_c(c^f)\left[h_s^f(s^f) - \frac{d\tau^f}{ds^f} + \frac{d\tau^f}{ds^m}\right] = 0. \tag{4.14}$$

Now in the pure earnings function bias towards male case, $\delta^m = \delta^f = \delta$ and (4.3) implies that $c^m = c^f$. Then using (4.4) and (4.5), (4.14) can be written as

$$(U_c(c_2^p) - \delta U_c(c^m))(1-\delta\lambda)U_{cc}(c^m)[h_s^m(s^m) - h_s^f(s^f)]\left[\frac{1}{(1-\delta\lambda U_{cc}(c^m) + \lambda U_{cc}(c_2^p)} + \frac{1}{\lambda U_{cc}(c_2^p)}\right]$$

$$= \delta U_c(c^m)[h_s^m(s^m) - h_s^f(s^f)]. \tag{4.15}$$

(4.15) is satisfied when $h_s^m(s^m) = h_s^f(s^f)$ as in Horowitz and Wang (2004). However, as discussed earlier despite this equality, the time spent in schooling remains inefficiently high. From (3.7) and (4.3) it also follows that in the reverse transfer case since $s^m > s^f$, $c^m = c^f$, $l^m < l^f$, and $\tau^m > \tau^f$. Male children work less than female children and transfer more to parents.

In the case of pure son-preference, it is easy to show that $h_s(s^m) = h_s(s^f)$ does not solve (4.14). However, due to very complex expressions, I am not

[9] As mentioned in footnote 2, there are differences between Horowitz and Wang's (2004) model and the model developed in this paper. However, these differences are not the cause of divergence of results.

able to derive the conditions under which $h_s(s^m) > h_s(s^f)$ or $h_s(s^m) < h_s(s^f)$. It is possible to have $s^m \gtreqless s^f$ and $l^m \gtreqless l^f$.

Proposition 5: (*Reverse transfers from both children to parents*)

(i) The time spent in schooling by children is inefficiently high, $h_s^i(s^i) < 1$ for both $i = m, f$.

(ii) In the case of the pure earnings function bias towards male, $h_s^m(s^m) = h_s^f(s^f)$, $s^m > s^f$, $c^m = c^f$, $l^m < l^f$, and $\tau^m > \tau^f$.

Now, I consider the case in which parents receive transfers only from the jth type of children, $b^i > 0$ and $\tau^j > 0$. As discussed earlier, in the pure son-preference case $i = m$ and in the pure earnings function bias towards male case, $i = f$. The second period budget constraint for parents is given by: $c_2^p = A + k + \tau^j - b^i$. The first order condition for the transfer from the jth child is modified to

$$(1 - \delta^i \lambda) U_c(h^j(s^j) - \tau^j) = \lambda U_c(A + k - b^i + \tau^j). \tag{4.16}$$

Using (4.16), one can derive

$$\frac{d\tau^j}{ds^j} = \frac{(1 - \delta^i \lambda) U_{cc}(c^j) h_s^j(s^j)}{(1 - \delta^i \lambda) U_{cc}(c^j) + \lambda U_{cc}(c_2^p)} > 0 \ \& \tag{4.17}$$

$$\frac{d\tau^j}{dk} = -\frac{\lambda U_{cc}(c_2^p)}{(1 - \delta^i \lambda) U_{cc}(c^j) + \lambda U_{cc}(c_2^p)} = -\frac{d\tau^j}{db^i} < 0. \tag{4.18}$$

(4.18) shows that an increase in k and reduction in b^i reduces transfers from the jth child to parents.

The parental problem in the first period is to choose $l^m, l^f, s^m, s^f, b^m,$ & k to maximize their utility subject to (2.7)-(2.10), and (4.16). The optimal choices of l^m, l^f, s^i continue to be given by (3.1) and (3.2). The other first order conditions are

$$b^i: \ U_c(c_2^p) \left[1 - \frac{d\tau^j}{db^i} \right] = \delta^i U_c(c^i) - \delta^j U_c(c^j) \frac{d\tau^j}{db^i}; \tag{4.19}$$

$$s^j: -\delta^j V_s(1 - l^j - s^j) + U_c(c_2^p) \left[\frac{d\tau^j}{ds^j} \right] = \delta^j U_c(c^j) \left[\frac{d\tau^j}{ds^j} - h_s^j(s^j) \right]; \tag{4.20}$$

$$k: \; U_c(c_1^p) + \delta^j U_c(c^j)\frac{d\tau^j}{dk} = U_c(c_2^p)\left[1 + \frac{d\tau^j}{dk}\right]. \qquad (4.21)$$

Using (3.1), (4.18), (4.19) and (4.21), one can derive

$$\delta^i U_c(c^i) = U_c(c_1^p). \qquad (4.22)$$

Then, (3.1) and (3.2) imply that $h_s^i(s^i) = 1$. Thus, the time spent in schooling for the *ith* child continues to remain at the efficient level. Turning to the time spent in schooling for the *jth* child, combining (3.1), (4.20) and (4.21) I have,

$$U_c(c_2^p)\left[1 + \frac{d\tau^j}{dk} - \frac{d\tau^j}{ds^j}\right] = \delta^j U_c(c^j)\left[h_s^j(s^j) + \frac{d\tau^j}{dk} - \frac{d\tau^j}{ds^j}\right]. \qquad (4.23)$$

Now, note that (4.17) and (4.18) imply that $\frac{d\tau^j}{dk} - \frac{d\tau^j}{ds^j} = -1$, when $h_s^j(s^j) = 1$. Then, for $U_c(c_2^p) > \delta^j U_c(c^j)$ (4.23) implies that $h_s^j(s^j) = 1$. Thus, reverse transfer from the *jth* child leads to the efficient choice of the time spent in schooling for the *jth* child by parents.

Proposition 6: In the case $b^i > 0$ and parents receive transfers from the *jth* type of child in the second period, $\tau^j > 0$, the time spent in schooling for both male and female children is characterized by $h_s^m(s^m) = h_s^f(s^f) = 1$ and the economy achieves efficient allocations.

The reason that the reverse transfer from the *jth* child leads to efficient outcomes is that the choice of the time spent in schooling no longer imposes a positive externality on parents ($\frac{d\tau^m}{ds^f} = 0$). In addition, savings by parents only affect transfers by the *jth* type of child. In essence, if one looks at equation (4.9), one has $\frac{d\tau^m}{dk} - \frac{d\tau^i}{ds^j} = 0$, when $b^i > 0$ and $\tau^j > 0$. Thus, (4.9) is satisfied for the *jth* type of child, when $h_s^j(s^j) = 1$. The above analysis suggests that in the case of gender bias reverse transfers may not lead to efficient allocations and there is a scope for policy interventions in poor countries.

5 Empirical Evidence

In this section, I empirically examine the relative importance of the two types of gender biases in explaining the gender differentials in child labor. I focus on their effects on the time allocated to leisure (equation 3.7 and Proposition 1). The theoretical model predicts that other things remaining the same, if there is a son-preference female children will have less leisure time compared to male children. On the other hand, in the absence of son-preference (or weak son-preference), there should not be any significant difference between leisure time enjoyed by male and female children. I focus on this implication for a variety of reasons. Firstly, this implication is robust to whether bequest or schooling constraints are binding or not. Secondly, it is difficult to obtain data on bequests and reverse transfers.

5.1 Data and Estimation Method

The data are drawn from the rural samples of the Bangladesh Multiple Indicator Cluster Survey (MICS) for 2005-2006. This survey was conducted in 2005 during the June-October period. Bangladesh is a patriarchal society and is known for a strong son-preference (Williamson 1976, Islam 1979). The gender bias against women in Bangladesh is well-documented (e.g. Islam 1979, Kabeer 2003). Empirical evidence suggests that female children have less access to schooling and their quality of education are low on average compared to male children (Kabeer 2003) and they face discrimination in the allocation of food and health expenditure (Chen et. al. 1982). The labor market is gender segregated and women are expected to work at home, while men are expected to be primary bread-winers (Islam 1979, Kabeer 2003). Women in paid employment in both rural and urban areas receive significantly lower wages than men even in the same occupations (e.g. Akter 2005, Ahmed and Mitra 2010).

The Bangladesh MICS is a nationally representative survey conducted by the Bangladesh Bureau of Statistics and Planning in collaboration with the UNICEF. This survey was especially designed to monitor the situation of children and women and is widely used by researchers and policy-makers. It provides detailed information on the employment activities of children aged 5-14 years and the time allocated to various employment activities. The employment activities include household chores, working in the household farms and businesses as well as working for outsiders (paid or unpaid).

One short-coming of this data-set is that it has limited information on schooling. In particular, it does not provide data on the number of hours spent in schooling by children. It only provides data on the number of days a child attends school in the survey week. Given the number of hours of schooling differ across grades and regions, large scale abseentism by teachers, and school-attendance not being compulsory, it is very difficult to generate a reliable number of hours spent in schooling by children from the available data.[10] In addition, this survey does not provide information on many important factors affecting schooling decision such as the quality of schools, the direct cost of attending school, etc.

Given these data limitations, I restrict my sample to children who do not attend school.[11] My sample consists of 11,395 children aged 5-14 years with 6515 boys and 4880 girls. For this set of children, (3.7) implies that if there is a son-preference female children should work more than male children. The bias in the earnings function towards male should not affect the gender differential in child labor.

To examine the relative significance of these two types of gender bias, I estimate the following regression model.

$$H^j = \alpha^j + \beta^j X^j + \xi^j, \text{ for j} = \text{m}, \text{f} \tag{5.1}$$

where H is the vector of the number of hours worked in the survey week by children, α is the estimated constant term, X is the matrix of various explanatory variables, and β is the associated co-efficient vector. ξ is the error term and is assumed to be normally distributed.

(5.1) is estimated separately for male and female children. The separate estimation is done for two reasons. Firstly, theoretical models suggest that explanatory variables are expected to have differential effects on the child labor of male and female children (see below). Secondly, empirical literature suggests that pooling male and female children data leads to an aggregation bias, which attenuates the effects of explanatory variables on child labor (e.g. Bhalotra and Heady 2003, Bhalotra 2007, Emerson and Souza 2007). Since for many children, the reported number of child labor hours is zero, a Tobit estimator is used to estimate (5.1). Then, I test the null hypothesis of

[10] These problems also apply to other publicly available micro data-sets such as the World Bank Living Standard Measure surveys or UNICEF's Demographic and Health surveys. Due to the non-availability of data on the number of hours spent on the schooling, most of the studies on schooling focus on the school participation decision (see discussion by Orazem and King 2007).

[11] This raises sample selection issue as these children may belong to very poor household or have low educational ability or do not have access to good quality schools and thus may not be representative of the general population.

$\alpha^m = \alpha^f$ against the alternative of $\alpha_m < \alpha_f$ using $t - statistics$ under the assumption that these two samples are independently drawn.

Tables 1 and 2 below provide the summary statistics of the number of children (5-14 years), number of hours worked, and the labor force participation rate (LFPR) by the children who were not attending school in the survey week and also did not attend school any day in the year 2004-05.

Table 1 shows that that the LFPR for female children (61.7%) was higher than that of male children (56.4%). Table 2 below provides the summary statistics for the number of hours worked by children by gender.

Table 2 shows that the average number of hours worked by male children (14.79 hours) in the survey week was higher than that of female children (10.46 hours). However, the median hours worked by female children (5 hours) were higher than that of male children (4 hours).

5.2 Explanatory Variables

Explanatory variables include child-specific characteristics, household-specific characteristics, and regional and seasonal characteristics. These variables are suggested by the model developed in this paper and the existing literature, and are widely used. Among child-specific characteristics, I include age, age-squared (age^2), and previous educational attainment (Years-School). Age captures the birth-order effect, with the older children expected to work more than the younger children. Educational attainment is used as it affects the availability of opportunities to work. It may have a differential effect on male and female children, if the labor market is segregated across gender. In particular, it may increase the work opportunities of male children more than that of female children if female children face restrictions in working outside home. The adult altruism may depend on the relationship of the child to the household head. There is evidence that adult altruism has a genetic basis. To capture these differences in preferences, I include a dummy for the relationship with the household head (Others), where this dummy takes a value of 0 if a child is either the son or daughter, nephew or niece, or grandchild of the household head and 1 for other relatives.

Among household-specific characteristics, I include education levels of the father (Father-Edu) and the mother (Mother-Edu) and whether the father (Father-Stay) or mother (Mother-Stay) lives in the household. The inclusion of these variables allows for the relaxation of the common preference assumption of parents implicit in the unitary household framework. Theoretical and empirical literature suggests that the educational levels of the father and mother have differential effects on child labor. The father's and mother's educational levels may reflect their relative bargaining power in the household decision making. Also it has been argued that fathers generally have a greater say in the decisions about sons and mothers have a greater say in the decisions about daughters. I include Father-Stay and Mother-Stay as explanatory variables as the roles and responsibilities of men and women can be quite distinct in a household, particularly in the developing countries. Women are expected to be home-makers and work inside home, while men are expected to be bread-winners and work outside home. These gender differences in activities may also get reflected in the division of labor among male and female children. In the case the father does not stay at home, sons may be expected to take up his roles and responsibilities. Similarly, if the mother does not stay at home, daughters may be expected to take up her roles and responsibilities. In the regression results, I provide a test of whether these variables have a differential impact on the child labor of male and female children.

The other household characteristics which are included are the ownership of assets of the household (Wealth), the household size (HH-Size), and the number of children under age five (Child< 5). The MICS data does not provide information on the earnings of adults. It provides a wealth score for each household which is based on the principal component analysis of the different kinds of assets owned by the households. The score is normalized such that the mean is zero and the standard deviation is one. I use the wealth score as a proxy for the earnings of adults. A higher wealth score is expected to have a negative effect on child labor. However, wealth is not an exogenous variable and the earnings of children contribute to household wealth. In that case, one may get a positive correlation between wealth and child labor. In addition, in the case of an imperfect labor market, wealth - particularly ownership of land - can have a positive impact on child labor (Bhalotra and Heady 2003, Basu et. al. 2010). The household size reflects the available pool of family labor and affects the incentive to put children to work. It is expected to have a negative effect on child labor. The presence of children under five increases the need for child care and may also reduce the availability of the mother for other labor activities. This is likely to increase the demand for child labor.

In many households, fetching water is one of the most important household chores. The presence of a drinking water source in the household is likely to reduce child labor. The MICS data provide information on whether a household has a water connection. I include a dummy for the households which receive piped water. Child labor and its gender differentiation may also depend on cultural and social norms. To capture this aspect, I include dummy to indicate the religion of the household head (Muslim).

Apart from child and household specific characteristics, I also include dummies for regions. Bangladesh is divided into six regions: Barisal (Region1), Chittagong (Region2), Dhaka (Region3), Khulna (Region4), Rajshahi (Region5), and Sylhet (Region6). Region6 is treated as the base. As the MICS data was collected over five months (June, July, August, September, and October), to capture any seasonal effects I include dummies for different months with October treated as the base month. Tables A1 and A2 in the appendix provide summary statistics of the explanatory variables for male and female children respectively.

5.3 Regression Results

Table 3 presents the estimated results with the limited set of explanatory variables and a test of the difference between the average number of hours worked by male and female children. Columns 2 and 3 show the unconditional average number of hours worked by male and female children respectively. It shows that male children worked less (3.35 hours) compared to female children (4.65 hours).[12] The $t-statistics$ shows that the difference is statistically significant at a 1% level of significance. In columns 4 and 5, I add child-specific characteristics. Again the results show that female children work more than male children and the difference is statistically significant.

Table 4 reports regression results based on the full set of explanatory variables. The results show that female children work more than male children and the difference is statistically significant. The regression results suggest that son-preference is potentially an important factor in explaining the gender differential in child labor in rural Bangladesh.

These results, however, can alternatively be interpreted as reflecting differences in the ability to work of male and female children or the differential rates of return from working. These alternative interpretations, though, require that female children on average have a greater ability to work than male children or the marginal rate of return on their labor is higher than

[12]The unconditional means reported in Table 2 are based on the OLS regression.

that of male children. There is no reason to believe that either is the case.

Table 4 brings out other very interesting aspects of gender differences in child labor. In particular, it suggests that the educational levels of the mother and father and whether the mother and father live in the household have differential effects on male and female child labor. The education level of the father significantly reduces the child labor of both male and female children. But the education level of the mother significantly reduces the child labor of only male children. The F-statistics suggests that the education levels of the mother and father have a significantly different effect on the child labor of female children. The result that the educational level of the mother has an insignificant effect on the child labor of female children is different from ones obtained in previous studies (Bhalotra and Heady 2003, Bhalotra 2007, Emerson and Souza 2007). The main reason is that mothers in our sample are largely illiterate and there is not much variation in their educational level.

Results suggest that if the father lives in the household, it has a significantly negative effect on child labor for both male and female children. But, if the mother lives in the household, it significantly reduces child labor for female children only. It has an insignificant effect on child labor for male children. The F-statistics suggests that whether the mother and father live at home has a significantly different effect on child labor for male children but not for female children. This result is consistent with the view that there is a gender differentiation in the roles and responsibilities of male and female children.

Previous years of schooling have a positive effect on child labor for both male and female children. But it is significant only for male children. This may be due to the fact that females face restrictions in working outside the home in Bangladesh. Thus, schooling increases the opportunities to work for male children relatively more than for female children. Religion also has a differential effect on child labor. It has a significant negative effect on child labor for female children but it has an insignificant effect on the child labor for male children.

Regression results show that age, number of children under five years, and other relatives have a significant positive effect on the child labor of both male and female children. Age-squared, household-size, and connection to piped water have a significant negative effect on the child labor of both male and female children. Wealth has a positive but insignificant effect on the child labor of both male and female children. This result is similar to many studies who find that wealth has an insignificant effect on child labor.

As discussed earlier, it may be due to the endogeneity of wealth (see Bhalotra 2003, Edmonds 2007 for a review).

So far, I have discussed the effects of various explanatory variables on the latent variable. Table 5 presents the marginal effects of changes in the explanatory variables on the observed levels of child labor, where marginal effects are evaluated at the means of explanatory variables.

Table 5 shows that the observed child labor goes up substantially with age. An additional year of age leads to 4.99 hours of additional child labor for male children and 4.20 hours for female children. The results show that having access to piped water can substantially reduce child labor for both male and female children. Male children living in a household with piped water on average worked 8.16 hours less compared to male children living in a household without a water connection. The corresponding figure for female children is 5.94 hours. Both male and female other relatives work significantly more hours than direct relatives.

6 Conclusion

In this paper, I developed a model with bilateral altruism to analyze the effects of gender bias on the gender differentials in child labor, schooling, and efficiency. I find that the effects of gender bias depend on both its form as well as whether parents can give bequests or not. When parents can give bequests, both male and female children receive an equal amount of schooling, but female children work more than male children in the son-preference case. But, in the case of an earnings function bias, not only do male children receive more schooling than female children, but also work less. When parents cannot give bequests, in the son-preference case male children receive more schooling than female children and work less. However, in the case of the earnings function bias towards male, male children can receive more or less schooling than female children and can also work more or less than female children. In the son-preference case time allocated to leisure for female children is lower than for male children. But in the case of earnings function bias towards male, both male and female children enjoy same amount of leisure. Finally, regarding efficiency, allocations are efficient when parents can give positive bequests. When parents cannot give bequests to one or both of the children, child labor is inefficiently high and schooling is inefficiently low for children who do not receive bequests. In this model, reverse transfer by children to parents does not solve the inefficiency problem, when parents receive transfers from both children in the second period. Empirical evidence from rural Bangladesh suggests that son-preference is an important factor in explaining the observed gender differential in child labor.

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Table 1
Child Labor

	No. of Children	No. of Child Labor	LFPR(%)
Male	6515	3676	56.4
Female	4880	3012	61.7
Total	11395	6688	58.69

Table 2
Child Labor Hours

	Mean	Median	s.d.	Max	Min
Male	14.79	4.00	22.44	162	0
Female	10.46	5.00	14.57	114	0
Total	12.94	4.00	19.58	162	0

Table 3
Regression Results: Parsimonious Model
Dependent Variable: Child Labor Hours

Explanatory Variables	Male	Female	Male	Female
Constant (α_i)	3.3460*	4.6450*	-82.8813*	-52.4025*
	(0.47)	(0.86)	(4.32)	(2.94)
Age			12.9239*	9.7471 *
			(0.99)	(0.69)
Age^2			-0.3544*	-0.3196*
			(0.05)	(0.37)
Years-School			0.7635*	0.1174
			(0.23)	(0.17)
Others			17.9200*	15.4967*
			(2.76)	(2.05)
Pseudo R^2	0.00	0.00	0.08	0.10
Sample Size	6515	4880	6515	4880
Censored Observations	2839	1868	2839	1868
Log-Likelihood	-20289.74	13597.59	-18608.57	-13489.81
$\alpha_m = \alpha_f$	2.31(0.01)[a]		5.23(0.00)[a]	

[a] t-statistics(p-value against one-sided alternative)

Note:

1. White-Huber heteroskedastic consistent errors are reported in brackets.
2. $*$, $**$, and $***$ indicate a 1%, 5%, and 10% level of significance respectively for a two-tailed test.

Table 4
Regression Results: Full Model
Dependent Variable: Child Labor Hours

Explanatory Variables	Male	Female
Constant (α_i)	-62.0715 (5.46)*	-34.226 (3.51)*
Age	12.4708 (0.99)*	9.6793(0.68)*
Age^2	-0.3299(0.05)*	-0.3094(0.04)*
Years-School	0.8358(0.23)*	0.2286(0.17)
Others	20.8316(3.43)*	13.2735(2.37)*
Father-Stay	-3.8489(1.62)**	-2.5745(1.11)**
Mother-Stay	1.3330(1.78)	-2.6575(1.17)**
Father-Edu	-0.4877(0.28)***	-0.746(0.18)*
Mother-Edu	-0.7776(0.32)*	-0.0631(0.20)
Wealth	0.2699(1.00)	0.7271(0.64)
HH-Size	-1.2817(0.20)*	-1.2513(0.13)*
Child(< 5)	2.5593(0.56)*	3.0022(0.34)*
Piped	-20.3960(8.03)*	-13.7975(5.40)*
Muslim	1.3251 (1.3177)	-3.0467(0.81)*
Pseudo R^2	0.09	0.10
Sample Size (Censored Observations)	6515 (2839)	4880 (1868)
Log-Likelihood	-18503.14	-13351.83
$\alpha_m = \alpha_f$	4.29(0.00)[a]	
Father-Stay = Mother-Stay	3.90(0.05)[b]	0.01(0.92)[b]
Father-Edu = Mother-Edu	0.34(0.56)[b]	4.22(0.04)[b]

[a] t-statistics(p-value against one-sided alternative)
[b] F-Statistics(p-value against two-sided alternative)
Note:

1. White-Huber heteroskedastic consistent errors are reported in brackets.
2. $*$, $**$, and $***$ indicatea 1%, 5%, and 10% level of significance respectively for a two-tailed test.
3. Regressions include regional and month dummies (not reported).

Table 5
Marginal Effects Conditional on Being Uncensored

Independent Variables	Male	Female
Age	4.99	4.20
Age^2	-0.13	-0.13
Years-School	0.33	0.10
Others	8.33	5.70
Father-Stay	-1.54	-1.08
Mother-Stay	0.53	-1.16
Father-Edu	-0.20	-0.31
Mother-Edu	-0.31	-0.03
Wealth	0.11	0.33
HH-Size	-0.51	-0.55
Child(< 5)	1.02	1.29
Piped	-8.16	-5.94
Muslim	0.53	-0.86

Note: Marginal effects are evaluated at the means of independent variables.

Table A1
Summary Statistics of Explanatory Variables: Male

	Mean	Median	s.d.	Max	Min
Age	9.17	9	3.44	14	5
Years-School	1.30	0.00	2.06	10	0
Others	0.02	0.00	0.14	1	0
Father-Stay	0.86	1	0.34	1	0
Mother-Stay	0.94	1	0.24	1	0
Father-Edu	1.66	0	2.02	5	0
Mother-Edu	0.92	0	1.45	5	0
Wealth	-0.50	-0.62	0.46	3.63	- 1.05
HH-Size	6.06	6	2.21	34	2
Child(< 5)	0.61	0	0.76	5	0
Piped	0.001	0	0.04	1	0
Muslim	0.91	1	0.28	1	0
Region1	0.08	0	0.28	1	0
Region2	0.21	0	0.40	1	0
Region3	0.28	0	0.45	1	0
Region4	0.12	0	0.32	1	0
Region5	0.22	0	0.41	1	0
June	0.11	0	0.31	1	0
July	0.32	0	0.47	1	0
August	0.35	0	0.48	1	0
September	0.18	0	0.39	1	0

Note:

1. Years-School ranges from 0 to 10, with 0=no schooling, 10= 10 years of schooling.

2. Parent's education ranges from 0 to 5 with 0 = None, 1= Primary Incomplete, 2= Primary Complete 3=Secondary Incomplete, 4= Secondary Complete, 5= Higher Than Secondary

Table A2

Summary Statistics of Explanatory Variables: Female

	Mean	Median	s.d.	Max	Min
Age	8.69	7	3.52	14	5
Years-School	1.29	0.00	2.18	10	0
Others	0.03	0.00	0.15	1	0
Father-Stay	0.85	1	0.36	1	0
Mother-Stay	0.92	1	0.28	1	0
Father-Edu	1.70	0	2.04	5	0
Mother-Edu	1.00	0	1.51	5	0
Wealth	-0.47	-0.61	0.51	3.25	- 1.08
HH-Size	6.12	6	2.24	28	2
Child(< 5)	0.69	1	0.78	5	0
Piped	0.002	0	0.05	1	0
Muslim	0.89	1	0.31	1	0
Region1	0.09	0	0.28	1	0
Region2	0.22	0	0.42	1	0
Region3	0.28	0	0.45	1	0
Region4	0.10	0	0.30	1	0
Region5	0.19	0	0.40	1	0
June	0.11	0	0.31	1	0
July	0.34	0	0.47	1	0
August	0.35	0	0.48	1	0
September	0.17	0	0.38	1	0

Note:

1. Years-School ranges from 0 to 10, with 0=no schooling, 10= 10 years of schooling.

2. Parent's education ranges from 0 to 5 with 0 = None, 1= Primary Incomplete, 2= Primary Complete 3=Secondary Incomplete, 4= Secondary Complete, 5= Higher Than Secondary