Is Child Labor Inefficient?

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We build a model of child labor and study its implications for welfare. We assume that there is a trade-off between child labor and the accumulation of human capital. Even if parents are altruistic and child labor is socially inefficient, it may arise in equilibrium because parents fail to fully internalize its negative effects. This occurs when bequests are zero or when capital markets are imperfect. We also study the effects of a simple ban on child labor and derive conditions under which it may be Pareto improving in general equilibrium. We show that the implications of child labor for fertility are ambiguous.

I. Introduction

Although child labor is an age-old phenomenon and of enormous importance in the contemporary world,[1] there has been little formal analysis of this issue. While the existence of child labor is frequently condemned as odious and immoral, the real issue is to better understand

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[1] For example, the International Labour Office (1996) estimates that, worldwide, 120 million children between the ages of 5 and 14 work full-time.

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the determinants of child labor so as to evaluate its welfare implications. In this paper we show that, even when parents are fully altruistic toward their children, child labor can be Pareto inefficient. Central to our analysis is the impact of labor on a child's future earning ability as an adult. Child labor is socially inefficient when it has a sufficiently adverse effect on such ability, but it may nevertheless persist either when parents leave their children no bequests or when capital markets are imperfect. Both of these circumstances imply that parents fail to internalize the socially efficient trade-off between child labor and earning ability.

We first show that child labor is inefficient when the family is so poor that parents do not leave bequests to their children. When bequests are positive, parents completely internalize the adverse impact of child labor on the future income of their children since, by reducing bequests accordingly, they can compensate themselves for the current income they lose when not making their children work. Second, even if bequests are interior, child labor may be inefficiently high because parents face capital market imperfections, which stop their transferring the future reduction in bequest into the present.

Since the inefficiency of child labor partly stems from the nonnegativity constraint on bequests, one might conjecture[2] that introducing reverse altruism, with transfers from children to parents, would restore the efficiency of resource allocation. We show in an extension to our basic model that this is indeed the case when parents face perfect capital markets. However, the inefficiency of child labor stemming from imperfect capital markets is unaltered by the presence of reverse altruism.[3]

Turning to policy implications, we show that if the general equilibrium effects are well behaved, a small ban on child labor may constitute an actual Pareto improvement even though it does not directly compensate parents. The reason is that endogenous changes in wages induced by a reduction in child labor may make parents and firms better off.[4]

The observation that a nonnegativity constraint on bequests can lead to inefficient resource allocation in the family is originally due to Becker and Murphy (1988) and Nerlove, Razin, and Sadka (1988). We show that this has important implications for the efficiency of child labor. The intuition behind our results is related to the Rotten Kid theorem of Becker (1974) as formalized by Bergstrom (1989). Bergstrom derived the general conditions under which, if intrafamily transfers are interior,

[2] We are grateful to the editor for bringing this point to our attention.

[3] While our basic model is the altruistic model of Becker (1991), the extension of our results to the case of two-sided altruism with imperfect capital markets shows that child labor would be inefficiently high in the conventional old-age security model of fertility (see, e.g., Nugent 1985).

[4] This result contrasts with that of Basu and Van (1998), who find that a ban on child labor is not Pareto improving.

family members independently choose actions that benefit the whole family, that is, maximize joint family income. However, in a one-good model, which is equivalent to the one we study when saving is positive, interiority of transfers is itself sufficient to establish efficiency. This is what interior bequests achieve. However, when saving is at a corner, our model effectively has two dated goods and the Rotten Kid theorem does not hold in general. Thus positive transfers are not sufficient to guarantee efficiency in this case.[5] The importance of the nonnegativity constraints on both bequests and savings arises from capital market imperfections. In the case of bequests, if children could borrow when they were young, they could transfer resources to their parents and compensate them for reduced child labor, even if parents subsequently planned to leave no bequests.[6] Alternatively, children could enter into a contract with their parents involving a transfer of future income in exchange for a current reduction in child labor. However, such contracts are in general neither self-enforcing nor legally enforceable.

Our analysis adds to the literature on child labor in a number of ways. As in Eswaran (1996) and Basu and Van (1998), we find that child labor is a facet of poverty.[7] However, in neither of their papers is there a clear-cut welfare argument that suggests that child labor is inefficient.[8] Grootaert and Kanbur (1995) suggest that if there is a trade-off between child labor and education, then child labor can be inefficient if there are positive externalities to human capital accumulation. In our view, even when the social return to human capital is ignored, the nature of intrafamily resource allocation may stop even the private return from being captured, and we present two new arguments as to why this might be so. The idea that the amount that parents induce their children to work may be inefficient can be traced to John Stuart Mill since he regarded child labor as a case par excellence, "in which it would be highly for the advantage of everybody, if everybody were to act in a certain manner, but in which it is not the interest of any individual to

[5] In the spirit of Bergstrom's results, we could in fact show that, with more than one good and without transferable utility, child labor could be inefficient even when bequests and savings were interior. Nevertheless, we feel that the simpler model we develop in this paper characterizes intuitively the circumstances under which child labor is inefficient.

[6] Loury (1981) developed a related model with heterogeneous agents in which investment in education is the only way to transfer resources between generations. Capital market imperfections generally imply that the marginal return to education will not be equalized across families so that investment in human capital is inefficient.

[7] The connection between poverty and child labor is well established in the empirical literature (e.g., Rosenzweig 1981; Labenne 1997).

[8] For example, Basu and Van (1998) construct a model of the labor market in which there are multiple stable equilibria. In one there is a high wage that allows adults not to send their children to work, and in the other there is a low wage and child labor. These equilibria are not Pareto ranked since in the equilibrium without child labor firm profits are lower.

adopt the rule for the guidance of his own conduct, unless he has some security that others will do so too" (1965, p. 699) (see the discussion in Hollander [1985, p. 749]). Later, Mill notes that

> it is right that children … should be protected … from being overworked. Labouring for too many hours in the day, or on work beyond their strength, should not be permitted to them, for if permitted it may always be compelled. Freedom of contract, in the case of children, is but another word for freedom of coercion. Education also, the best which circumstances admit of their receiving, is not a thing which parents or relatives … should have it in their power to withhold. [1965, p. 952]

The opportunity to put children to work has been claimed to distort fertility decisions upward. For example, Dasgupta (1995, p. 1895) argues that

> in poor countries children are also useful as income-earning assets. This provides households … with another motive for procreation." Similarly, Weiner (1991, p. 186) claims that "many … governments have not been deterred from making education compulsory by the presence of widespread poverty and by the argument that the poor need the income of their children. Government officials … have reasoned that parents ought not to be allowed to use children to increase their own income. Such a policy … is … an inducement to a high fertility rate. By establishing policies that deny parents the income of their children, children cease to be regarded as economic assets and there is less incentive to increase their numbers."

Eswaran (1996) proposes a formal model to support this idea (see also Basu and Van 1998). He shows that when children are needed to provide old-age security, allowing parents to put their children to work may induce parents to substitute away from small, more educated to large, less educated families.[9] We study the effects of child labor on fertility in Section IV. The impact of a reduction in child labor on fertility decisions crucially depends on the former's impact on parental income (such as a rise in parental wages).

Our model is consistent with rather general interpretations both of child labor and of the nature of future earnings ability. For example, child labor includes not just salaried occupations outside the household

[9] Rosenzweig and Evenson (1977) find a positive relation between fertility and child wage rates using district data from India; see also Cain and Mozumder (1981).

but also domestic tasks imposed on children. The implications of such labor on future earnings include not just the loss of formal education and human capital but also the lack of social and cognitive skills[10] or increased health hazards. There is some controversy in the empirical literature about the effects of child labor on the educational attainment of children (see Grootaert and Kanbur 1995). Some studies have found that child labor does not have a significantly adverse effect. Yet it seems hard to believe that in general the human capital accumulation of children is not impaired by having to work. In a recent study of Ghana, Canagarajah and Coulombe (1997, p. 42) conclude that "poverty is significantly correlated with the decision to send children to school, and there is a significant negative relationship between going to school and working" (see also the evidence in Psacharopoulos [1997] and Jensen and Nielsen [1997]). In support of our model, Weiner (1991, p. 195) reports that "in India the proprietors of large businesses have not opposed child-labor laws…. One of the complaints of managers of large firms is that their labor force is not sufficiently educated, that too many workers are unable to read manuals or follow the simple instructions written on machines."

The paper proceeds as follows. In Section II, we develop the basic model of family choice with exogenous fertility and embed this within a simple market framework to study the equilibrium amount of child labor. We then extend the model to analyze first the implications of reverse altruism (in Sec. III) and second the effects of child labor on fertility (Sec. IV). Section V discusses the policy implications of our analysis, and Section VI presents a conclusion.

II. The Basic Model: One-Sided Altruism and Exogenous Fertility

The model consists of two periods, $t = 1, 2$, and there is no discounting of the future by any agent. At the beginning of the first period there are L_p parents alive, who live for both periods. At the beginning of the first period they decide how many children to have, with each set of identical parents having n children. Children also live for both periods. The other agents in the economy run firms and use labor to produce the numeraire good. For simplicity we consider a single such agent (a "representative firm"), who lives for both periods and has no children. In the first period parents decide how to allocate their children's unit time endowment between child labor and human capital accumulation. Parents work and supply labor inelastically, and we assume that each

[10] For example, Ennew (1982, p. 560) notes that "when relatively young children are forced to care for even younger siblings … the older child loses educational opportunity at school, but in addition the younger child may be prevented from developing sufficient verbal and conceptual skills to benefit from formal education."

parent has A efficiency units of labor in each period. In $t = 1$, parental labor supply is AL_p and the supply of child labor is nL_pl_c, where $l_c \in [0, 1]$ is the fraction of a child's time that is allocated to work. In $t = 1$, parents control all income, including that earned by children. In $t = 2$, children, now called adults, work. Their total labor supply at this date is $nL_ph(1 - l_c)$, where $h(1 - l_c)$ are the additional units of human capital possessed by an adult who worked for a fraction l_c of his time endowment when a child. The function h is twice continuously differentiable, strictly increasing, and strictly concave with $h(0) = 1$ (so that a child who spent all his time working in the first period still has a single efficiency unit of labor as an adult). In $t = 2$, adults control their own income. We assume that the markets for young and old parental, child, and adult labor are all competitive with respective wage rates w_{p1}, w_{p2}, w_{c1}, and w_{c2} (all wage rates are per unit of human capital). In this section we shall assume that firms have a linear technology so that profits are zero and let all wages be identical and be set equal to one.

We assume that parents are endowed with a joint utility function defined over their own consumption of a single consumption good (which is the numeraire in the economy with price normalized to unity), denoted c_p^t, for $t = 1, 2$; the number of children that they have, n; and the utility of their children (all of whom have identical preferences and are treated identically by parents). Parental utility is denoted $W_p(c_p^1, c_p^2, n, W_c(c_c))$, where $W_c(c_c)$ is the utility function of a child, which depends only on child consumption, c_c (child consumption takes place only in $t = 2$). We follow Becker (1991) in assuming that W_p is separable (though nothing hinges on this) so that

$$W_p(c_p^1, c_p^2, n, W_c(c_c)) \equiv U(c_p^1) + U(c_p^2) + n\delta W_c(c_c), \tag{1}$$

where U and W_c are both twice continuously differentiable, strictly increasing, and strictly concave. Here $1 > \delta > 0$ is a parameter measuring the extent to which parents are altruistic. In the paper, n is treated as exogenous except in Section IV, where we specifically examine fertility decisions. For simplicity we therefore set $n = 1$ everywhere except in that section.

Apart from choosing the time allocation of children, l_c, parents can also decide to give them transfers of income in $t = 2$, which we call bequests and denote by $b \geq 0$. They can also transfer income between periods by saving, denoted by s. We assume that capital markets are imperfect, so that parents cannot borrow. Therefore, saving is restricted to be nonnegative, $s \geq 0$. Parents therefore face the budget constraints

$$c_p^1 = A + l_c - s, \tag{2}$$

$$c_p^2 = A - b + s, \tag{3}$$

and

$$c_c = h(1 - l_c) + b. \tag{4}$$

The three first-order conditions with respect to b, l_c, and s are, respectively,

$$\begin{aligned} &U'(c_p^2) = \delta W_c'(c_c) \quad \text{and} \quad b > 0 \quad \text{or} \\ &U'(c_p^2) > \delta W_c'(c_c) \quad \text{and} \quad b = 0, \end{aligned} \tag{5}$$

$$U'(c_p^1) = \delta W_c'(c_c) h'(1 - l_c), \tag{6}$$

and

$$\begin{aligned} &U'(c_p^1) = U'(c_p^2) \quad \text{and } s > 0 \quad \text{or} \\ &U'(c_p^1) > U'(c_p^2) \quad \text{and } s = 0. \end{aligned} \tag{7}$$

We assume that there exists an interior optimum level of child labor denoted by l_c^*, which satisfies (6).

To see that the level of child labor l_c^* that maximizes (1) may be inefficiently high, notice that child labor is efficient when the marginal return to education in terms of income is equal to its opportunity cost in terms of lower child labor, that is, when $h'(1 - l_c^*) = 1$.[11] Child labor is therefore inefficiently high when $h'(1 - l_c^*) > 1$ with $l_c^* > 0$. We first define the conditions under which the level of child labor decided by parents is efficient.

PROPOSITION 1. If bequests and savings are interior, then the laissez-faire level of child labor is efficient.

To see proposition 1, notice that from the first-order conditions above, if $b > 0$, then $U'(c_p^2) = \delta W_c'(c_c)$ (from eq. [5]). Equation (7) then implies that $U'(c_p^1) = \delta W_c'(c_c)$, and substituting this into (6) shows that $h'(1 - l_c^*) = 1$. From this proof, one can immediately see that when parental bequest is at a corner, so that $U'(c_p^2) > \delta W_c'(c_c)$, $h'(1 - l_c^*) > 1$. Hence we get the following proposition.

PROPOSITION 2. If bequests are at a corner, then $h'(1 - l_c^*) > 1$ and the laissez-faire level of child labor, l_c^*, is inefficiently high.

The family cannot be expected to solve this source of inefficiency on its own. The reason is that children do not have any resources from which they can compensate parents; they can promise to do so only when they are adults and are earning income. But such promises are

[11] This is of course also the condition under which family income is maximized.

not credible.[12] Moreover, as long as society does not legally enforce contracts signed by children, this problem cannot be solved by capital markets.

Under what circumstances does this result apply? From the first-order conditions one can easily see that bequests are more likely to be at a corner the lower A and δ are. Moreover, one can also infer from the first-order conditions that $\partial l_c^*/\partial\delta < 0$. This implies that as parents attach more weight to the utility of their children, they reduce the amount of child labor. On the other hand, it is also true that $\partial l_c^*/\partial A < 0$, so that a fall in parental endowment (i.e., increased poverty) increases child labor. Therefore, the extent of child labor and its inefficiency can be interpreted as due to either poverty or lack of altruism.

We now show that even if bequests are interior, child labor is inefficiently high if the nonnegativity constraint on savings binds. This occurs as capital markets are imperfect so that parents cannot borrow. Intuitively, even though parents fully internalize the negative effects of child labor on second-period income through their bequest, they value period 1 income more highly. With imperfect capital markets they transfer income into period 1 by making children work more than the socially efficient amount.[13]

PROPOSITION 3. If savings are at a corner, then the laissez-faire level of child labor, l_c^*, is inefficiently high.

To see this result, note that $b > 0$ arises when $U'(c_p^2) = \delta W_c'(c_c)$. The first-order condition for $s = 0$ then gives $U'(c_p^1) > \delta W_c'(c_c)$, again implying that $h'(1 - l_c^*) > 1$. Proposition 2 also holds when bequests are also at a corner since in that case parents value their own consumption in period 2 more than that of their children, and one can still derive the implication that $h'(1 - l_c^*) > 1$.

Even though we did not formally introduce a discount factor, it is clear that the inefficiency pointed to in proposition 3 is more likely to arise as parents discount the future more heavily.

III. Two-Sided Altruism

We now show how the results of Section II extend to the situation in which children are simultaneously altruistic toward their parents. The

[12] In a repeated or dynamic game, families could use intergenerational punishment strategies (e.g., of the type considered in Ehrlich and Lui [1991]) in order to sustain the credibility of contracts. While this is certainly a theoretical possibility, we doubt that it has much explanatory power in poor countries. For example, when mortality risk is high and life expectancy short, agents discount the future heavily, and this makes it unlikely that the threat of future punishment can sustain the credibility of transfers. Moreover, such punishments may well not be renegotiation proof.

[13] Areas in which credit schemes oriented toward the poor, such as the Grameen Bank, have developed recently may provide an interesting empirical test of the impact of capital market imperfections on child labor.

timing and endowments of all agents in the economy are identical to those defined in Section II, as is the utility function of parents, which is the same function as (1), namely, $W_p = U(c_p^1) + U(c_p^2) + \delta W_c$. However, instead of children's utility function W_c being defined simply over their own consumption in period 2, we now assume that children are also altruistic toward their parents so that $W_c = V(c_c) + \lambda W_p$, where $1 > \lambda > 0$ measures the extent of filial altruism. In this case, when these two conditions are solved simultaneously, parents maximize

$$W_p = \frac{U(c_p^1) + U(c_p^2) + \delta V(c_c)}{1 - \delta\lambda} \tag{8}$$

subject to the new budget constraints

$$c_p^1 = A + l_c - s \tag{9}$$

and

$$c_p^2 = A - b + s + \tau, \tag{10}$$

where $\tau \geq 0$ is a transfer from child to parent. Children choose τ to maximize

$$W_c = \frac{V(c_c) + \lambda[U(c_p^1) + U(c_p^2)]}{1 - \delta\lambda}$$

subject to

$$c_c = h(1 - l_c) + b - \tau.$$

Family choices are timed as follows. In the first period parents choose child labor and saving, and in the second they choose the level of bequests followed by the choice of transfers by children. Thus the choice of τ is conditioned on all previous choices by parents, and parents take into account the way in which transfers are affected by their own choices in maximizing (8). We can therefore solve for the equilibrium allocation of resources by solving for the optimal choice of τ conditional on l_c, s, and b. This satisfies the first-order condition

$$V'(h(1 - l_c) + b - \tau) = \lambda U'(A - b + s + \tau). \tag{11}$$

In making their initial choices, parents anticipate the effects on the transfer they get from their child. Note that a positive transfer from child to parent is like a negative bequest. Since what is important is the net transfers between parent and child, τ is positive only when $b = 0$, and vice versa. When b is strictly positive, the two first-order conditions below reduce to those of Section II, and the results demonstrated there apply. We therefore restrict attention to the situation in which b is at a corner so that $U'(c_p^2) > \delta V'(c_c)$.

The respective first-order conditions for l_c and s are

$$U'(c_p^1) + U'(c_p^2)\frac{d\tau}{dl_c} = \delta V'(c_c)\left[h'(1 - l_c) + \frac{d\tau}{dl_c}\right] \tag{12}$$

and

$$U'(c_p^1) + \delta V'(c_c)\frac{d\tau}{ds} = U'(c_p^2) + U'(c_p^2)\frac{d\tau}{ds}. \tag{13}$$

Note first that even if reverse altruism exists and even if bequests are at a corner, it may still be the case that $\tau = 0$. This will be true if the following condition is satisfied: $V'([1 + h(1 - l_c^*)]) > \lambda U'(A + s^*)$. This occurs, for example, when λ is small. In this case the result of the previous section goes through unchanged, so that if bequests are at a corner then the laissez-faire level of child labor, l_c^*, is inefficiently high.

More interestingly, we now show that the intuition that reverse altruism will solve the commitment problem by relaxing the nonnegativity constraint on bequests is true only when capital markets are perfect.

PROPOSITION 4. If capital markets are perfect and transfers are interior, then the laissez-faire level of child labor, l_c^*, is efficient.

The easiest way to prove the result is to note that the first-order conditions (12) and (13) hold at the Pareto-efficient level of child labor, that is, when $h'(1 - l_c) = 1$. Perfect capital markets imply that (13) holds. We use this condition to substitute $U'(c_p^1)$ from (12), giving

$$U'(c_p^2)\left(1 + \frac{d\tau}{dl_c} + \frac{d\tau}{ds}\right) = \delta V'(c_c)\left[h'(1 - l_c) + \frac{d\tau}{dl_c} + \frac{d\tau}{ds}\right]. \tag{14}$$

When the derivatives $d\tau/dl_c$ and $d\tau/ds$ from equation (11) are computed, it is easy to show that

$$\frac{d\tau}{dl_c} + \frac{d\tau}{ds} = -1.$$

As a result, the left-hand side of equation (14) is equal to zero. As $\delta V'(c_c) > 0$, it follows that $h'(1 - l_c)$ must be equal to one. Even though bequests are at a corner, parents are choosing the socially efficient level of child labor.

We now show that, with imperfect capital markets, when savings are at a corner, the equilibrium amount of child labor is inefficiently high despite the presence of reverse altruism. In this case, equation (13) can be rewritten as

$$\frac{dW_p}{ds} = -U'(c_p^1) - \delta V'(c_c)\frac{d\tau}{ds} + U'(c_p^2) + U'(c_p^2)\frac{d\tau}{ds} < 0, \quad s = 0. \tag{15}$$

We now have the following result.

PROPOSITION 5. When capital markets are imperfect, the laissez-faire level of child labor, l_c^*, is inefficiently high even if transfers are interior.

To prove this result, note that, from equation (15), we can define a $\Delta > 0$ such that

$$U'(c_p^1) = \Delta + U'(c_p^2) + U'(c_p^2)\frac{d\tau}{ds} - \delta V'(c_c)\frac{d\tau}{ds}.$$

Now, following the proof of proposition 4, we find that, at the socially efficient point at which $h'(1 - l_c) = 1$, $dW_p/dl_c = \Delta > 0$, so that parents choose a level of child labor that is inefficiently high.[14]

IV. Endogenous Fertility

We now return to the model of Section II to endogenize the choice of family size by parents.[15] As is conventional, we shall assume that n is a continuous variable. We assume that it costs $\sigma > 0$ units of income to have a child. We focus on the case in which bequests are at a corner and capital markets are perfect.[16] In this case the objective function of the parents is

$$U(A - n\sigma + nl_c - s) + U(A - nb + s) + \delta n W_c(h(1 - l_c) + b). \quad (16)$$

Therefore, in addition to the three first-order conditions (5)–(7), we have

$$U'(c_p^1)(l_c - \sigma) + \delta W_c(c_c) = 0, \quad (17)$$

where $l_c - \sigma < 0$ if the choice of fertility is to be interior.

One can easily show that the impact of a reduction in child labor on fertility is in general ambiguous. To see why, first imagine a hypothetical situation in which parental income is unchanged when the amount of child labor is reduced (for instance, they get fully compensated by the state). As the net marginal cost of a child in period 1 is also unchanged by the transfer, the net effect of a reduction in child labor is to increase

[14] Interestingly, it is not generally true that the ultimate source of inefficiency in our model is the fact that parents, and not the children themselves, have the property rights over child labor. Consider the case in which the efficient level of child labor is positive. Then if l_c were chosen by the children, it would be efficient only when bequests are interior. Otherwise, children would choose an inefficiently low level of l_c.

[15] A referee has pointed out to us the following interesting problem with the Becker model of altruism when fertility is endogenous: The optimal fertility decision is sensitive to positive monotone transformations of children's utility function. To avoid this problem, the results of the paper could be derived using a different formulation of parental utility such as $U(c_p^1, c_p^2, n, c_c)$ (with $U_{34} > 0$), where the utility function of children does not enter directly into the utility function of parents.

[16] The results in the case in which capital markets are imperfect follow closely those derived in this paper.

the marginal value of a child in the future (through the rise in W_c), which stimulates higher fertility. On the other hand, consider now a situation in which child labor is reduced by law, with no explicit compensation to the parents (remember that, because of the technology, wages remain constant). A reduction in child labor now has three effects: a negative income effect on the parents, an increase in the current-period net cost of a child, and an increase in the future value of the child. Differentiating equation (17) and using the first-order conditions (6) and (7), one can show that

$$\frac{dn}{dl_c} = -\frac{n}{l_c - \sigma},$$

so that the net effect of a reduction in child labor is to reduce fertility.

This discussion was carried out assuming that the technology is linear so that wages are constant. With more general production technologies, wages vary and can generate a positive income effect on parents, reversing the sign of dn/dl_c. We consider this issue in the next section.

V. General Equilibrium and Policy Implications

So far we have argued that, under plausible assumptions about timing and capital markets, it is highly unlikely that families themselves will be able to solve the inefficiencies isolated in this paper. This suggests that there may be a welfare-enhancing role for government policy. What form might this take? It might be thought that a simple ban on child labor would not implement a Pareto improvement since parents would be worse off if uncompensated. Interestingly, this is not necessarily so. To investigate these issues, we now revert to the one-sided altruistic model of Section II with $n = 1$. In order to use calculus techniques, we analyze the case of a marginal, rather than a complete, forced reduction in child labor. In reality this would occur if the government were to pass legislation to reduce the hours children are allowed to work. For expositional simplicity, we carry out the discussion by focusing on the case in which bequests are at a corner whereas savings are interior. A similar discussion, yielding identical results, can be carried out with interior bequests and savings at a corner.

We first show that, with a linear technology, a marginal ban on child labor is Pareto improving. Such a ban does not affect firm profits or any wages. Next, since parents choose l_c optimally, by the envelope theorem a small reduction in the amount of child labor has no first-order effect on parental welfare. Finally, when bequests are assumed to be at a corner, the effect on child welfare is unambiguously positive since $dW_c/dl_c = -W_c'(c_c)h' < 0$. In other words, the effect on parental utility is

second-order and that on child welfare is first-order. This gives the following result.

PROPOSITION 6. With a linear technology, a marginal ban on child labor is a Pareto improvement when bequests or savings are at a corner.

While proposition 6 is of interest, our view is that in reality the general equilibrium effects of a ban on child labor are likely to be important.[17] A ban on child labor reduces the supply of child labor while increasing the supply of adult labor in the future. As a result, one would expect current wages, those of both adults and children, to rise and future wages to fall. Therefore, while we expect children's utility to rise in most cases, parental welfare will increase only when the effect on current wages dominates. We now show that such a situation can exist so that a small ban on child labor can be Pareto improving.

The firm maximizes the sum of profits, denoted π, over the two periods and is endowed with nonlinear technologies for converting efficiency units of labor into output. For simplicity, we assume that output is separable in parental and child labor, so that output in any one period is $f_p + f_c$, where $f_p(AL_p)$ is the output produced by parents in both periods and $f_c(l_c L_p)$ and $f_c(L_p h(1 - l_c^*))$ are the outputs produced by children in periods 1 and 2, respectively. We assume that the production function f_i for $i = p,c$ is twice continuously differentiable, strictly increasing, and concave so that the elasticity of the wage rate to the amount of labor demanded can be defined as

$$\epsilon_{it} = \frac{\partial w_{it}}{\partial L_{it}} \frac{L_{it}}{w_{it}} \equiv \frac{f_i''(\cdot) L_{it}}{f_i'(\cdot)} \quad \text{for } i = p, c, \; t = 1, 2.$$

Let w_{it} stand for the wage rate for agent i in period t. Firms choose L_{it} to maximize

$$\pi = \sum_{t=1}^{2} \sum_{i=p,c} [f_i(L_{it}) - w_{it} L_{it}],$$

so that labor demand solves $f_i'(L_{it}) = w_{it}$. Let $L_{it}(w_{it})$ denote the optimal demand for labor function with derivative $L_{it}'(w_{it}) < 0$.

In period 1, parental labor supply (in efficiency units) is AL_p and child labor supply is $L_p l_c^*$. In period 2, parental labor supply is identical and adult labor supply is $L_p h(1 - l_c^*)$. Thus equilibrium wages w_{it}^* solve the

[17] Historically, trade unions were influential in pressing for banning child labor, one reason being that it was thought to depress wages. For example, Davin (1982, pp. 635–36) notes that "organized workers' … attitudes to child and juvenile labour were also coloured by the extent of its use to undercut adults.… The support of sections of the working class for regulation of child labour thus stemmed from the … recognition that the regulation would at least partly reduce competition on an over-stocked labour market." Zelizer (1994, p. 63) argues that in the United States opposition to child labor partly developed because "by the turn of the century the cheap labor of children threatened to depress adult wages."

market-clearing conditions $AL_p = L_{p1}(w_{p1})$, $L_p l_c^* = L_{c1}(w_{c1})$, $AL_p = L_{p2}(w_{p2})$, and $L_p h(1 - l_c^*) = L_{c2}(w_{c2})$.

We now investigate the effects of a small ban of child labor on the welfare of all agents in the economy, taking into account the general equilibrium effects. First note that, by the envelope theorem, the effect of such a ban on profits is given by

$$\frac{d\pi}{dl_c} = -\frac{\partial w_{c1}}{\partial l_c} L_{c1} - \frac{\partial w_{c2}}{\partial l_c} L_{c2}. \tag{18}$$

Differentiating the market equilibrium conditions, we have

$$\frac{\partial w_{c1}}{\partial l_c} = \frac{L_p}{L'_{c1}(w_{c1})} < 0$$

and

$$\frac{\partial w c_2}{\partial l_c} = -\frac{h' L_p}{L'_{c2}(w_{c2})} > 0.$$

Substituting these into (18), we find

$$\frac{d\pi}{dl_c} = \left[-\frac{L_{c1}}{L'_{c1}(w_{c1})} + \frac{h' L_{c2}}{L'_{c2}(w_{c2})} \right] L_p = (-w_{c1}\epsilon_{c1} + h' w_{c2}\epsilon_{c2}) L_p,$$

which is negative if $w_{c1}\epsilon_{c1} \geq h' w_{c2}\epsilon_{c2}$.

Consider the effect of the ban on parental welfare when bequests are at a corner. This is

$$\frac{dW_p}{dl_c} = U'(c_p^1) \left(w_{c1} + l_c \frac{\partial w_{c1}}{\partial l_c} \right) - \delta W'_c(c_c) \left(h' w_{c2} - h \frac{\partial w_{c2}}{\partial l_c} \right). \tag{19}$$

We have used the envelope theorem to remove terms in savings.[18] From the first-order condition on child labor, this simplifies to

$$\frac{dW_p}{dl_c} = U'(c_p^1) w_{c1} (\epsilon_{c1} - \epsilon_{c2}),$$

which is negative if the current child wage rises faster than the future wage falls.

The effect on children's utility is

$$\frac{dW_c}{dl_c} = W'_c(c_c) \left(-h' w_{c2} + h \frac{\partial w_{c2}}{\partial l_c} \right) = -W'_c(c_c) h' w_{c2} (1 + \epsilon_{c2}),$$

which is negative if $\epsilon_{c2} \geq -1$. This condition implies that the elasticity

[18] If savings are at a corner, we cannot use the first-order condition to simplify the expressions; nevertheless, the result holds a fortiori.

is such that the total wage bill accruing to adult children rises. We therefore have proved the following result.

PROPOSITION 7. A marginal ban on child labor is a Pareto improvement when parental bequests or savings are at a corner if $\epsilon_{c2} \geq -1$ and

$$\epsilon_{c2} \geq \epsilon_{c1} \geq h' \frac{w_{c2}}{w_{c1}} \epsilon_{c2}.$$

The conditions under which the result holds are compatible. In particular, when $\epsilon_{c2} \geq -1$ and the two demand elasticities are equal, the result holds if and only if child labor is inefficient, that is, if $h'w_{c2} > w_{c1}$. Proposition 7 has been derived under the assumption that the production functions were separable in parental and child labor inputs. In a more general setting, we can expect those inputs to be at least partial substitutes, so that parental wages increase in the first period[19] but fall in the second period. The net effect of these changes on parental utility is complex. Note, however, that when savings are at a corner, the marginal value of current consumption is higher than that of future consumption so that the positive effect on parental welfare of rising current wages is given a higher weight.

The impact of some policy interventions, other than a marginal government ban, can be deduced from the results above. For example, imagine that a firm within a country decides not to employ child labor or that output is partially exported and that an external country bans the import of goods produced with child labor. These interventions clearly have effects similar to those of a marginal ban.[20] An alternative way to attain efficiency would be for the government to subsidize human capital creation (which in essence it does through massive public support for education or through more sophisticated schemes such as a "food for education" program such as developed in Bangladesh). Such a policy could be Pareto improving if paid for by a tax on adult earnings.[21] The state can also tax child labor. Thus in Europe, family allowances (and tax rebates) are given on the explicit condition that children are not wage earners and regularly attend school.

[19] This is the effect stressed by Basu and Van (1998) in reaching the conclusion that parents benefit from a ban on child labor.

[20] Simple bans or trade restrictions can be countereffective if they foster illegal and hidden forms of child labor (such as prostitution). In this respect, policies based on incentives, instead of prohibitions, may be much more effective.

[21] Becker and Murphy (1988) conjectured that compulsory education in conjunction with a social security system might be Pareto improving when parents underinvest in their children because social norms are not strong enough for children to compensate parents in old age. When the phenomenon of child labor is combined with human capital accumulation, proposition 7 shows that the general equilibrium effects of compulsory education may be such as to make it Pareto improving without the need for a compensation scheme such as the one proposed by them.

VI. Conclusion

In this paper we have developed two new arguments about why child labor exists in equilibrium despite the fact that it may be socially inefficient. Child labor is inefficient when it is used by parents as a substitute for negative bequests (to transfer income from children to parents) or, because of capital market imperfections, as a substitute for borrowing (to transfer income from the future to the present). The inefficiency cannot be solved through intrafamily contracting since such contracting would be either not self-enforcing or illegal. We investigated the role that a (small) ban on child labor may play.

Our demonstration that child labor may be Pareto inefficient raises the issue as to why it appears to be so difficult to abolish child labor in reality. As the discussion of the last section made clear, there are a number of policies that are potentially Pareto improving. In order to think about this question, it is necessary to extend our model to introduce heterogeneity of both firms and families. In this case, while, for example, banning child labor can potentially improve welfare (at least if the conditions of proposition 7 are satisfied), it may have distributional impacts that may not be offsettable given the feasible set of fiscal instruments. For example, some firms may benefit from child labor and have (or have adopted) technology in which human capital is not highly valued, whereas other firms would benefit significantly from a more educated workforce. For a ban to be Pareto improving and thus unanimously supported, the first set of firms would have to be compensated by taxing the second set. Equally interesting, and in line with the analysis of Weiner (1991) for India, imagine a situation in which there is inequality between families. Rich families do not send their children to work, whereas poor families do (this is an implication of our model). In this case a ban on child labor affects the distribution of income in the economy since if the children of poor people become more educated as adults, the wage of the already educated adult workers may be depressed. This generates losers from the eradication of child labor whom it may not be possible to compensate through feasible fiscal mechanisms.

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