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ABSTRACT

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This paper augments the existing literature on trade and child labor by exploring the effects of terms of trade changes in the context of a three good general equilibrium model, where one of the goods is a non-traded good. We find that under quasi-linear preferences the effect of the terms of trade on child labor depends critically on the pattern of substitutability (or complementarity) in the excess demand functions between the export good and the non-traded good. We extend the analysis to the case of homothetic preferences and find that the basic result is somewhat modified in a context where the marginal utility of income is affected by the terms of trade. We also extend the analysis to the case where factors move freely between the three goods as in a Heckscher-Ohlin type framework. Finally, we show that a balanced budget policy of taxing the education of skilled families and subsidizing the education of unskilled families must reduce child labor without any impact on aggregate welfare.

JEL Classification: F1, O19

Keywords: child labor, non-traded goods, substitutability or complementarity, terms of trade

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1. Introduction[1]

The problem of child labor has occupied a central place in the recent discussions on trade and development policy. Trade sanctions, import tariffs and product labeling (for example the Rugmark initiative in the carpet industry[2]) have been proposed and in some instances, implemented, to reduce the extent of child labor. These sanctions have the effect of reducing the price of the exported good produced using child labor. The intended effect of this policy is to lower the demand for labor and thereby reduce the incentive to provide child labor. However, as Basu and Van (1998) have noted parents dislike child labor but have to endure it for generating household income. Therefore, a fall in the export price due to the sanction that leads to a lowering of the family income may induce the parents to offer more child labor. Since the substitution effect and the income effect go in opposite directions (in this context), it is unclear whether child labor may rise or fall due to a trade sanction.

Along with the theoretical literature on the issue there have been substantial empirical progress in recent times.[3] A recent paper by Edmonds and Pavcnik (2004a) looks at the effect of change in rice price in Vietnam on child labor and finds that the income effect is the dominant factor. Indeed, they find that when the price of rice goes up, the supply of child labor is lower

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[1]We would like to thank Ron Balvers, Eric Bond, Sajal Lahiri, Arvind Panagariya, and, seminar participants at Southern Illinois University at Carbondale and West Virginia University for very helpful comments. The usual disclaimer applies.

[2]See Labeling Child Labour Products by Janet Hilowitz, IPEC, ILO, 1998.

[3]Besides the papers discussed above, some other widely cited theoretical contributions are Baland and Robinson (2000), Ranjan (2001) and Jafarey and Lahiri (2002), among others.

because of the income effect.[4] The implication of this finding is that a trade sanction may actually end up raising child labor because of the strength of the income effect. Another important paper by Cigno and Rosati (2002) focuses on the effect of globalization on child labor. They point out that nations with child labor are heterogeneous. Some have a greater proportion of skilled labor than others. The ones that have a greater proportion of skilled labor can participate in trade more effectively (by supplying intermediate products etc.) with developed countries. The rise in wages in these developing countries will be for the relatively more educated workers, raising the skill premium and discouraging child labor. On the other hand, countries who have a relative abundance of uneducated workers will see a rise in the unskilled wage through Stolper-Samuelson effects (as they face a greater demand due to globalization for their low skill intensive goods). For these countries there is more ambiguity regarding the effect of trade on child labor. The rise in the unskilled wage will raise the incentive to send children to work. However, as in Edmonds and Pavcnik (2004a and 2004b), the wage hike will raise family incomes and that may reduce child labor if it is considered undesirable by the family.

This paper provides a framework within which one can see the interplay between these effects. It also presents a model of skill formation in general equilibrium that highlights the role of the factors that may affect the choice between child labor and skill acquisition. An issue that is closely related to this discussion is the presence of alternate employment opportunities for

[4]In a related paper, Edmonds and Pavcnik (2004b) explore this issue with cross-country evidence. Their findings suggest that a greater degree of openness of a nation is associated with lower child labor. When they control for income differences between nations, they find "..no evidence of a substantive or statistically significant association between trade and child labor." Therefore, the conclusion is that greater openness leads to higher incomes, reducing the incidence of child labor. Therefore, as in their other paper, the role of income in determining child labor is of critical importance.

child labor outside of the sector that is facing the trade sanction. In other words, a trade sanction may be ineffective because of at least two reasons: (i) the income effect; and, (ii), the general equilibrium interaction between the traded good and in the alternate sector (say the non-traded service sector). The first effect has been discussed clearly in the existing literature. The second effect works as follows. A trade sanction on one of the sectors using child labor will tend to reduce the demand for child labor. However, the wage of child labor is also determined by the supply-demand condition in the non-traded sector. It is quite possible that the non-traded sector may soak up all the excess supply of child labor at the prevailing wage, leading to no impact of the sanction on child labor. Given the importance of the non-traded sector in hiring child labor in developing nations, this is an issue that should not be ignored. We propose a model that captures this general equilibrium linkage and lays down precise conditions under which a decline (or rise) in the terms of trade may reduce or raise child labor.

Our general equilibrium model pays close attention to some of the stylized facts pertaining to child labor. The latest global count of child labour (ILO, 2002) is at 245.5 million children in the 5-17 age group in year 2000 of which 178.9 million children are engaged in hazardous work and unconditionally worst forms of child labor (as defined by ILO Convention 182, 1999) including forced and bonded labor, prostitution, etc..[5] The problem is especially significant for Asia and the Pacific, with the highest count, and Sub-Saharan Africa, with the highest participation rate of working children. The agricultural sector employs most of the world's children (about 70% of economically active children). The children often work long

[5]There were 351.7 million economically active children in the world in year 2000. Of these 245.5 million count as child labour that need to be abolished (see ILO Conventions 138, 1973 and Convention 182, 1999).

hours for low pay under difficult or hazardous working conditions. On the other hand, less than 17% of economically active children work in manufacturing, trade, hotels and restaurants, combined. According to ILO 2002, "The informal economy is a burgeoning field of economic activity to be found throughout the developing world as well as in transition and in some developed countries....The informal economy is where by far the most child laborers are found. It cuts across all economic sectors and may be closely linked to formal sector production". The sector is typically characterized by a preponderance of small or micro establishments that are unregulated, untaxed with no formal employment relationships or any links to the formal institutions of a country.

We try to incorporate these institutional features in a three sector model of child labor where children may either work in Agriculture, or the Services sector. The Services sector (for the lack of a better name) attempts to incorporate the informal sector into the model. It is assumed that children do not work in the Manufacturing sector. Also, the Services sector produces a non-tradeable good while those produced by Agriculture and Manufacturing may be traded. It may be useful to visualize this setup in terms of a Cocoa exporting country of Sub-Saharan Africa. Cocoa is the exportable commodity and its production routinely involves child labor in these nations. Children also work in the informal sector. Suppose a sanction is imposed on cocoa exports, it will contract the cocoa sector and set off general equilibrium adjustments in the goods and factor markets. A-priori it is difficult to know the direction of these adjustments and their effects on child labor. Our model and analysis provides some insights on this issue.

We find that the effect of a change in the terms of trade on child labor critically depends on the pattern of substitutability (or complementarity) between the Services sector and the exportable sector. If the export good is a substitute (complement) for the non-traded good, then an improvement in the terms of trade must raise (reduce) child labor. This result is surprising because one expects that a trade sanction on the export good produced by child labor should lead to a reduction in child labor. Clearly, that is not true under complementarity. This result holds regardless of whether the sanction is imposed in period-1 or in period-2 (in this two period model). This may be explained as follows. Under substitutability between the traded sector and the non-traded sector, a sanction in period-1 that reduces price of the export good will reduce the excess demand for the non-traded good. Thus, the unskilled wage in that period must fall. This will lead to a greater incentive for skill acquisition and lead to lower child labor.[6] A second period sanction has a similar effect on the second period unskilled wage. Of course, that raises the skill premium and raises the incentive to acquire skills, thereby reducing child labor. While sanctions in either period leads to lower child labor (under substitutability), they work through different channels. The first period sanctions works through the cost side of the education decision. It reduces the opportunity cost of sending a child to school by lowering the first period wage. The second period sanction works through benefit side of the equation. It raises the skill premium and encourages more children to acquire education, thereby reducing child labor.

Section-2 presents the basic model and the analysis. Section-3 discusses modeling choices that we have made and how our conclusions may be affected under alternate

[6]Note that under complementarity, the excess demand for the non-traded good rises and therefore there are two opposing effects on the demand for child labor. In general, the fall in demand in the traded sector may be offset by the rise in demand by the non-traded sector with ambiguous effect on the net final demand for child labor. Our model structure is designed to highlight this possibility and presents a case where the rise or fall in child labor in response to a terms of trade movement depends precisely on the nature of substitutability in excess demand functions.

assumptions. Section-4 briefly discusses alternate policy choices outside the arena of trade policy that may be yield better outcomes. Section-5 concludes.

2. The Model and Analysis

Let there be three representative households: skilled, unskilled and landowning. There are three goods, manufacturing (M), agriculture (A) and services (V) and two periods (1 and 2). M and A are traded by this small open economy.[7] V is a non-traded good. The landowners have an endowment of land $\hat{T}$ in both periods. They do not supply labor, have no children and simply consume their income from land. The skilled households are characterized by an endowment of adult skilled labor $\hat{S}$ in period-1. These households have children all of whom acquire education (i.e., they supply no child labor).[8] In period-2, the skilled adults (of period-1) retire and their children grow up to supply skilled labor. Unskilled households are characterized by adult unskilled labor $\hat{L}$ in period-1. Their children either perform child labor (C_u) or acquire education. Adults in period-1 retire from the labor force in period-2. The children who receive education in period-1 grow up to be skilled adults in period-2. The child labor from period-1 grow up to be unskilled adult labor in period-2. Let θ be the number of children per unit of adult labor for both skilled and unskilled households. We also assume that there are no credit

[7]We assume that this is a small open economy which exports A and imports M. Therefore, the prices of A and M are exogenous to the model. However, the price of V is endogenously determined. M is assumed to be the numeraire good and we further assume that its price is constant between the two periods. Thus, the price of M in both periods is set to unity. Changes in terms of trade are exogenous changes in the price of A in either period-1 or period-2 (or both).

[8]We believe this to be a sensible depiction of reality in developing nations. For example, children from educated middle class or upper class families in India do not work as child labor. It is extremely unusual for an affluent family to send its children to work as unskilled labor - the explanation may lie in the history or in social norms.

opportunities. So families spend what they earn in period-i, (i = 1, 2).[9]

Let the utility function of an unskilled household in both periods from consumption be described by ũ. Also, let $\beta(C_u)$ capture the disutility from child labor.[10] The household discounts the future at the rate δ. M_i^u , A_i^u and V_i^u are the i-th period consumption of the three goods by the unskilled household. Prices of the three goods in each of the two periods are given by p_i^j, period-i = 1, 2 and good j = A, M or V. The wage w_i^j denotes the period-i wage of the j-th kind of labor: skilled (j = s), unskilled (j = u). Child labor is assumed to earn the unskilled wage. The cost of education for an unskilled (skilled) family is e_u (e_s). It is the adult unskilled (skilled) labor time used up to provide successful education to their respective children.

Unskilled households have the following optimization problem:[11]

$$U^u(A_1^u, V_1^u, M_1^u, A_2^u, V_2^u, M_2^u, C_u) = \tilde{u}(A_1^u, V_1^u, M_1^u) - \beta(C_u) + \delta\, \tilde{u}(A_2^u, V_2^u, M_2^u), \qquad (1a)$$

subject to the following constraints:

$$p_1^M M_1^u + p_1^A A_1^u + p_1^V V_1^u = w_1^u\{\hat{L} - e_u(\theta\hat{L}-C_u)\} + w_1^u C_u, \text{ and} \qquad (1b)$$

$$p_2^M M_2^u + p_2^A A_2^u + p_2^V V_2^u = w_2^s(\theta\hat{L}-C_u) + w_2^u C_u. \qquad (1c)$$

We assume that the utility function is quasi-linear and takes the form:[12]

$$\tilde{u}(A_i^u, V_i^u, M_i^u) = u(A_i^u, V_i^u,) + M_i^u, \quad i=1,2. \qquad (1d)$$

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[9]The issue of credit markets has already been explored in the literature by Jafarey and Lahiri (2002). Similarly the issue of survival has been explored by Basu and Van (1998). Extensions of our model can incorporate these. However, we choose to focus on other issues in this paper.

[10]We assume that marginal disutility from child labor is positive and increasing in it (i.e., βN and βO are both positive).

[11]The optimization problems for the other households may be similarly derived. The important difference is that they are assumed not to supply any child labor.

[12]In section-3 of the paper, we explore the role of this assumption in driving our results by analyzing the basic model with a standard homothetic utility function.

The solution to this problem yields:

$$u_1(A_1^u, V_1^u) = p_1^A,\ u_2(A_1^u, V_1^u) = p_1^v,\ \ u_1(A_2^u, V_2^u) = p_2^A, \text{ and, } u_2(A_2^u, V_2^u) = p_2^v; \text{ and} \tag{2a}$$

$$w_1^u(1+e_u) + \delta(w_2^u - w_2^s) - \beta'(C_u) \leq 0, \text{ or, } C_u = \theta\bar{L}. \tag{2b}$$

If the inequality is strictly negative we have $C_u = 0$. With no child labor in unskilled households we will not have a sensible child labor problem to consider. At the other extreme it is possible that all the children in the unskilled household are child laborers ($C_u = \theta\bar{L}$). These are uninteresting cases where marginal policy changes will not make a difference in reducing child labor or skill acquisition. Therefore, we focus on the interior solution. In this case, we have a mix in unskilled households, with some children receiving education, and marginal policy changes having an impact on this mix.[13]

On the production side, we assume that the economy is characterized by competitive firms producing the three goods. M uses unskilled and skilled labor and is CRS in the two inputs. Skilled labor is specific to M. Good-A is CRS in land and unskilled labor. Land is specific to A and is given at the same level, $\bar{T}$, throughout our analysis. Thus, sector-A exhibits diminishing returns to unskilled labor. V is assumed to be produced by unskilled labor only. The production functions are:

$$M_i = M_i(L_i^M, S_i^M);\ A_i = A_i(L_i^A, \bar{T}) = f_i(L_i^A),\ f_i''(.) < 0;\ V_i = L_i^v,\ i = 1, 2 \tag{3}$$

where M_i, A_i and V_i are the production of the three goods in period-i. L_i^M, L_i^A, and L_i^v are the

[13]In reality, there is heterogeneity in this category. An affluent slum dweller may send his children to school at least part time. On the other hand, the poorest of the slum dwellers are unlikely to afford that luxury. There are people in between who may fit in well in terms of making marginal choices depending on their access to education. We felt that a good compromise in our modeling is to lump these into the unskilled category and consider the choice between school and work as a marginal decision.

unskilled labor used in the sectors M, A and V, respectively, in period-i. S_i^M is the skilled labor used in M in period-i. $\hat{T}$ is the land used in A in each period. We assume that manufacturing employs unskilled adult labor only. Child labor is not used in the organized manufacturing sector but is used in agriculture and services.[14] First period factor supply and demand must satisfy the following relationships:

$$L_1^M + L_1^A + L_1^v = \hat{L} - e_u(\theta\hat{L} - C_u) + C_u;\ L_1^A = l_1^A + C_u^A;\ L_1^v = l_1^v + C_u^v,$$

$$S_1^M = \hat{S}(1 - e_s\theta),\ \text{and},\ T_1^A = \hat{T} \tag{4a}$$

where, (l_1^A, C_u^A) and (l_1^v, C_u^v) are the combinations of child and adult labor used in A and V, respectively in period-1. Note that in period-2 the unskilled labor force is simply the child labor of period-1 who are now adults. The skilled labor are the educated children from period-1. There is no child labor in period-2. Thus:

$$L_2^M + L_2^A + L_2^v = C_u,\ \text{and},\ S_2^M = \theta(\hat{L}+\hat{S}) - C_u,\ T_2^A = \hat{T}. \tag{4b}$$

Competitive profit maximization yields:

$$w_i^u = p_i^v;\ \text{and}\ C^{iM}(w_i^u, w_i^s) = 1;\ i = 1, 2. \tag{5}$$

$C^{iM}(.)$ is the marginal cost function of sector-M. (5) implies that:

$$w_i^s = w_i^s(w_i^u), \quad i = 1, 2. \tag{5′}$$

Using (5) and (5′) in (2b) and focusing on the interior solution, we have:

$$p_1^v(1+e_u) + \delta\{p_2^v - w_2^s(p_2^v)\} - \beta'(C_u) = 0. \tag{6}$$

(6) implicitly defines (suppressing δ):

$$C_u = C_u(p_1^v, p_2^v, e_u). \tag{6′}$$

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[14]This fits reality in the sense that most formal manufacturing units will comply with labor laws and not hire child labor. On the other hand the informal nature of the Service sector and Agriculture in developing nations will easily allow child labor.

Now consider the demand for the non-traded good. Under the assumption of quasi-linearity in M and identical utility functions across all households, and noting the structure of first order conditions in (2a) we recognize that the demand for the non-traded good in period-i must be a function of the prices of A and V in that period only. Thus the market demand for V^D in period-i is given by:[15]

$$V^{Di}(p_i^A, p_i^v) = V_i^s(p_i^A, p_i^v) + V_i^u(p_i^A, p_i^v) + V_i^T(p_i^A, p_i^v). \quad (7)$$

Noting relations (4a), (4b) and (6N), and denoting $C_u(p_1^v, p_2^v, e_u)$ by $C_u(.)$, the revenue function describing the supply side in periods 1 and 2 (suppressing $\hat{T}$) are:

$$R^1 = R^1[p_1^A, p_1^v, p_1^M, \hat{L}(1-e_u\theta) + C_u(.)(1+e_u), \hat{S}(1-e_s\theta)]; \text{ and,}$$

$$R^2 = R^2[p_2^A, p_2^v, p_2^M, C_u(.), \theta(\hat{L}+\hat{S}) - C_u(.)]. \quad (8)$$

The supply function for the non-traded good in the two periods are $\partial R^i/\partial p_i^v$ (i = 1, 2). Thus, the equilibrium in the non-traded market in period-1 requires that:

$$V^{D1}(p_1^A, p_1^v) = \partial R^1/\partial p_1^v; \text{ or,}$$

$$V^{D1}(p_1^A, p_1^v) = R_2^1[p_1^A, p_1^v, p_1^M, \hat{L}(1-e_u\theta) + C_u(.)(1+e_u), \hat{S}(1-e_s\theta)], \quad (9)$$

where $R_i^j(.)$ is the partial derivative of the revenue function in the j-th period with respect to the i-th argument (i.e., R_2^1 is the supply of V in period-1). Suppressing the labor endowments and the parameter θ and noting that p_1^M is fixed at unity, (9) implicitly defines:

$$p_1^v = p_1^v(p_1^A, p_2^v, e_u, e_s). \quad (10)$$

Period-2 equilibrium in the non-traded market requires that:

$$V^{D2}(p_2^A, p_2^v) = R_2^2[p_2^A, p_2^v, p_2^M, C_u, \theta(\hat{L}+\hat{S}) - C_u], \quad (11)$$

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[15] V^s and V^T are the demand functions for the non-traded good by the skilled households and landowners, respectively. Their choice rules are similar to relation (2a).

where, using (10), $C_u = C_u(p_1^v, p_2^v, e_u) = C_u\{p_1^v(p_1^A, p_2^v, e_u, e_s), p_2^v, e_u\}$. Relation-(11) implicitly defines:

$$p_2^v = p_2^v(p_1^A, p_2^A, e_u, e_s). \tag{12}$$

Relation-(12) completes the description of the model. The small country takes the prices of good-A (in the two periods) to be given. Therefore, p_2^v can be solved from (12), and this allows us to solve for p_1^v from (10). Working backwards we can solve for the other endogenous variables.

Section-2.1: Improvement in the terms of trade in period-1 (i.e., rise in p_1^A)

<u>Proposition-1</u>

An improvement in the terms of trade in period-1 must raise (reduce) child labor if V is a substitute (complement) for A in that period. If A and V are substitutes in period-1, a rise in p_1^A raises p_1^v (and hence w_1^u), reduces p_2^v (and w_2^u) and must raise w_2^s. The utility effect is ambiguous in general. If the first period consumption of goods A and V is sufficiently small, utility of the unskilled families must rise (under substitutability between A and V).

<u>Proof</u>

Using (6′), (10) and (12), and suppressing e_u and e_s, it is clear that $C_u = C_u(p_1^A, p_2^A)$. We can show that:

$$\partial C_u/\partial p_1^A = (\partial C_u/\partial p_1^v)(\partial p_1^v/\partial p_1^A)\{(\partial V^{D2}/\partial p_2^V) - R_{22}^2\}/D_2, \tag{13}$$

where, $D_2 = \partial(V^{D2} - R_2^2)/\partial p_2^V$ is the slope of the excess demand curve for the non-traded good in period-2 and can be shown to be negative. The terms $(\partial C_u/\partial p_1^v)$ and $\{(\partial V^{D2}/\partial p_2^V) - R_{22}^2\}$ may easily be shown to be positive and negative, respectively. Thus, the sign of $(\partial C_u/\partial p_1^A)$ is the same as the sign of $(\partial p_1^v/\partial p_1^A)$. Using (9) and (10):

$$Mp_1^v/Mp_1^A = -(MED^{v1}/Mp_1^A)/D_1, \tag{14}$$

where, $ED^{v1} = \{V^{D1}(.) - R_2^1(.)\}$, is the excess demand function for V in period-1. Also,

$D_1 = MED^{v1}/Mp_1^v = MV^{D1}/Mp_1^v - R_{22}^1 - R_{24}^1(1 + e_u)(MC_u/Mp_1^v)$. Note that, $R_{24}^1 = Mw_1^u/Mp_1^v = 1$. Therefore, it is easy to see that D_1 must be negative. Using (13) and (14):

$$MC_u/Mp_1^A \ \$\ 0 \text{ if and only if } MED^{v1}/Mp_1^A \ \$\ 0, \tag{15}$$

Relation-(15) completes the first part of the proof.

Using (10):

$$dp_1^v/dp_1^A = Mp_1^v/Mp_1^A + (Mp_1^v/Mp_2^v)(dp_2^v/dp_1^A). \tag{14a}$$

Using the above equations we can show that:

$$dp_2^v/dp_1^A = (MC_u/Mp_1^v)(Mp_1^v/Mp_1^A)(w_2^sN -1)/ (-D_2), \text{ where, } w_2^sN = Mw_2^s/Mw_2^u < 0. \tag{14aN}$$

From (14aN) we find that the sign of dp_2^v/dp_1^A is opposite of the sign of (Mp_1^v/Mp_1^A). Under substitutability this implies that $dp_2^v/dp_1^A<0$. It is also easy to see from (10) that $Mp_1^v/Mp_2^v<0$. Thus, (14a) implies that $dp_1^v/dp_1^A >0$. Therefore, under substitutability, as p_1^A rises, p_1^v (and w_1^u) must rise, while p_2^v (and w_2^u) must fall. Of course, this implies that w_2^s must rise.

We now turn to the effect of the terms of trade on the utility of the unskilled households. Let σ^u be the indirect utility function of the unskilled households. Given (1a), (1b) and (1c):

$$\sigma^u = \sigma^u(p_1^A, p_1^v, p_2^A, p_2^v, w_1^u, w_2^u, w_2^s). \tag{16}$$

Using the envelope properties of the indirect utility function and noting that in equilibrium p_1^v and p_2^v must equal w_1^u and w_2^u, respectively, we have:

$$d\sigma^u = -A_1^u dp_1^A + \{C_u(1+e_u) + \hat{Ł}(1-e_u\theta) - V_1^u\}dp_1^v$$
$$+ \delta\{C_u + w_2^sN(\theta\hat{Ł} - C_u) - V_2^u\}dp_2^v = -A_1^u dp_1^A - V_1^u dp_1^v - \delta V_2^u dp_2^v + d\sigma^{u*}, \tag{17}$$

where, $d\sigma^{u*} = \{C_u(1+e_u) + \hat{Ł}(1-e_u\theta)\}dp_1^v + \delta\{C_u + w_2^sN(\theta\hat{Ł} - C_u)\}dp_2^v$, is the welfare effect ignoring the consumption effects on goods A and V. It can be shown that:

$$d\sigma^{u*}/dp_1^A = \{(\partial p_1^v/\partial p_1^A)/ D_2\}S, \text{ where,} \tag{18}$$

$$S = \{C_u(1+e_u) + \hat{L}(1-e_u\theta)\}D_2 - Z(w_2^{s\prime}-1)(\partial C_u/\partial p_1^v), \text{ and,}$$

$$Z = \{C_u(1+e_u) + \hat{L}(1-e_u\theta)\}(\partial p_1^v/\partial p_2^v) + \delta\{C_u + w_2^{s\prime}(\theta\hat{L} - C_u)\}.$$

It can be shown that S is negative. Thus, $d\sigma^{u*}/dp_1^A > 0$ if $\partial p_1^v/\partial p_1^A>0$. Thus, under substitutability, σ^{u*} must rise with p_1^A, which in turn implies that σ^u will rise with p_1^A, if the consumption of goods A and V are sufficiently small.   Of course, under complementarity, this is reversed.

<u>Comment-1</u>: Relation-(17) suggests that the direct effect of a rise in p_1^A is to reduce utility because of a rise in the price of a consumption good for the unskilled families. On the other hand, note that p_1^v and p_2^v are endogenous and thus there are indirect effects on utility that work through these variables. Assuming substitutability, a rise in p_1^A raises p_1^v (and hence w_1^u), reduces p_2^v (and thus w_2^u) and raises w_2^s. Unskilled households benefit from a rise in the wage income in period-1, are hurt by the loss of unskilled wage income from period-2 but benefit in that period from a higher skilled wage earned by the educated members of the family. As we show above, the beneficial effects dominate, assuming consumption of A and V are sufficiently small for these families.

Section-2.2: Improvement in the terms of trade in period-2 (i.e., rise in p_2^A)

<u>Proposition-2</u>

An improvement in the terms of trade in period-2 must raise (reduce) child labor if V is a substitute (complement) for A in that period. If A and V are substitutes in period-2, a rise in p_2^A reduces p_1^v (and hence w_1^u), raises p_2^v (and w_2^u) and must reduce w_2^s. If the first period consumption of good-V is sufficiently small, utility of the unskilled families may fall.

Proof :

Using (6N), (10) and (12), we can show that:

$$MC_u/Mp_2^A = \{(MC_u/Mp_1^v)(Mp_1^v/Mp_2^V) + MC_u/Mp_2^V\}(dp_2^V/dp_2^A). \quad (19)$$

Using (6N) and (10) it can be shown that: $\{(MC_u/Mp_1^v)(Mp_1^v/Mp_2^V) + MC_u/Mp_2^V\}>0$. Thus, from (19) we know that the sign of (MC_u/Mp_2^A) is the same as that of (dp_2^V/dp_2^A). Using (6N) and (10) through (12), we find that:

$$dp_2^V/dp_2^A = \{(MV^{D2}/Mp_2^A) - R_{21}^2\}/(-D_2) = (MED^{v2}/Mp_2^A)/(-D_2), \quad (20)$$

where, $ED^{v2} = V^{D2} - R_2^2$ = Excess Demand Function for the non-traded good in period-2. From (20) we find that the sign of dp_2^V/dp_2^A is the same as the sign of (MED^{v2}/Mp_2^A). Thus, (MC_u/Mp_2^A) is positive, negative or zero as V is a substitute, complement or an unrelated good for A, respectively. Relation-(20) provides the proof for the first part of the proposition. Using (16) and a modified version of (17) (noting that for this sub-section, $dp_1^A = 0$, $dp_2^A \ldots 0$):

$$d\sigma^{u*} = \{C_u(1+e_u) + \hat{L}(1-e_u\theta)\}dp_1^v + \delta\{C_u + w_2^s N(\theta\hat{L} - C_u)\}dp_2^v$$

$$Y\ d\sigma^{u*}/dp_2^A = Z(dp_2^v/dp_2^A), \quad (21)$$

where Z is defined following proposition-1. It can be shown that:

$$Z = C_u(MC_u/Mp_2^V)\beta O(.)\{(MV^{D1}/Mp_1^v) - R_{22}^1\}/D_1 + \hat{L}(1-e_u\theta)(Mp_1^v/Mp_2^V) + \delta\theta\hat{L}w_2^s N. \quad (22)$$

The first term on the right hand side of (22) is positive, while the other two are negative. Therefore Z cannot be signed. Relation-(20) shows that the sign of (dp_2^v/dp_2^A) depends on whether V is a substitute or complement of A (in period-2). Assuming substitutability, (20), (21) and (22) imply that the sign of $(d\sigma^{u*}/dp_2^A)$ is the same as that of Z. If Z is negative, a terms of trade improvement in period-2 must reduce unskilled utility for sufficiently small consumption of goods A and V by these households. This case contrasts the utility result for the previous section.

Comment-2: It is interesting to compare and contrast the implications of the two propositions. Both suggest that a terms of trade improvement in a particular period will lead to a rise in child labor if and only if the non-traded good is a substitute for the export good in the respective period. An implication of this finding is that a trade sanction (in either period) on nations using child labor will lead to a reduction in child labor if and only if the respective substitutability conditions are satisfied. However, the utility effects (on unskilled families) of the sanctions in the two periods under substitutability (i.e., in the situation when the sanction is effective in reducing child labor) may be opposite. Suppose we ignore the consumption effects (i.e., assume that A_1^u, V_1^u, A_2^u and V_2^u are zero). A first period sanction must reduce utility. On the other hand, a second period sanction that reduces p_2^A raises p_1^v and the unskilled utility. This effect may dominate the other effects and lead to a rise in unskilled utility. The result is striking and has interesting policy implications. It seems to suggest that a sanction in the future (that is effective in reducing child labor) may be better than a current sanction from the perspective of the unskilled families. A practical application of this result will be to have pre-announced sanctions to be imposed in future periods on goods using child labor.

Section-3: Modeling Choices and Relevance of Modeling Assumptions

3.1: Homothetic Preferences

In this sub-section we explore the role that quasi-linearity plays in driving our results by replacing that assumption by homotheticity. Equations (1a) through (1c) are still valid. We replace (1d) by:[16]

$$\tilde{u}(A_i^u, V_i^u, M_i^u) = M_i^u\, \tilde{u}(A_i^u/M_i^u, V_i^u/M_i^u, 1); \qquad i=1,2. \tag{1d$'$}$$

The solution to the utility maximization problem (assuming an interior solution for child labor) is:

$$\tilde{u}_1(A_1^u, V_1^u, M_1^u)/\tilde{u}_3(A_1^u, V_1^u, M_1^u) = p_1^A \,;\ \tilde{u}_2(A_1^u, V_1^u, M_1^u)/\tilde{u}_3(A_1^u, V_1^u, M_1^u) = p_1^v; \text{ and,}$$

$$\tilde{u}_1(A_2^u, V_2^u, M_2^u)/\tilde{u}_3(A_2^u, V_2^u, M_2^u) = p_2^A; \text{ and, } \tilde{u}_2(A_2^u, V_2^u, M_2^u)/\tilde{u}_3(A_2^u, V_2^u, M_2^u) = p_2^v; \tag{2a$'$}$$

$$w_1^u(1+e_u)\tilde{u}_3(A_1^u, V_1^u, M_1^u) + \delta(w_2^u - w_2^s)\tilde{u}_3(A_2^u, V_2^u, M_2^u) - \beta'(C_u) = 0. \tag{2b$'$}$$

where, $\tilde{u}_3(A_i^u, V_i^u, M_i^u)$ is the marginal utility of income in period-i.

Since $\tilde{u}_j(.)$ (where j=1,2,3) is homogeneous of degree zero, (2a$'$) implies that:

$$\tilde{u}_1(A_1^u/M_1^u, V_1^u/M_1^u, 1)/\tilde{u}_3(A_1^u/M_1^u, V_1^u/M_1^u, 1) = p_1^A \,; \text{ and,}$$

$$\tilde{u}_2(A_1^u/M_1^u, V_1^u/M_1^u, 1)/\tilde{u}_3(A_1^u/M_1^u, V_1^u/M_1^u, 1) = p_1^v;$$

$$\Rightarrow A_1^u/M_1^u = f^A(p_1^A, p_1^v); \text{ and, } V_1^u/M_1^u = f^V(p_1^A, p_1^v). \tag{23a}$$

Similarly,

$$A_2^u/M_2^u = f^A(p_2^A, p_2^v), \text{ and, } V_2^u/M_2^u = f^v(p_2^A, p_2^v). \tag{23b}$$

Using (23a) and (23b) and noting the homogeneity of degree zero of $\tilde{u}_j(.)$:

$$\tilde{u}_3(A_i^u, V_i^u, M_i^u) = \tilde{u}_3(A_i^u/M_i^u, V_i^u/M_i^u, 1) = \tilde{u}_3(p_i^A, p_i^v); \ i=1,2. \tag{24}$$

Using (24) in (2b$'$):

$$w_1^u(1+e_u)\tilde{u}_3(p_1^A, p_1^v) + \delta(w_2^u - w_2^s)\tilde{u}_3(p_2^A, p_2^v) - \beta'(C_u) = 0. \tag{2b$''$}$$

Relation-(2b$''$) implicitly defines:

$$C_u = C_u(p_1^A, p_1^v, p_2^A, p_2^v, w_1^u, w_2^u, w_2^s). \tag{25a}$$

[16] There is no loss in generality in choosing a linear homogenous utility form, because all homothetic utility functions are monotonic transformations of this form and thereby represent the same preference ordering.

The production side of the model is unchanged. Using (5) and (5N):

$$C_u = C_u(p_1^A, p_1^v, p_2^A, p_2^v). \quad (25b)$$

Using (23a) and (23b) and assuming all households (skilled, unskilled and landowners) have identical and homothetic preferences (over the commodities), we have :

$$V^{Di} = V_i^s + V_i^u + V_i^T = f^v(p_i^A, p_i^v)(M_i^u + M_i^s + M_i^T)$$

$= f^v(p_i^A, p_i^v)M^{Di}$, where M^{Di} is the aggregate demand for M in period-i. (26a)

Trade balance in period-i requires:

$M^{Di} - M^{Pi} = p_i^A(A^{Pi} - A^{Di})$, i=1,2; where M^{Pi} is the production of M in period-i, A^{Pi} and A^{Di} are the production and consumption of A in period-i, respectively. (27)

Using the logic of (26a):

$$A^{Di} = f^A(p_i^A, p_i^v)M^{Di}. \quad (26b)$$

Using (26b) in (27) and arranging terms:

$$M^{Di} = (M^{Pi} + p_i^A A^{Pi})/\{1 + p_i^A f^A(p_i^A, p_i^v)\}. \quad (28)$$

Note {from relation-(8) in section-2} that: $M^{Pi} = R_3^i(.)$, and $A^{Pi} = R_1^i(.)$, where $R^i(.)$ is the revenue function of period-i. Linear homogeneity (in prices) of the revenue function requires that:

$$M^{Pi} + p_i^A A^{Pi} = R^i(.) - p_i^v R_2^i . \quad (29)$$

Using (29) in (28) and using (26a):

$$V^{Di} = f^v(p_i^A, p_i^v)M^{Di} = f^v(p_i^A, p_i^v)\{R^i(.) - p_i^v R_2^i\}/\{1 + p_i^A f^A(p_i^A, p_i^v)\};\ i = 1,2. \quad (30a)$$

Note from relation-(8) that $R^i(.)$ is a function only of p_i^A, p_i^v and C_u (given that $p_1^M = p_2^M = 1$). Using this fact in (30a), we have:

$$V^{Di} = V^{Di}(p_i^A, p_i^v, C_u). \quad (30b)$$

Using (30b), the market clearing equations for the two periods for the non-traded good are:

$$V^{Di}(p_i^A, p_i^v, C_u) = R_2^i(.). \tag{31}$$

Relation-(31) defines:

$$p_i^v = p_i^v(p_i^A, C_u). \tag{32}$$

Using (32) in (2b0) and noting (5) and (5N):

$$p_1^v(.)(1+e_u)\tilde{u}_3\{p_1^A, p_1^v(.)\} + \delta[p_2^v(.) - w_2^s\{p_2^v(.)\}]\tilde{u}_3\{p_2^A, p_2^v(.)\} - \beta\mathsf{N}(C_u) = 0. \tag{33a}$$

Relation-(33a) implicitly defines:

$$C_u = C_u(p_1^A, p_2^A). \tag{33b}$$

The left hand side of (33a) is the net marginal benefit from supplying child labor. Assuming that this net benefit function to be downward sloping with respect to C_u, and using the implicit function theorem on (33a) and (33b), we find that:

$$\text{sign of } (\mathsf{M}C_u/\mathsf{M}p_1^A) = \text{sign of } [\{\tilde{u}_3(p_1^A, p_1^v) + p_1^v(\mathsf{M}\tilde{u}_3/\mathsf{M}p_1^v)\}(\mathsf{M}p_1^v/\mathsf{M}p_1^A) + (\mathsf{M}\tilde{u}_3/\mathsf{M}p_1^A)p_1^v]. \tag{34}$$

Similarly,

$$\text{sign of } (\mathsf{M}C_u/\mathsf{M}p_2^A) = \text{sign of } [\{p_2^v - w_2^s(.)\}(\mathsf{M}\tilde{u}_3/\mathsf{M}p_2^A)]$$
$$+ (\mathsf{M}p_2^v/\mathsf{M}p_2^A)[\{p_2^v - w_2^s(.)\}(\mathsf{M}\tilde{u}_3/\mathsf{M}p_2^v) + \tilde{u}_3(1-w_2^s\mathsf{N})]. \tag{35}$$

It is clear from (34) and (35) that the effect on child labor of a change in the terms of trade in period-i depends on: (a) the pattern of substitutability between V and A (i.e., on the term $\mathsf{M}p_i^v/\mathsf{M}p_i^A$ as in section-2); and, (b). the direct and indirect effects of the change in the terms of trade on the marginal utility of consumption of good-M [i.e., the terms $(\mathsf{M}\tilde{u}_3/\mathsf{M}p_1^v)(\mathsf{M}p_1^v/\mathsf{M}p_1^A)$, $(\mathsf{M}\tilde{u}_3/\mathsf{M}p_1^A)$, etc.].

Suppose that a rise in p_i^A leads to a greater consumption of good-M in period-i (i.e., they are substitutes in consumption), this will lead to a lower marginal utility of consumption from M.

Thus, in period-1, $(M\tilde{u}_3/Mp_1^A) < 0$.[17] Based on (34) this suggests that (MC_u/Mp_1^A) is more likely to be negative.[18] Indeed, even if $(Mp_1^v/Mp_1^A) > 0$, it is possible that $(MC_u/Mp_1^A) < 0$. That is, even under substitutability in excess demand functions, we may find that a terms of trade improvement has reduced child labor. This modifies the findings presented in proposition-1. Similarly, based on (35), we can see that proposition-2 will be modified. It is interesting to note, however, that in this second case, (MC_u/Mp_2^A) is more likely to be positive. It is definitely positive if $(Mp_2^v/Mp_2^A) > 0$. The rise in p_2^A reduces the marginal utility value of the second period skill-premium and therefore discourages skill acquisition. Thus, child labor tends to rise with a rise in p_2^A.

3.2: The Model Without the Non-Traded Good

We highlight the role of the non-traded good in our analysis by providing a specific

factor

model along the lines of section-2 with one important difference - the absence of the service sector. Let utility function for all households be quasi-linear of the following form:

$$U(M_i, A_i, C_u) = u(A_i) + M_i - \beta(C_u); \quad i=1;$$

$$= u(A_i) + M_i; \quad i=2. \qquad (36)$$

where u(.) is strictly concave. Relation-(2b) carries over to this context. Therefore:

[17] Assuming that the diagonal terms of the matrix of second derivatives of the function $\tilde{u}(A_i^u, V_i^u, M_i^u)$ are negative and assuming that the off-diagonal terms are positive, it is easy to show using the differentials of the first order conditions of utility maximization that: $(M\tilde{u}_3/Mp_2^A) < 0$, and, $(M\tilde{u}_3/Mp_2^v) < 0$.

[18] Note that under substitutability in excess demand functions between A and V, a rise in p_1^A will raise p_1^v $(=w_i^u)$. This tends to raise child labor. However, there are two other effects. The induced rise in p_1^v will lower $\tilde{u}_3$ assuming that M and V are substitutes in consumption. This lowers the utility value of first period wage relative to the value of skill premium and tends to reduce child labor. Similarly, the direct effect of p_1^A on the marginal utility of good-M is also negative and therefore adds to the possibility of a reduction in child labor (faced with a terms of trade improvement).

$$C_u = C_u[w_1^u, w_2^u, w_2^s(w_2^u)]. \quad (37)$$

Using (37) and suppressing e_u and e_s, note that::

$$w_1^u = R_3^1[p_1^M, p_1^A, \bar{L}(1-e_u\theta) + e_u C_u(.), \bar{S}(1-e_s\theta)] = w_1^u(p_1^A, w_2^u), \text{ and,}$$

$$w_2^u = R_3^2[p_2^M, p_2^A, C_u(.), \theta(\bar{L} + \bar{S}) - C_u(.)] = w_2^u(p_1^A, p_2^A);\ p_1^M = p_2^M = 1. \quad (38)$$

Let p_1^A remain constant at unity. It can be shown that:

$$dC_u/dp_2^A = \mu(dw_2^u/dp_2^A), \text{ where,}$$

$$\mu = (\partial C_u/\partial w_1^u)(\partial w_1^u/\partial w_2^u) + (\partial C_u/\partial w_2^u) + (\partial C_u/\partial w_2^s)w_2^{s\prime}. \quad (39)$$

It can be shown that μ and (dw_2^u/dp_2^A) are both positive. Therefore, $\partial C_u/\partial p_2^A > 0$.

Proposition-3

In a two sector, three factor model, where land is specific to the exportable sector (A) and skilled labor to the importable sector (M), a terms of trade improvement necessarily raises child labor.

Proof and Comment:

Relation-(26) and the discussion above complete the proof. This proposition is important as a benchmark. It shows that the presence of the non-traded good is crucial to our analysis. Without it, a terms of trade improvement leads to an unambiguous rise in child labor.

3.3: The Model With Intersectoral Factor Mobility

In this section we consider production characterized by the three sectors, all using three factors, unskilled labor, skilled labor and land. The production functions are CRS. Competitive profit maximization conditions yield:

$$p_1^j = C^{1j}(w_1^u, w_1^s, w_1^T);\ \text{and, } p_2^j = C^{2j}(w_2^u, w_2^s, w_2^T);\ j = V, M \text{ and } A. \quad (40)$$

Using (40) and the normalized prices: $p_1^A = p_1^M = p_2^M = 1$, we have:

$$w_1^u = w_1^u(1,1,p_1^v) = w_1^u(p_1^v);\ w_2^u = w_2^u(1, p_2^A, p_2^v) = w_2^u(p_2^A, p_2^v);\ \text{and,}$$

$$w^s_2 = w^s_2(1, p^A_2, p^v_2) = w^s_2(p^A_2, p^v_2). \tag{41}$$

Using (40), (41) and the interior solution for (2b):

$$w^u_1(p^v_1)(1+e_u) + \delta\{w^u_2(p^A_2, p^v_2) - w^s_2(p^A_2, p^v_2)\} - \beta N(C_u) = 0. \tag{42}$$

Relation-(42) implies that:

$$C_u = C_u(p^v_1, p^v_2, p^A_2). \tag{43}$$

Using (43) and the first period equilibrium for the non-traded good, we have:

$$p^v_1 = p^v_1(p^v_2, p^A_2). \tag{44}$$

Using (43) and (44) in the second period equilibrium condition, we get:

$$p^v_2 = p^v_2(p^A_2). \tag{45}$$

It is easy to check that $dp^v_2/dp^A_2 > 0$, if V is a substitute for A in period-2. Using (43) through (45), we have:

$$dC_u/dp^A_2 = X(dp^v_2/dp^A_2) + Y, \text{ where, } X = (\partial C_u/\partial p^v_1)(\partial p^v_1/\partial p^V_2) + \partial C_u/\partial p^V_2; \text{ and,}$$

$$Y = (\partial C_u/\partial p^v_1)(\partial p^v_1/\partial p^A_2) + \partial C_u/\partial p^A_2. \tag{46}$$

Let us now make the following assumptions:[19]

(1). In sectors M, A and V, the largest shares of income belong to skilled labor, landowners and unskilled labor, respectively.

(2). Technology is CRS and Cobb-Douglas in both periods in all the three sectors:

$$M = (L_M)^\beta(S_M)^\alpha(T_M)^\beta;\ A = (L_A)^\beta(S_A)^\beta(T_A)^\alpha;\ \text{and, } V = (L_v)^\alpha(S_v)^\beta(T_v)^\beta,$$

where, $\alpha > \beta$, and, $\alpha + 2\beta = 1$.

---

[19]We know from Ethier (1984) and other related contributions that it is not easy to generalize Stolper-Samuelson type results in higher dimensions without imposing further restrictions. Therefore, to highlight our central results without getting into the details of higher dimensional issues, we choose to use a reasonable special case for our purpose.

Clearly, shares of skilled labor in M, unskilled labor in V and land income in A all equal α. All other factor shares equal β. Using this functional form we can show:

$$\partial w_1^u/\partial p_1^v > 0;\ \partial w_2^u/\partial p_2^v > 0;\ \partial w_2^s/\partial p_2^v < 0;\ (\partial w_2^u/\partial p_2^A) - (\partial w_2^s/\partial p_2^A) > 0. \quad (47)$$

Using (47), we can show that: X and Y are both positive. Thus, assuming substitutability, (46) implies that $dC_u/dp_2^A>0$. On the other hand, since Y>0, (46) suggests that under complementarity the sign of (dC_u/dp_2^A) is ambiguous.

Proposition-4

In a 3x3 Heckscher-Ohlin type model characterized by Cobb-Douglas technology with equal factor shares between non-intensive factors, a terms of trade improvement in period-2 leads to an increase in child labor if the non-traded labor intensive good is a substitute for the land intensive export good. If it is a complement, then the effect of the terms of trade on child labor is ambiguous.

Proof and Comment:

Relations (46) and (47) provide the proof. Under substitutability, our finding from proposition-1 in the text carries over to a 3x3 Heckscher-Ohlin context. However, the result is altered under complementarity to some degree. In the text, for a given p_1^A and p_2^v, relation-(10) implied that p_1^v is fixed. Thus, (6′) implied that C_u is given if p_1^A and p_2^v are held constant. This is not the case in the H-O model. Even if p_1^A and p_2^v are held constant, a rise in p_2^A will change both p_1^v and C_u. This is captured by the term: $Y = (\partial C_u/\partial p_1^v)(\partial p_1^v/\partial p_2^A) + \partial C_u/\partial p_2^A$, in Relation-(46). To that extent proposition-1 is modified under complementarity.

Section-4: Changes in Costs of Education for Unskilled and Skilled Families (i.e., changes in e_u and e_s)

Proposition-5

A rise (fall) in the education cost for the skilled (unskilled) households reduces child labor. An education tax on skilled families that finances education subsidies for unskilled families must reduce child labor with no impact on aggregate welfare.[20]

Proof:

Using (6′) and (10) through (12):

$$C_u = C_u(p_1^A,\ p_2^A,\ e_u,\ e_s). \qquad (48a)$$

$$dC_u/de_u \text{ (given } p_1^A,\ p_2^A,\ e_s)$$

$$= \{(\partial C_u/\partial p_1^v)(\partial p_1^v/\partial e_u) + (\partial C_u/\partial e_u)\}[\{(\partial V^{D2}/\partial p_2^V) - R_{22}^2\}/D_2], \qquad (48b)$$

Relation-(48b) implies that $dC_u/de_u > 0$ if $\{(\partial C_u/\partial p_1^v)(\partial p_1^v/\partial e_u) + (\partial C_u/\partial e_u)\} > 0$. It can be shown that the latter is true. Therefore, $dC_u/de_u > 0$. Similarly, it can be shown that: dC_u/de_s (given p_1^A, p_2^A, e_u) is negative.

A fall in e_u has two effects, both of which reduce child labor by lowering the effective cost of education as described in (6′). First, it raises the labor available for production in period-1. This expands production in V, reduces p_1^v ($=w_1^u$) and hence the cost of education as well. Second, it lowers the effective cost of education directly as is clear on inspection of relation-(6′). On the other hand, a rise in e_s reduces the amount of skilled labor available to the economy (for production) in period-1. As skilled labor used in production falls, sector-M contracts. More

[20] In contrast, it is easily seen that a trade sanction (in either period) must reduce aggregate welfare through the adverse terms of trade effect.

unskilled labor is available for the non-traded sector. At given prices production in V must expand, the excess supply reduces p_1^v and w_1^u. As p_1^v (or w_1^u) is reduced, the effective marginal cost [i.e., $p_1^v(1+e_u)$] of acquiring education for the unskilled family falls. Therefore, more children acquire education (i.e., C_u must fall).

Let us consider a utilitarian representation of aggregate welfare: $W = U^s + U^u + U^T$, where U^s, U^u and U^T are the utility levels of the skilled, unskilled and the landowning households, respectively. Using envelope properties:

$$\partial W/\partial e_u = - w_1^u(\theta\hat{L}-C_u) < 0; \partial W/\partial e_s = -w_1^s\theta\hat{S}<0. \qquad (49)$$

Thus, a fall in e_u must necessarily raise welfare, while a rise in e_s will reduce it. Now, consider a revenue neutral tax-subsidy scheme on education. If the education budget is balanced:

$$(w_1^s\theta\hat{S})t_s = w_1^u(\theta\hat{L}-C_u)s_u, \qquad (50)$$

where t_s is a unit tax on time resources spent by skilled labor to educate their children and s_u a corresponding subsidy to unskilled households. Evaluating the tax and subsidy at zero:

$$(w_1^s\theta\hat{S})dt_s = w_1^u(\theta\hat{L}-C_u)ds_u \Rightarrow (w_1^s\theta\hat{S})de_s = -w_1^u(\theta\hat{L}-C_u)de_u, \text{ where } de_s=dt_s>0, \text{ and, }$$

$$de_u = -ds_u<0. \qquad (51a)$$

When this subsidy-tax plan is used, (49) and (51a) yield (for given t_2^A):

$$dW = - \{w_1^u(\theta\hat{L}-C_u)de_u + w_1^s\theta\hat{S}de_s\} = 0. \qquad (51b)$$

Thus, a revenue neutral (small) tax-subsidy policy will have no impact on welfare but will reduce the extent of child labor in the economy.

Given a resource constraint, one way to finance the lowering of education costs for the unskilled will be to raise the education cost of the skilled families. In other words, an education tax for skilled families can finance an education subsidy for the unskilled. In view of proposition-3, this policy has no trade-offs vis-a-vis child labor, since the tax (on the skilled) actually accentuates the reduction of child labor that will be obtained by providing the subsidy. In addition, since this policy has no adverse welfare effect (on aggregate) it seems to be less damaging to the developing nation than a trade sanction. Of course, if resources can be obtained to subsidize the education of children from unskilled families without having to raise the educational costs of the skilled families it will be a superior outcome. This may be possible, if foreign aid is provided to help reduce child labor and such aid is used for subsidization.

5. Conclusion

This paper complements the existing literature on the subject of child labor by discussing the role of the non-traded sector in a general equilibrium model. We derive qualitative results on when one may expect terms of trade movements to aggravate or reduce the incidence of child labor and also explore the income distribution effects of such changes. The results seem to be fairly robust to alternate model specifications. The analysis casts doubts about the wisdom of using trade sanctions to control child labor. Instead, we suggest that education policies that finance the education of unskilled households by taxing the education of skilled households are effective in reducing child labor and may cause no reduction in aggregate welfare.

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