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Gender Bias and Child Labor in LDCs

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Abstract

Empirical evidence suggests that girls work more than boys as child labor. In this paper, we develop a model to analyze the causes and consequences of the gender differentials in child labor. In particular, we analyze the effects of gender bias on child labor. We find that when parents can give strictly positive bequests to both boys and girls, *son preference* on its own does not lead to gender differential in child labor. Only when parents cannot give bequests, girls work more than boys as child labor. On the other hand, if there are *gender differences in earnings functions*, then children with superior earnings function work less than children with inferior earnings function. Our analysis shows that not only the existence of gender bias, but also its form is important for gender differentials in child labor.

Keywords: gender differential in child labor, gender bias, efficiency, bequests, human capital

JEL Classifications: J22, I20, D60

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Empirical evidence suggests that girls work more than boys as child labor. In this paper, we develop a model to analyze the causes and consequences of the gender differentials in child labor. In particular, we analyze the effects of gender bias on child labor. We find that when parents can give strictly positive bequests to both boys and girls, *son preference* on its own does not lead to gender differential in child labor. Only when parents cannot give bequests, girls work more than boys as child labor. On the other hand, if there are gender differences in earnings functions, then children with superior earnings function work less than children with inferior earnings function. Our analysis shows that not only the existence of gender bias, but also its form is important for gender differentials in child labor.

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1 Introduction

The issue of child labor has received a great deal of attention from both researchers and policy makers. Child labor is an important issue with 15.8 percent of the world's 5-14 year old children economically active in 2004 (IPEC 2006). The incidence of child labor is much higher in developing countries.

The labor force participation by children and number of hours worked tend to differ significantly by gender. Edmonds and Pavcnik (2005) using UNICEF MICS (Multiple Indicator Cluster Survey) data for thirty-six countries find that the incidence of child labor for girls (72.1 percent) is much higher compared to boys (64.8 percent).¹ They also find that girls are more likely to work long hours than boys. Their calculation shows that 22.1 percent of girl worked 20 hours or more per week. The corresponding percentage for boys was 19.4 percent.

Allais (2009) using SIMPOC survey data for sixteen countries finds similar evidence. His calculation shows that the incidence of child labor (including domestic work) was 62 percent and 72 percent percents respectively for boys and girls aged 5-14 years in 2006. Girls worked 32.1 hours per week on average, while boys worked 29 hours per week.

There is a large literature which documents the existence of gender bias. The gender bias may take the form of the parental gender bias, favoring children of particular gender, or the discrimination in labor market, or the differential cost of acquiring human capital. There is substantial empirical evidence for these forms of gender bias.

Empirical evidence suggests that son preference (parental gender bias in favor of sons), is quite wide-spread in many regions of the world (Williamson 1976, Boserup 1980, Behrman 1988). There is also a large empirical literature which shows significant gender wage gap between male and female workers of similar attributes (Oaxaca 1976, Birdsall and Sabot 1985). In addition, there is substantial evidence that girls in developing countries have significantly less accessibility to schools compared to boys (Lloyd et. al. 2005, World Bank 2009).

In this paper, we develop a model in which children differ in terms of their gender, which allows us to analyze the causes and consequences of gender

¹Child 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).

differentials in child labor. We extend the model of Baland and Robinson (2000), which is widely used to analyze the effects of savings and bequests on child labor. Baland and Robinson (2000) develop a two-period model in which parents are altruistic. Parents' utility depends not only on their own consumption, but also on the utility enjoyed by their children. Parents choose levels of child labor, bequests and savings to maximize their own utility, where bequests and savings are constrained to be non-negative. In the model, parents face a trade-off between child labor and human capital acquisition for their children. A higher level of child labor in the first period leads to a lower level of human capital (earnings opportunities) in the next period.

To introduce gender bias, we make two important departures from their model.² First, we assume that each family has two types of children: sons and daughters. Parents are altruistic, but they may put more weight on the utility of their sons. Secondly, sons and daughters may have differential earnings (human capital) functions. We analyze three versions of models. In the first version, we assume that parents put more weight on the utility of their sons, but sons and daughters have identical earnings functions. We call it *pure son preference case*. In the second version, we assume that parents put identical weights on the utilities of their sons and daughter, but sons and daughters have differential earnings functions. We call it *pure earnings differential case*. In the third version, we combine the first two cases. We call it the *mixed case*.

Our analysis shows that the form of gender bias and the ability of parents to leave bequests have important implications for the gender differential of child labor. When the bequests and savings constraints are not binding (unconstrained equilibrium), parents choose identical levels of child labor for sons and daughters in the pure son preference case. Preference for sons on its own does not lead to gender differential in child labor. Rather it results in a higher level of consumption and bequests for sons.

On the other hand, in the case of pure earnings differential, children with superior earnings function have lower child labor and lower bequests. But sons and daughters have identical levels of consumption. In the mixed case, children with superior earnings function have lower child labor and sons have

²In this paper, we only analyze models with one-sided altruism (from parents to children). The analysis of models with bilateral altruism between parents and children is left for future research.

higher consumption.

When bequests are at the corner (for one or both children), then pure son preference leads to gender differentials in child labor. In particular, in this case sons have lower child labor than daughters. In the pure earnings differential case, the results are ambiguous with regard to gender differentials in child labor. In the case of binding bequest constraints, children with superior earnings function can have higher or lower child labor compared to children with inferior earnings function.

The issue that whether children with superior earnings function can have higher or lower child labor and, in particular, whether they can have lower human capital has been an important issue in the literature (Horowitz and Wang 2004). The latter case is known as *absolute reverse specialization*. Our analysis shows that the occurrence of absolute reverse specialization depends on whether bequest constraint is binding for one type of children or both. In the pure earnings differential case, the absolute reverse specialization can occur only when bequest constraints are binding for both types of children. In the mixed case, the absolute reverse specialization can arise for daughters, when bequest constraints are binding only for them but not for sons.

Regarding efficiency, allocations are efficient in the unconstrained equilibrium. In the constrained equilibrium in which bequest constraints bind, but not the savings constraint, child labor is inefficiently high for the children for whom bequest constraints are binding. When savings constraint bind, then the child labor allocation is inefficiently high for both types of children regardless of whether bequest constraints bind or not. We also find that savings affect the levels of child labor, but not their gender differential.

Our analysis has several important policy implications. Firstly, we find that a higher public investment in schooling and a greater provision of scholarships for studying reduce the incidence of child labor. A lower interest rate has the similar effect. In the case where child labor is inefficiently high, partial banning of child labor improves welfare, provided the government can impose differential levels of child labor. Income transfers to poor families can also reduce the incidence of child labor, particularly for girls. Finally, affirmative action in favor of women and policies designed to eliminate labor market discriminations can reduce the incidence of child labor for girls.

Our paper is related to Horowitz and Wang (2004), who study the issue of efficiency of child labor in a model in which children differ in terms of their ability (talent) to acquire human capital. Their model is similar to our model of pure earnings differential. However, they do not analyze the case of pure

son preference and also the mixed case. In addition, they only analyze the case in which either bequest constraints are binding for all children or they are non-binding for all. Our analysis shows that whether bequest constraints are binding for all children or particular type have important implications for child labor. Finally, they do not analyze the case in which saving constraints bind.

The remainder of this paper is structured as follows. Section 2 presents our model. Section 3 analyzes the unconstrained case in which bequest and savings are non-binding. Section 4 analyzes the constrained case in which either bequests constraints or savings constraint or both are binding. Section 5 discusses the policy implications and Section 6 concludes.

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 son and one daughter. Parents and children live for both periods. Parents are altruistic, but they may prefer sons over daughters. Parents discount future by discount rate $0 < \beta < 1$. Parents are endowed with A units of labor in each period. Throughout the paper, we measure labor in efficiency units.

Firms produce goods using labor. They hire labor in a competitive labor market. Assume that firms have linear technology. Linear technology and competitive labor market imply that wages (marginal product of labor) per efficiency unit of labor are constant. We 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 either for work or acquisition of human capital. The acquisition of human capital in the first period increases labor endowment of children in efficiency units or earnings in the next period. Let l^m and l^f be the labor supplied by son and daughter respectively. Assume that the human capital acquired by children next period or their earnings function depends on time spent acquiring human capital, $e^i \equiv 1 - l^i$. The earnings/human capital function is assumed to be strictly increasing and concave:

$$h^i(e^i) \equiv h^i(1 - l^i), \text{ for } i = m, f. \quad (1.1)$$

The earnings function for sons and daughters may be different. This difference may arise due to labor market discriminations, differential access to schools, differential quality of schools etc. For future use, a child, i , is said to have superior earnings opportunity than child, j , if for any $l^i = l^j$, $h^i(1 - l^i) > h^j(1 - l^j)$ and $h_e^i(1 - l^i) > h_e^j(1 - l^j)$. Thus a child with superior earnings opportunity has higher total as well as marginal return on time spent acquiring human capital.

The household decisions are made by parents. The parents choose their consumption, c_t^p , child labor for both children, l^m , and, l^f , and savings, s . We assume that capital markets are imperfect, so that parents cannot borrow against their future income, i.e., $s \geq 0$. In addition, parents can also give bequests, $b^i \geq 0$ for $i = m, f$, to their children. Let R be the rate of return on savings. Let the parental inter-temporal utility function be

$$U(c_1^p) + \beta[U(c_2^p) + \delta^m W(c^m) + \delta^f W(c^f)] \quad (1.2)$$

where functions U and W are period utility functions of parents and children respectively. Both functions U and W are twice continuously differentiable, strictly increasing, and concave. Parameters $0 < \delta^i < 1$ for $i = m, f$ measure the degree of altruism. We assume that $\delta^m \geq \delta^f$. In the case of son preference, we assume that $\delta^m > \delta^f$, which captures the idea that parents care more about the welfare of son than daughter.

The budget constraints faced by parents are

$$c_1^p + s = A + l^m + l^f; \quad (1.3)$$

$$c_2^p + b^m + b^f = A + Rs; \quad (1.4)$$

$$c^m = b^m + h^m(1 - l^m); \quad (1.5)$$

$$c^f = b^f + h^f(1 - l^f). \quad (1.6)$$

The parental optimization problem is

$$\max_{c_1^p, c_2^p, l^m, l^f, b^m, b^f, s} U(c_1^p) + \beta[U(c_2^p) + \delta^m W(c^m) + \delta^f W(c^f)] \quad (1.7)$$

subject to budget constraints (1.3-1.6) taking R and wages as given. In the rest of the paper, we will assume interior solution for child labor, i.e., $0 < l^m, l^f < 1$. The first order conditions are

$$l^m : U_c(c_1^p) = \beta\delta^m W_c(c^m) h_e^m (1 - l^m); \quad (1.8)$$

$$l^f : U_c(c_1^p) = \beta\delta^f W_c(c^f) h_e^f (1 - l^f); \quad (1.9)$$

$$b^m : U_c(c_2^p) = \delta^m W_c(c^m), \text{ if } b^m > 0; \quad (1.10)$$

$$b^m : U_c(c_2^p) > \delta^m W_c(c^m), \text{ if } b^m = 0; \quad (1.11)$$

$$b^f : U_c(c_2^p) = \delta^f W_c(c^f), \text{ if } b^f > 0; \quad (1.12)$$

$$b^f : U_c(c_2^p) > \delta^f W_c(c^f), \text{ if } b^f = 0; \quad (1.13)$$

$$s : U_c(c_1^p) = R\beta U_c(c_2^p), \text{ if } s > 0; \quad (1.14)$$

$$s : U_c(c_1^p) > R\beta U_c(c_2^p), \text{ if } s = 0. \quad (1.15)$$

The LHS of (1.8) is the marginal benefit of male child labor to parents and the RHS is its marginal cost. One additional unit of male child labor increases parental utility by $U_c(c_1^p)$ in the first period. But it reduces the earnings opportunities of male child next period by $h_e^m(1 - l^m)$. The discounted loss in utility terms to parents is then $\beta\delta^m W_c(c^m) h_e^m (1 - l^m)$. (1.9) can be interpreted in a similar way.

(1.10) equates the marginal cost of giving bequest to male child (LHS) with its marginal benefit (RHS). An additional unit of bequest reduces utility of parents by $U_c(c_2^p)$ in the second period. At the same time, it increases utility of parents by $\delta^m W_c(c^m)$. If the marginal cost of bequest to male child exceeds the marginal benefit, then parents will not leave any bequest to sons. (1.11) characterizes this condition. (1.12) and (1.13) can be interpreted in a similar way.

(1.14) equates the the marginal cost of savings (LHS) with its marginal benefit (RHS). The marginal cost of saving is the loss in utility by having one

unit less to consume in the first period. One unit of savings increases income by R in the next period, the discounted value of which is $R\beta U_c(c_2^p)$. If the marginal cost of savings exceeds the marginal benefit, then the borrowing constraint will bind and $s = 0$. (1.15) characterizes this condition.

(1.8) and (1.9) imply that

$$\delta^m W_c(c^m) h_e^m (1 - l^m) = \delta^f W_c(c^f) h_e^f (1 - l^f) \quad (1.16)$$

(1.16) shows that parents choose levels of child labor which equalizes their marginal rate of return on earnings of sons and daughters in *utility terms*.

In the rest of the paper, the case in which parents prefer sons over daughters but earnings functions are same for both, i.e. $\delta^m > \delta^f$, but $h^m() = h^f()$, we call it *pure son preference* case. On the other hand, when $\delta^m = \delta^f$ (no son preference), but $h^m() \neq h^f()$, we call it *pure differential earnings* case. Finally, the case in which we have both earnings differential and son preference, we call it the *mixed* case.

Next, we characterize levels of child labor, consumption of children, and bequest pattern under different conditions. We begin with the case in which both savings and bequests are interior ($s, b^m, b^f > 0$). We call this case *unconstrained equilibrium*.

3 Unconstrained Equilibrium

First, when savings and bequests are interior, then equations (1.8), (1.9), (1.10), (1.12) and (1.14) apply. These equations imply that the optimal choices of child labor, l^m and l^f are given by

$$h_e^m (1 - l^m) = h_e^f (1 - l^f) = R. \quad (1.17)$$

Parents choose level of child labor such that the rate of return on human capital equals rate of return on savings, R . (1.17) also characterizes the efficient levels of child labor.³It equates the marginal return on human capital in terms of income to its opportunity cost in terms of lower child labor. (1.17) shows that child labor is at efficient level regardless of son preference or earnings differential.

³The 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.

(1.17) generalizes the results of Baland and Robinson (2000) and Horowitz and Wang (2004). Baland and Robinson (2000) in their model with homogeneous children show that child labor is efficient in the unconstrained case. Horowitz and Wang (2004) in their model of children with heterogeneous talent also derive the same result.

Pure Son Preference

Since the rate of return on human capital is same for both sons and daughters, (1.17) implies that $l^m = l^f$. Thus, both sons and daughters acquire same amount of human capital. The preference for sons does not lead to gender differentiation in child labor. Though sons and daughters work the same amount as child labor, (1.16) and (1.17) imply that daughters have lower consumption, $c^f < c^m$, and receive lower bequests, $b^f < b^m$. Parents are able to provide higher consumption to sons by giving them higher level of bequests.

Pure Earnings Differential

The levels of child labor are characterized by (1.17), which shows that children with superior earnings function have lower child labor. Parents optimal choices follow reinforcing strategy in terms of human capital. This result is similar to one derived by Horowitz and Wang (2004) in the model of children with heterogeneous talent.

(1.16) and (1.17) together imply that consumption of sons and daughters are equal, $c^m = c^f$. This implies that children with better earnings function receive lower bequests. In particular, if sons have better earnings function, they receive lower bequests. This result is in contrast to the pure son preference in which sons receive higher bequest and have higher consumption.

Mixed Case: Son Preference and Earnings Differential

In the case we have both son preference and differential earnings functions, (1.16) and (1.17) imply that consumption of sons are higher than daughters, $c^m > c^f$. Since (1.17) holds, children with better earnings function have lower child labor.

The level of bequests depends on whether sons or daughters have superior earnings function. In the case daughters have superior earnings function, sons necessarily receive greater bequests, $b^m > b^f$. In the case, sons have superior earnings function, sons may receive higher or lower bequests depending on the strength of son preference and differences in earnings opportunities.

From (1.5) and (1.6), we have

$$b^m - b^f = [c^m - c^f] - [h^m(1 - l^m) - h^f(1 - l^f)]. \quad (1.18)$$

(1.18) shows that if son preference is small and earnings opportunities for sons are sufficiently superior, then daughters may receive higher bequests.

The above analysis shows that in the unconstrained case gender differential in child labor can arise only when there is differential earnings functions. In particular, child labor for daughters can be higher only when they have inferior earnings function. The results derived so far are summarized in the following proposition:

Proposition 1: If bequests and savings are interior, $b^m, b^f, s > 0$, then child labor for both sons and daughters are at efficient levels. In the case of son preference, consumption of sons is higher than daughters, $c^m > c^f$, otherwise both sons and daughters have identical consumptions levels.

- a. In the case of *pure son preference*, sons and daughters have same levels of child labor, $l^m = l^f$. But sons receive greater bequest, $b^m > b^f$.
- b. In the *pure earnings differential case*, children with superior earnings function have lower child labor and receive smaller bequests.
- c. In the mixed case, results in part b. above apply for child labor. Regarding bequests, sons receive higher bequests if daughters have superior earnings function. If sons have superior earnings function, they may receive higher or lower bequests.

Next, I analyze the equilibrium in which either savings or bequests are at the corner. We call this case *constrained equilibrium*.

4 Constrained Equilibrium

First, we analyze the case in which bequests are at the corner, but savings are interior.

4.1 Binding Bequest Constraints

Throughout this sub-section, we assume that savings are interior, $s > 0$. When bequest constraints are binding, it is convenient to analyze pure son preference case and pure earnings differential case separately.

Pure Son Preference

We first consider the case in which bequest to daughters is at the corner, $s > 0$, $b^m > 0$, $b^f = 0$. This case can arise, if earnings of parents A are low and parents put small weight on the welfare of daughters. In this case, using first order conditions, it is easy to show that

$$h_e(1 - l^f) > h_e(1 - l^m) = R \quad (1.19)$$

(1.19) shows that $l^m < l^f$. In addition, child labor for sons continues to be at the efficient level, but the child labor for daughters is inefficiently high. Given that $b^m > b^f = 0$, (1.5), (1.6) and (1.19) also imply that $c^m > c^f$.

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

$$h_e(1 - l^m) \& h_e(1 - l^f) > R. \quad (1.20)$$

Thus, for both sons and daughters child labor is inefficiently high. Given $b^m, b^f = 0$, (1.5), (1.6), and (1.16) imply that $c^m > c^f$ and $l^f > l^m$. Sons have lower child labor and higher consumption than daughters.

The above analysis suggests that binding bequest constraints lead to inefficiently high levels of child labor. The reason for this inefficiency is that parents value their consumption relatively more than the consumption of child whose bequest constraint is binding. Since, children cannot make transfers to parents when they become adults, it leads to inefficiently high levels of child labor.

In the pure son preference case, one cannot have $b^f > b^m = 0$. The proof is straightforward. If $b^m = 0$ and $b^f > 0$, then $h_e(1 - l^m) > R$ and $h_e(1 - l^f) = R$. Thus, $l^m > l^f$. But then it would imply that $c^m < c^f$, which contradicts (1.16). The following proposition summarizes the results of this sub-section:

Proposition 2: (*Pure Son Preference*): When savings are interior ($s > 0$), then child labor is inefficiently high for children whose bequest constraint is binding. Binding bequest constraint leads to more unequal distribution of human capital compared to the efficient level. If bequests to either daughter or both sons and daughters are at the corner, then child labor for daughters

is higher than sons, $l^f > l^m$, and they consume less than sons, $c^f < c^m$. It is not possible to have $b^f > b^m = 0$.

The above analysis suggests that son preference can lead to gender differences in child labor if bequests are binding. In particular, it leads to higher child labor for daughters. As long as parents can give positive bequests to both the children, they are able to discriminate against daughters by giving her less bequest. But, when bequests are at the corner (either both or for daughters only), in that case they can do so only by choosing higher level child labor for daughters than sons.

Next we consider pure earnings differential case.

Pure Earnings Differential

We first consider the case in which bequest constraint is binding only for daughters and not sons, s , $b^m > 0$ & $b^f = 0$. As shown below, this case can arise only when daughters have superior earnings function. (1.10) and (1.13) imply that

$$W_c(c^m) > W_c(c^f). \quad (1.21)$$

For (1.21) to hold it must be the case that $c^m < c^f$. Then (1.8), (1.14), (1.16) and (1.21) imply that

$$h_e^m(1 - l^m) = R < h_e^f(1 - l^f). \quad (1.22)$$

(1.22) shows that child labor for sons is at efficient level, but child labor for daughters is inefficiently high.

Using (1.21) and (1.22), one can show that this case can arise only if daughters have superior earnings function. Suppose to the contrary that sons have superior earnings function. Since (1.22) holds, this implies that human capital of sons is higher than the human capital of daughters, $h^m(1 - l^m) > h^f(1 - l^f)$. As $b^m > b^f = 0$, this implies that $c^m > c^f$, which is a contradiction.

(1.22) also shows that binding bequest constraint leads to more egalitarian distribution human capital compared to the efficient level. The issue that whether children with superior earnings/human capital function can have higher child labor (*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 *absolute reverse*

specialization. (1.21) and (1.22) show that daughters who have superior earnings function can have higher or lower child labor than sons i.e. there can be reverse specialization. But since, $c^f > c^m$, there cannot be absolute reverse specialization in this case. Daughters must have higher human capital.

Next we consider the case in which bequest constraint is binding only for sons and not for daughters, $s, b^f > 0$ & $b^m = 0$. This case cannot arise in the pure son preference case. Using the arguments similar to the previous case, one can show that this case can arise only if sons have superior earnings function and $c^m > c^f$. Also, child labor for daughters is at efficient level, but child labor for sons is inefficiently high. In this case as well, binding bequest distribution leads to more egalitarian distribution human capital compared to the efficient level. Also there can be reverse specialization for sons. But there cannot be absolute reverse specialization.

Next we consider the case, when both bequest constraints are binding, $s > 0$ & $b^m = b^f = 0$. This is the case analyzed by Horowitz and Wang (2004). In this case, (1.8), (1.9), (1.11), (1.13), and (1.14) imply that

$$h_e^m(1 - l^m) \& h_e^f(1 - l^f) > R. \quad (1.23)$$

Thus, child labor for both sons and daughters are inefficiently high. In this case, (1.16) implies that $c^m \gtrless c^f$ depending on whether $h_e^m(1 - l^m) \lesseqgtr h_e^f(1 - l^f)$. If consumption of sons is higher than daughters, the marginal rate of return on human capital for sons must be higher and *vice-versa*.

(1.16) and (1.23) show that children with superior earnings function can have higher or lower consumption than children with inferior earnings function. This implies that there can be absolute reverse specialization. This case can arise when the gap between earnings opportunities is relatively large. This result is different from the case in which bequest constraint is binding for only one type of children.

Proposition 3: (*Pure Earnings Differential*) When savings is interior, the child labor is inefficiently high for children whose bequest constraint binds.

a. If the bequest constraint binds for only one type of children, it must bind for children with superior earnings function. Children with superior earnings function may have higher or lower child labor compared to children with inferior earnings function. But there cannot be absolute reverse specialization. Children with superior earnings function have higher consumption and human capital.

b. If bequest constraint binds for both children, there may be absolute reverse specialization and children with superior earnings function may have lower human capital and consumption than children with inferior earnings function.

A comparison of pure son preference case and pure earnings differential case reveals a number of important differences. Firstly, binding bequest constraints lead to less egalitarian distribution of human capital in pure son preference case, while it leads to more egalitarian distribution of human capital in pure earnings differential case. Secondly, if bequest constraints bind for both types of children, there is possibility of absolute reverse specialization in the case of pure earnings differential. Thirdly, in the pure earnings differential case, bequest constraints can bind for either sons or daughters depending on who have superior earnings function. Finally, consumption of sons is always higher in the pure son preference case, which may not be true in the pure earnings differential case.

Next we consider the case in which we have both son preference and differential earnings function.

Mixed Case: Son Preference and Earnings Differential

The combination of son preference and earnings differential does not change the efficiency results. The child labor remains inefficiently high for children whose bequest constraint binds. Also, it does not change the results qualitatively in the case in which bequest constraint is binding only for sons. As before the case in which $b^f > b^m = 0$ can arise only when sons have superior earnings function.

However, it does modify the results in the case in which only bequest constraint for daughters binds, $s > 0$, $b^m > b^f = 0$. In this case we have

$$U_c(c_2^p) = \delta^m W_c(c^m) > \delta^f W_c(c^f). \quad (1.24)$$

(1.24) shows that if preference for sons is relatively strong, daughters consumption can be lower than sons. Also (1.16) and (1.24) imply that this case can arise even when daughters have inferior earnings function. In addition, with strong son preference it is possible to have absolute reverse specialization for daughters, in the sense that human capital for daughters is lower despite their superior earnings function.

Next, we consider the case in which savings constraint is binding.

4.2 Binding Savings Constraint

First we consider the case in which both bequest constraints are interior, $b^m, b^f > 0$. This case can arise, if either earnings of parents A is low or parents put relatively low weight on future consumption. In this case, (1.8), (1.9), (1.10), (1.12), and (1.15) apply. (1.8), (1.9), (1.10), and (1.12) imply that

$$h_e^m(1 - l^m) = h_e^f(1 - l^f). \quad (1.25)$$

Thus parents still equalize the marginal rate of return on human capital as in the unconstrained case. The first order conditions also imply that

$$h_e^i(1 - l^i) > R, \text{ for } i = m, f. \quad (1.26)$$

(1.26) shows that child labor is inefficiently high for both sons and daughters. (1.26) generalizes the results of Baland and Robinson (2000), who find that child labor is inefficiently high in a model with homogeneous children, when savings constraint binds. Since, (1.16) continues to hold, results with regard to consumption pattern, bequests, and gender differentials in child labor summarized in proposition 1 apply.

So far we have not considered the case in which savings constraint as well as at least one of the bequest constraints bind. In such cases, it is straightforward to show that child labor is inefficiently high. With regard to consumption pattern, bequests, and gender differentials in child labor results stated in propositions 2 and 3 apply. The results of this subsection are summarized below:

Proposition 4: If savings is in corner, then child labor is inefficiently high for both sons and daughters. Savings affect the level of child labor, but not their gender differences.

So far, we have considered the cases in which parents can save if they wish to. In other words, there exists a financial market. But now suppose that financial market does not exist or parents do not have access to saving technology. In this case, one may have

$$U_c(c_1^p) < R\beta U_c(c_2^p). \quad (1.27)$$

Then, (1.8), (1.9), (1.10), (1.12), and (1.27) imply that

$$h_e^i(1 - l^i) < R, \text{ for } i = m, f. \quad (1.28)$$

Thus in the absence of financial market, child labor is too low compared to the first best. In the absence of the financial market, parents over-invest in the human capital of children. Notice though that $h_e^i(1 - l^i) < R$ is constrained efficient. These results have an interesting policy implication. In a very poor society, introduction of financial market may lead to higher child labor.

4.3 Alternative Equilibria and Child Labor

The following table summarizes various types of possible equilibria and their implications with regard to gender differentials in child labor. The first column shows conditions in which child labor for sons is necessarily lower than daughters. The last column shows conditions in which child labor for sons is necessarily higher than daughters. The middle column corresponds to cases in which child labor for sons can be higher or lower than for daughters. The first panel shows results of pure son preference case. The second panel summarizes the results when sons have superior earnings function. The third panel summarizes the results when daughters have superior earnings function.

Table 1
Characteristics of Alternative Equilibria

	$l^m < l^f$	$l^m \begin{matrix} \geq \\ \leq \end{matrix} l^f$	$l^m > l^f$
Pure Son * Preference	$b^m > b^f = 0; c^m > c^f$ $b^m = b^f = 0; c^m > c^f$	$b^m > b^f > 0; c^m > c^f$	
Pure Earnings Differential	Son's Earnings $0 < b^m < b^f; c^m = c^f$	Function $b^f > b^m = 0; c^m > c^f$ $b^m = b^f = 0; c^m \begin{matrix} \geq \\ \leq \end{matrix} c^f$	Superior
Mixed	$b^m, b^f > 0; b^m \begin{matrix} \geq \\ \leq \end{matrix} b^f;$ $c^m > c^f$	$b^f > b^m = 0; c^m > c^f$ $b^m = b^f = 0; c^m \begin{matrix} \geq \\ \leq \end{matrix} c^f$ $b^m > b^f = 0; c^m \begin{matrix} \geq \\ \leq \end{matrix} c^f$	
Pure Earnings Differential	Daughter's Earnings	Function $b^m > b^f = 0; c^f > c^m$ $b^m = b^f = 0; c^m \begin{matrix} \geq \\ \leq \end{matrix} c^f$	Superior
Mixed		$b^m > b^f = 0; c^m > c^f$ $b^m = b^f = 0; c^m \begin{matrix} \geq \\ \leq \end{matrix} c^f$	

Note * In pure preference for son case $l^m = l^f$.

The table shows that in societies where bequest constraints do not bind, gender differentials in child labor can only arise when sons and daughters have differential earnings function. However, in societies where bequest constraints bind, a higher incidence of child labor for girls can be attributed, in part, to son preference.

Empirical evidence suggests that incidence of child labor varies greatly across regions. Asia-Pacific and sub-Saharan regions account for more than 80 percent of child labor. Also the incidence of child labor is highest in sub-Saharan region followed by Asia-Pacific region. In both regions, the incidence and intensity of child labor for girls are higher than for boys. Within Asia-Pacific region, South Asian countries, particularly, India, Pakistan, Nepal, and Bangladesh account for majority of child labor. It is interesting to ask how these Asian and Sub-Saharan countries fit into table 1.

It is well-established that South Asian countries are characterized by strong son preference. In addition, labor market discriminations against women and lower accessibility as well quality of schools for girls are wide-

spread. These countries can be characterized as mixed societies with superior earnings function for sons. On the other hand, literature suggests absence of son preference in sub-Saharan countries (Boserup 1980, Svedberg 1990, Hadad and Reardon 1993). In these societies, a higher incidence and intensity of child labor for girls can be traced to inferior earnings function for women.

5 Policy Implications

This model provides implications as to how policy can tackle two potential goals: achieving efficiency in the case of inefficiently high child labor and reducing gender differences in child labor. Below we consider effects of several policies.

5.1 Ban on Child Labor

The issue of ban on child labor has received a great deal of attention in literature (Basu and Van 1998, Baland and Robinson 2000, Horowitz and Wang 2004). Now we ask the question whether the government can achieve efficient labor allocations using partial ban in our model when child labor is inefficiently high either for sons or daughters or both.⁴ The answer depends on whether the government can impose *gender-specific* ban and the presence of earnings differentials. In our model with earnings differential, the efficient level of child labor differs across gender and is characterized by, $h_e^m(1 - l^{m*}) = h_e^f(1 - l^{f*}) = R$. If the government can impose gender-specific partial bans, then they can achieve efficient labor allocations by setting child labor equal to l^{m*} and l^{f*} for sons and daughters respectively.

If the government *cannot* impose gender-specific ban, then the partial ban can achieve efficiency only in two cases. The first is the pure son preference case. The reason is that the efficient levels of child labor for sons and daughters are equal. The second is when the child labor is inefficiently high only for children with inferior earnings function. This can be shown as follows. Suppose for expositional purpose, sons have superior earnings function and child labor for them is at efficient level. In this case, $l^m = l^{m*} < l^{f*} < l^f$. Suppose that the government imposes a partial ban on child labor such that child labor should be less than or equal to l^b . Then by setting $l^b = l^{f*}$, the government can achieve efficient outcomes.

⁴Complete ban is inefficient in our model.

The government cannot achieve efficient allocations if $l^m > l^{m*}$, even if child labor for daughters is at efficient level, $l^f = l^{f*}$. Note that any partial ban $l^b < l^{f*}$ is not efficient. In this case, child labor for daughters is too low. Thus, $l^b \geq l^{f*} > l^{m*}$. Assuming that $l^m > l^b$, we have $h_e^m(1-l^b) > h_e^f(1-l^{f*})$. Thus (l^b, l^{f*}) are not efficient allocations. Though the partial ban cannot achieve efficient labor allocation in this case, it improves efficiency by moving child labor by sons towards efficient levels. The above reasoning implies that the government cannot achieve efficient allocations, when child labor is inefficiently high for both sons and daughters. Below we consider some other policy alternatives.

5.2 Other Policy Interventions

When child labor is inefficiently high, using first order conditions one can show that higher parental income, A , reduces child labor. This suggests that targeted income transfers may reduce child labor. The source of the inefficiency is important in this case. If inefficiency arises due to savings at the corner, as characterized by (1.15), then a transfer to parents in the first period when they have young children would be more effective. (1.15) shows that the marginal utility of first period consumption for parents is too high for relative to the second period. If the first period consumption could be raised by a transfer then the marginal utility of first period consumption would fall reducing the child labor. If inefficiency arises due to bequests at the corner then income transfers can be made in either period.

Income transfers require financing. Lump sum taxation would not change the efficient level of child labor, so the transfers described would reduce child labor towards the efficient level. External aid can also be used to finance such income transfers. However, financing transfers through distortionary taxation would alter the first order conditions and change the optimal response of parents. In this case, the efficient level of child labor would change and it is not clear whether child labor would increase or decrease.

The efficient level of child labor for each child could itself be changed by policy. For example, financial development that reduces the market rate of return, R , will reduce the efficient level of child labor for each child. Similarly, measures which increase the return on human capital such as improving the quality of schools through public expenditure on education (financed by lump sum taxation or external aid) have similar effects.

Our analysis suggests that the greater incidence and intensity of child la-

bor among daughters can arise due to low income of parents (binding bequest constraint for daughters) and/or inferior earnings opportunities for daughters. Measures to remove labor market discriminations and improving the accessibility and quality of schooling for girls would reduce child labor among girls. Providing scholarship to girls for attending school would also reduce child labor among girls.

6 Conclusion

In this paper, we developed a model to analyze the role of gender bias in explaining the gender differentials in child labor. We find that in the case of *pure son preference* the parents choose same level of child labor for each child, when they can give strictly positive bequest to both. But daughters have lower consumption than sons. If the bequests (for one or both children) are at the corner, then daughters works more than sons. On the other hand, in a model without *son preference* but in which sons have superior earnings function, sons works less than daughters. Both sons and daughters have same level of consumption. Our analysis shows that for outcomes of children, not only the existence of gender bias, but also its form is important. We also find that when both bequests and savings are interior, the levels of child labor are efficient. In addition, the child labor allocation is inefficiently high for the child who does not receive bequests. If on the other hand, savings are at the corner, then the child labor allocation is inefficiently high for both children.

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