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Child Labor and Globalization*

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***Abstract*:** The paper embeds child labor in a standard general-equilibrium, two-sector (modern and agrarian) model of a small open economy facing perfectly competitive markets, efficiency wages, and free-trade. Trade policies that increase the modern-sector output reduce the incidence of child labor and the dispersion of wages between skilled and unskilled workers. Foreign direct investment in the modern sector reduces the incidence of child labor. Emigration of skilled (unskilled) workers reduces (increases) the incidence of child labor. Child-wage subsidies increase the incidence of child labor; and a ban on child-labor benefits unskilled adult workers but hurts skilled adult workers.

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1. Introduction

A recent International Labor Organization (ILO) report (ILO, 2006) reveals that in 2004 approximately 166 million children between the ages of five and fourteen years were classified as child laborers accounting for about 14 percent of all children in this age group. In the same year, about 75 million child laborers between the ages of five and fourteen years were engaged in hazardous work which can affect adversely the child's safety, health, or moral development. The Asian-Pacific region hosted more than half of working children, followed by Sub-Saharan Africa and Latin America. Although the report documents that over the period 2000-2004 the number of child laborers declined by 11 percent and the number of children in hazardous work fell by almost 33 percent, this encouraging trend is not satisfactory: Excessive effort, hazardous work, bonded labor, armed conflict, prostitution and pornography, long work hours, unhealthy working conditions, absence of schooling, malnutrition, and sexual harassment acquire a different meaning when applied to children.[1] The phenomenon of child labor has been viewed as an epidemic of the global economy that must be eventually eliminated. Thus analyzing the economic effects of globalization on the incidence of child labor constitutes high research and policy priorities.[2]

Although there is a significant body of literature on the economics of child labor, the international economics of child labor remains in its infancy.[3] Relatively speaking, only a few studies have formally addressed the link between globalization and child labor. Maskus (1997) has developed a two-sector specific-factors model, where child labor is modeled as a specific factor employed in the exportable sector and adult labor is modeled as a mobile factor. Trade liberalization raises the output of the exportable sector and increases the demand for child labor as well as the child-wage. Ranjan (2001) analyzes the effects of trade liberalization on the returns to education in the presence of credit constraints. Credit-constrained families can withdraw their children from the labor force when the family's income reaches a minimum level. Trade openness affects a poor unskilled-labor abundant

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[1] According to ILO (2002) in 2000 about 171 million children worked in hazardous conditions, 1.2 million children were involved in trafficking, forced and bonded labor (5.7 million), armed conflict (0.3 million), prostitution and pornography (1.8 million), and illicit activities (0.6 million).

[2] For instance, in the conclusion section of his survey Basu (1999, p1114) recognizes the need for further analytical work on the economics of child labor, and states: "Should child labor be banned outright? Should the WTO be given the responsibility of enforcing restrictions on child labor through the use of trade sanctions? Should there be a legal minimum wage for adults so as to make it unnecessary for parents to send their children to work? The answer depends on the context".

[3] Closed-economy models of child labor include Basu and Van (1998), Basu (2002), Genicot (2005) and Doepke and Zilibotti (2005) among others. Basu (1999) and Brown, Deardorff and Stern (2003) provide comprehensive surveys of the growing strand of child-labor literature.

country by raising the return to unskilled labor and inducing parents to educate their children instead of sending them to work.

Meanwhile, the nexus between trade openness and credit constraints is the focus of Jafarey and Lahiri (2002), who develop a two-period, two-good model with skilled and unskilled labor. Children can acquire skills through training instead of working. In their model, poor families (headed by unskilled parents) choose less education than rich families (headed by skilled parents). Easier access to international capital markets reduces the interest rate and increases the return to education. As a result, the incidence of child labor is reduced in this case. Trade liberalization raises the price of unskilled-intensive goods, reduces the returns to education and could lead to an increase in the incidence of child labor. Basu and Chau (2004) analyze the effects of trade openness in a dynamic model of child labor and debt bondage. Trade openness increases the short-run supply of child labor but does not affect the long-run incidence of child labor.

The above-mentioned open-economy models are more appropriate to analyze the long-run effects of trade liberalization on the supply-side determinants of child labor. They assume that, in the presence of credit-market distortions, altruistic parents decide on whether to educate their children or send them to work. They abstract from labor-market rigidities such as wage stickiness and interindustry wage differentials which are common in developing countries and shape the demand for child labor. They also do not model explicitly a number of educational infrastructure distortions that are prevalent in developing countries: It is not easy to educate an older working child who has skipped several years of formal schooling in the absence of special education and training programs. As such, these studies do not take into account the short and medium-run reactions of profit-maximizing employers to globalization-related policies.

Is the behavior of firms (as opposed to households) important for the international economics of child labor? A partial affirmative answer to this question can be given by considering the following child-labor incidence from the Bangladesh garment industry. A recent report by the ILO (2006) states that in 1993, when faced with the threat of child-labor-related trade sanctions, garment producers dismissed in a very short period of time many thousands of its child workers (as many as 50,000). There was speculation that many of these children were forced into hazardous work in the informal sector including prostitution instead of going to school. It took more than two years for the international organizations and the Government of Bangladesh to reach an agreement that would remove the child workers from the garment industry and place them in education programs. According to the ILO (2006. p75) report, “it is acknowledged that in the context of the panic response in 1993 and unavoidable delays in getting project components in place, many children and their families became worse off. In the end economic forces were swifter than the interventions that sought to protect children." It is hard to reconcile such an incidence with models that emphasize long-term supply-side determinants of child labor, according to which trade sanctions work through factor prices and the return to educational investments. There is a need for more emphasis on demand-side determinants of child labor which are based on profit-maximizing producers operating in distorted labor markets that are prevalent in many developing economies.

In order to address formally the effects of globalization on the demand for child labor, we build a model in which the market for child labor is based on decisions made by selfish parents/guardians and profit-maximizing producers. These producers offer nutritional efficiency wages to child workers and effort-based wages to skilled adult workers. Our starting analytical framework is a standard two-sector small open economy producing two homogeneous goods. The modern sector employs sector-specific capital and skilled adult labor measured in efficiency units. Efficiency wages are used by firms in the modern sector to induce higher effort and labor productivity[4]. The agrarian sector employs skilled adult workers and unskilled (child and adult) workers to produce a homogeneous good under perfect competition. In the absence of child labor, the model behaves as a small open economy with specific factors of production (capital and unskilled adult labor) and an endogenous effort-based wage differential in favor of the modern sector.

The model allows us to derive definite, and in some instances surprising, conclusions regarding the impact of policies on the endogenous incidence of child labor and the wage structure. A decline in the relative price of the unskilled-labor intensive good reduces the demand for skilled adult labor in the agrarian sector, the number of children employed, the real skilled-adult wages, and the wage gap between the modern and agrarian sectors. The opposite is true of trade policies that raise the relative price of the agrarian good. These results imply that trade sanctions (as in the case of the Bangladesh garment industry) imposed on countries that export child-labor intensive goods are effective in reducing the incidence of child labor. In contrast, studies that emphasize the supply-side determinants of child labor, such as Rajan (2001) and Jafarey and Lahiri (2002), find that trade sanctions might not be effective in reducing child labor.

Inward foreign direct investment (FDI) in the (child-labor free) modern sector leaves the structure of wages and commodity prices unaffected, but reduces the incidence of child labor by

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[4] Efficiency wages arise due to a firm's desire to induce more effort from workers, avoid the formation of a labor union, reduce shirking and turnovers etc. Stiglitz (1976), Shapiro and Stiglitz (1984), Akerlof and Yellen (1986), Solow (1979), and Weiss (1980) among others have developed the foundations of the efficiency-wage theory.

expanding the size of the modern sector and by causing more skilled adult labor to move from the agrarian sector into the modern sector. Emigration of children (trafficking, or legal emigration) reduces the endowment of children without affecting their wage and the number of working children. As a result, the incidence of child labor measured by the proportion of children employed increases! Lower migration barriers that induce unskilled adult workers to migrate from poor to rich countries, alone or with their children, increase the incidence of child labor. In contrast, emigration of skilled adult workers reduces the incidence of child labor. A specific child-wage subsidy, that might take the form of mid-day meals, reduces the cost of child workers and increases the incidence of child labor.

Finally, the model allows us to analyze the effects of an enforceable ban on child labor. This policy reduces the wage of skilled adult labor, raises the wage of unskilled adult workers and removes the economy's wage stickiness. The effects of a child-labor ban on the income of families headed by unskilled parents with a working child is ambiguous; its effect on the income of a family headed by a skilled worker without working children is negative; whereas the effect of a child labor ban on a family headed by an unskilled worker with staying-at-home children is positive. Since the share of working children is below 15 percent, these results imply that the majority of unskilled adult workers would support a ban on child labor, whereas skilled adult workers would oppose it. Doepke and Zilibotti (2005) arrive at a similar conclusion using a dynamic model of child labor with endogenous fertility and human capital formation.

The rest of the paper is divided into four parts. Section 2 develops the structure of the model by describing the determination of efficiency wages in the modern sector, the demand for adult and child labor in the agrarian sector, and the allocation of resources across the two sectors. Section 3 examines the impact of globalization and domestic policies by performing the standard comparative-statics exercises. Section 4 discusses the model's implications for the economics of child labor and section 5 offers several concluding remarks.

2. The Model

This section incorporates child labor in a standard two-sector general-equilibrium model of a small open economy facing perfectly competitive markets, efficiency wages, and a free-trade policy. The modern sector produces a homogeneous good (which is used as the numeraire good) using skilled adult labor and capital, and offering effort-based efficiency wages. The agrarian (traditional) sector produces a homogeneous good under perfect competition using three types of labor: child labor, unskilled adult labor, and skilled adult labor. Working children receive nutritional efficiency wages.

Following the literature on child labor, we introduce the following assumptions (postulates) that allow us to incorporate child labor into a general-equilibrium model and analyze its effects and determinants. First, we adopt the standard assumption that child labor and unskilled adult labor are perfect substitutes (e.g., Basu and Van, 1998; Ranjan, 2001; Doepke and Zilibotti, 2005; Genicot, 2005). In other words, we suppose that unskilled adult workers can do what children can do. The assumption of perfect substitutability between child and unskilled adult labor allows us to identify conditions under which globalization can eliminate the incidence of child labor and to analyze the economic effects of a ban on child labor. Second, we assume that agrarian skilled adult labor is an imperfect substitute for unskilled (child and adult) labor, following the literature on globalization and child labor cited above. This assumption means that more child workers increase the productivity of skilled adult workers and vice versa. Third, we assume that adult workers are fully employed whereas children could be underemployed. Full employment of adult workers is assumed for analytical convenience and can be readily relaxed.[5] The assumption of underemployed children is empirically relevant since less than 15 percent of children work (ILO, 2006), and it allows us to study the effects of globalization on the incidence of child labor. Fourth, we assume that children are employed only in the agrarian sector which produces the unskilled-labor intensive good. In other words, we postulate that the intensity of child labor differs across sectors by supposing that all children in the modern sector are staying at home.[6] One way to justify this assumption is to think of families consisting of an adult and a child, with skilled adult parents earning a sufficiently high wage that allows them to send their children to school, whereas unskilled adult parents earn a lower income which forces them to send their children to work.[7]

The determination of child wage is based on nutritional efficiency considerations. The idea of nutritional efficiency wages was introduced in the economic-development literature by Leibenstein (1957) and has been used by an extensive body of literature on nutrition-based productivity and wages (e.g., Rodgers, 1975; Stiglitz,1976; Dasgupta and Ray,1986, 1987; Basu, 1992; Dasgupta, 1993;

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[5] Matusz (1994, 1996, 1998) has developed several general-equilibrium models of trade and equilibrium unemployment based on efficiency-wage considerations.

[6] This assumption is consistent with evidence reported in Cigno and Rosati (2002) that in the case of India, the participation rate of child laborers in agriculture was 4.9 percent as opposed to 1.9 percent in non-agricultural activities for the year 1994. Edmonds and Pavcnik (2002) report that in the case of Vietnam, during the year 1993, 26 percent of children between the ages of 6 and 15 worked in agriculture and only 4 percent worked for non-agricultural enterprises.

[7] This interpretation is consistent with a weak version of the "luxury axiom" introduced by Basu and Van (1998) which states that when the household income exceeds a certain minimum level parents either keep their children at home or send them to school.

Genicot, 2005).[8] In this paper, we model the child wage determination process by embedding a version of the partial-equilibrium model developed by Gupta (2000) into a general-equilibrium framework. A typical agrarian family consists of an unskilled adult worker and a child. The former acts as the child's guardian and negotiates the child's wage with a prospective employer. Each employer in the agrarian sector offers a nutritional efficiency wage to each child worker, which is paid in kind (say food consisting of a mid-day meal), and a fixed cash premium over the value of the nutritional wage to each child's guardian.[9] This compensation scheme prevents the guardian from taxing the child's wage, because doing so results in reducing the child's productivity and therefore depriving the employer of additional profits. We believe that the present model is the first to explore the general-equilibrium implications of nutritional efficiency wages in the context of globalization and child labor.

2.1 The Modern Sector

The modern sector produces a homogeneous good with a specific factor and skilled adult workers and offers effort-based wages. Several manufacturing industries such as computer software, electronic components, batteries, toys, automobile parts, electrical appliances fall into the category of modern sectors in many developing countries such as India, Brazil, and China. The interpretation of the sector-specific factor as capital permits the analysis of foreign direct investment (FDI).

The technology in the modern sector is described by the following production function

$$Y = AZ(E, K)\,, \tag{1}$$

where *A* is a technological parameter capturing the level of total factor productivity in the modern sector; $Z(\cdot)$ is a constant returns to scale production function, *E* is total labor measured in efficiency units and K is sector-specific capital. We model labor in the sector as $E = eH_y$, where H_y is the number of skilled adult workers employed and function $e(.)$ measures the level of efficiency (i.e., effort or work hours) per worker.

We assume that the level of efficiency per worker is an increasing and concave function of the difference between the efficiency wage w_y, offered by firms in the modern sector, and the wage of skilled adult workers in the agrarian sector w_x which acts as the effective reservation wage

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[8] See also Strauss and Thomas (1998) for a review of the empirical literature on efficiency (productivity) and nutrition.

[9] Gupta (2000) models the cash component of each child's wage as the outcome of generalized Nash bargaining between the guardian and the child's employer. Here we assume that this premium equals a fixed parameter that captures the relative bargaining between the two negotiating parties.

$$e \equiv e(w_y - w_x) \, . \tag{2}$$

The function $e(\cdot)$ is defined over the domain $w_y \geq w_x > 0$ and has the following standard properties: $e(0) = 1$; $e_1 > 0$; $e_{11} < 0$, where Arab subscripts are used to denote the partial derivatives.[10] The absence of a wage differential yields $e = 1$ and $E = H_y$. In addition, we assume that the level of effort depends positively on the wage gap and exhibits diminishing returns. For instance, the function $e = 1 + b_0 (w_y - w_x)^{b_1}$ satisfies the above properties for $w_y \geq w_x$ and $b_0, b_1 \in (0,1)$.

It will become clear below that the results of the analysis hold also in the absence of an effort-based endogenous wage gap. However, equation (2) adds realism to the model by capturing a fundamental feature of a typical dual developing economy, where the wage in the modern sector exceeds the wage in the agrarian sector. It also captures the spirit of a strand of the efficiency-wage theory that analyzes the determinants of interindustry wage differences. For instance, studies by Stiglitz (1974), Shapiro and Stiglitz (1984), Akerlof and Yellen (1986), Bulow and Summers (1986), and Copeland (1989) among others formalize the idea that firms in an industry can increase profits by raising wages above the market clearing price (i.e., wages in other industries). These wage differentials reduce monitoring costs, since workers are induced to provide greater effort by the threat of termination and thus a wage reduction. Leamer (1999) builds a model of effort-based wages which captures the concept that a firm in an industry can contract with workers regarding both the wage level and working conditions. The elements of the contract that enhance labor productivity but are disliked by workers are called "effort" and the labor market thus offers a set of wage-effort contracts with higher wages offsetting higher effort. Both approaches provide rigorous micro foundations for the existence of a positive relationship between interindustry wage differentials and effort-induced labor productivity. For the purpose of illustrating the equilibrium geometrically, we assume that the wage differential in equation (2) takes an additive (as opposed to a multiplicative) form, following the approach of Bulow and Summers (1986).

The representative firm in the modern sector maximizes profits

$$\pi_y \equiv AZ(E, K) - w_y H_y - r_K K \tag{3}$$

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[10] Strictly speaking, equation (2) must be written as $e \equiv e(\max\{w_y - w_x, 0\})$ to guarantee that more effort is associated with a positive wage differential for all $w_y, w_x \geq 0$. We will use equation (2) instead, in order to keep the notation simple.

with respect to its wage w_y, employment H_y, and sector-specific capital K, for any given reservation wage w_x, price $P_y = 1$, and rental of capital r_K. In what follows, we will use the lower case letter "r" with the appropriate subscript to denote the wage of a sector-specific factor (capital, child labor, and unskilled adult labor). In addition, we will use the lower-case letter "w" to denote the wage of the mobile factor (skilled adult labor). Furthermore, in the case of skilled adult labor, the lower-case subscript ("x" or "y") will denote the sector. The first-order conditions for the firm's maximization problem are

$$\partial\pi_y / \partial H_y = AZ_1(eH_y, K)e - w_y = 0\,, \tag{4}$$

$$\partial\pi_y / \partial w_y = \{AZ_1(eH_y, K)e_1 - 1\}H_y = 0\,, \tag{5}$$

$$\partial\pi_y / \partial K = AZ_2(eH_y, K) - r_K = 0\,. \tag{6}$$

Combining equations (4) and (5) yields the standard efficiency-wage equilibrium condition

$$e_1(w_y - w_x) = \frac{e(w_y - w_x)}{w_y}\,. \tag{7}$$

That is, the equilibrium marginal value of effort, captured by the left-hand side (LHS) of (7), must be equal to effort per dollar.

The reservation wage w_x determines the allocation of skilled adult labor between the modern and agrarian sectors. It is therefore important to analyze the effects of w_x on the efficiency wage w_y, aggregate effort E, and sector-wide employment of skilled adult labor H_y. Totally differentiating equation (7) yields

$$dw_y / dw_x = 1 - e_1 / (e_{11} w_y) \ > \ 1\,, \tag{8}$$

which implies that an increase in the reservation wage increases the efficiency wage by more than the former and raises the wage gap $w_y - w_x$. This property depends on the assumption that work effort exhibits diminishing returns in the excess wage (i.e., $e_{11} < 0$), which guarantees a unique interior equilibrium. To see this, consider a marginal increase in the reservation wage w_x. For any given value of the efficiency wage, the efficiency-wage gap declines. Then the marginal value of effort increases due to diminishing returns, leading the RHS to exceed the LHS in equation (7). The original equality is restored only if the efficiency wage increases in such a way that the new equilibrium is characterized by a larger efficiency-wage gap. Therefore, an increase in the reservation wage leads to a larger increase in the efficiency wage as shown formally in (8).

The dependence of workers employed in the modern sector on the reservation wage can be established by totally differentiating equation (5) and using (8):

$$\frac{dH_y}{dw_x} = \frac{Z_1 e_{11} + e_1^2 Z_{11} H_y}{e e_{11} w_y Z_{11}} < 0 \,. \tag{9}$$

Equation (9) states that an increase in the reservation wage reduces the number of skilled adult workers in the modern sector. In addition, using (8) and (9), total differentiation of $E = e(w_y - w_x)H_y$ yields $dE / dw_x = Z_1 /(w_y Z_{11}) < 0$. In other words, an increase in the reservation wage reduces the aggregate amount of effort and the level of output in the modern sector. The following lemma summarizes these results:

Lemma 1: *An increase in the reservation wage ($w_x \uparrow$): raises the level of effort per worker ($e \uparrow$), the efficiency wage ($w_y \uparrow$), the wage gap [$(w_y - w_x)\uparrow$], and the value of effort ($w_y / e \uparrow$); but reduces the employment level ($H_y \downarrow$), the aggregate level of effort ($E \downarrow$), and the level of output in the modern sector ($Y \downarrow$).*

Lemma 1 establishes an inverse relationship between the reservation wage and both the employment and output in the modern sector. This relationship can be interpreted as a downward-sloped demand curve for adult labor, which makes the allocation of labor between the modern and agrarian sectors similar to that in the standard sector-specific factors model. This property enhances the tractability of the analysis.

2.2 Nutritional Efficiency Wages

In general, child labor is considered socially undesirable due to a variety of reasons such as sexual harassment, unhealthy working conditions, excessive effort, and obstructing a child's access to education. In some cases, child labor is believed to be coerced, forced, bonded, slaved, unfair in wages, and injurious to the health and safety of children. We model child labor using analytical building blocks from Gupta’s (2000) partial-equilibrium model which incorporates the idea that some parents are selfish and not interested in the well-being of their children. In other words, unlike Basu and Van

(1998) among many others, we assume away the presence of parental altruism.[11] The selfish parents/guardians ask their children to work for an employer who can also hire skilled adult workers and unskilled adult workers. The former are imperfect substitutes and the latter are perfect substitutes for child labor as would be the case for many tasks in agriculture and manufacturing workshops. For instance, skilled adult workers can be used as foremen, supervisors or machine operators, whereas children and unskilled workers can supply raw materials to machinists and package the finished product. Each child's productivity depends on nutrition, which in turn depends positively on the level of the child's consumption of food according to the standard consumption efficiency wage hypothesis introduced by Leibenstein (1957). We assume the following nutritional efficiency function:

$$h = h(r_C)\,, \qquad (10)$$

where r_C is the wage (value of food) that accrues to the child worker and consumed by the child itself.

We assume, of course, that the child's guardian does not (or cannot) tax this portion of the child's payment and, in fact does not have an incentive to do so since the child's productivity will decline and the firm will not hire an unhealthy child. Alternatively, one can think of r_C as the portion of child's wage paid by the employer in food and clothing and the fixed mark-up as the monetary fraction of the wage that goes to the guardian. This interpretation can be readily applied to children working as domestic servants or in agriculture.

We also assume that the function $h(r_C)$ has the following standard properties: $h(r_C) = 0$, if the child wage is less than some positive number $\bar{r}_C$; it is concave for $r_C > \bar{r}_C$, (that is, $h_1(r_C) > 0,\ h_{11}(r_C) < 0$); and it is bounded from above. The last restriction guarantees the existence of a nutritional efficiency wage. The employer pays a cash premium $(\theta - 1)r_C$ to the child's parent on top of the in-kind nutritional efficiency wage r_C. In other words, the cost of hiring a child incurred by the employer is θr_C, where $\theta \geq 1$ can be thought of as a measure of child-labor "exploitation" in the sense that the higher is the value of θ the higher is the proportion of the effective wage that is collected by the selfish parent. Gupta (2000) determines the values of θ and r_C endogenously through a Nash cooperative game between a child's parent and the employer. Here we deviate from this approach by assuming that the child's nutritional wage r_C is determined endogenously through profit

[11] Parsons and Goldin (1989) provide evidence that parents were partially motivated by their own self interests when seeking employment opportunities for their children. However, Basu and Van (1998) review empirical studies that support the assumption of altruistic parents.

maximization, and we will treat θ as an exogenous parameter. The main results of our analysis hold also in the absence of a monetary premium which corresponds to the case of $\theta = 1$.

2.3 *Agrarian Producer Behavior*

Output in the agrarian sector is denoted by X and is produced under perfect competition and constant returns to scale. There are three factors of production: Unskilled adult labor L and child labor C, which are perfect substitutes, and skilled adult labor H_x which is an imperfect substitute for the other two. We assume that one unit of skilled adult labor generates one unit of effective skilled adult labor independently of the level of effort. Therefore, H_x denotes the amount of agrarian skilled adult labor and the number of agrarian skilled adult workers. Finally, we assume that, despite the existence of efficiency wages in the modern sector, the skilled adult wage rate in the agrarian sector w_x is flexible and assures full employment of skilled adult workers. This assumption implicitly postulates that the level of effort does not enter the utility of an adult worker.[12] Also, the assumption that child labor is a perfect substitute for unskilled adult labor follows the standard practice of the literature (see Basu and Van, 1998; Doepke and Zilibotti, 2005; and Genicot, 2005; among others), and allows the analysis of child-labor bans without driving the agrarian output down to zero.

Based on the above considerations, we postulate the following Cobb-Douglas production function for the agrarian sector

$$X = \left(L + \beta h(r_C) C_x\right)^{\alpha} \left(H_x\right)^{1-\alpha}, \tag{11}$$

where *X* is the agrarian-sector output; C_x is the number of children employed with $C_x \leq C$, where C denotes the economy-wide endowment of child-labor; hC_x is the total amount of child labor employed, expressed in efficiency units, and $0 < \beta < 1$ is an adult-equivalent scaling constant (i.e., one unit of child labor is equivalent to β units of unskilled adult labor); and H_x is the number of skilled adult workers employed in this sector.

The value of profits in the agrarian sector is given by

$$\pi_x = p_x \left(L + \beta h(r_C) C_x\right)^{\alpha} \left(H_x\right)^{1-\alpha} - \theta r_C C_x - r_L L - w_x H_x. \tag{12}$$

In the above profit expression, p_x is the fixed international relative price of good X due to our choice

[12] Unemployment among adult workers can be readily introduced into the model by relaxing this assumption along the works of Shapiro and Stiglitz (1984) and Matusz (1996).

of Y as the numeraire. The first term of the right-hand-side is the firm's revenue $p_x X$, where X is given by (11). The last three terms correspond to three components of labor costs: θr_C is the per-unit (child) cost and $\theta r_C C_x$ is total child-labor cost to a firm employing C_x children; expressions $r_L L$ and $w_x H_x$ correspond to the labor costs of employing unskilled and skilled adult workers respectively. Each firm takes p_x, r_L and w_x as given and chooses the number of child workers C_x, unskilled adult workers L, skilled adult workers H_x, and the nutritional efficiency wage r_C to maximize profits π_x. The first-order conditions for this maximization problem are given by

$$\partial\pi_x / \partial C_x = \alpha\, p_x \left(L + \beta h(r_C) C_x\right)^{\alpha-1} \left(H_x\right)^{1-\alpha} \beta h(r_C) - \theta r_C = 0\,, \tag{13}$$

$$\partial\pi_x / \partial H_x = (1-\alpha)\, p_x \left(L + \beta h(r_C) C_x\right)^{\alpha} \left(H_x\right)^{-\alpha} - w_x = 0\,, \tag{14}$$

$$\partial\pi_x / \partial L = \alpha\, p_x \left(L + \beta h(r_C) C_x\right)^{\alpha-1} \left(H_x\right)^{1-\alpha} - r_L = 0 \tag{15}$$

$$\partial\pi_x / \partial r_C = \alpha\, p_x \left(L + \beta h(r_C) C_x\right)^{\alpha-1} \left(H_x\right)^{1-\alpha} \beta h_1(r_C) C_x - \theta C_x = 0\,. \tag{16}$$

We can illustrate and explore the properties of the general-equilibrium solution by proceeding as follows: Combine equations (13) and (16) to generate the following equilibrium condition

$$h_1(r_C) = \frac{h(r_C)}{r_C}\,. \tag{17}$$

Equation (17) states that, at the optimum, the firm chooses the nutritional wage that minimizes the wage cost per efficiency unit $h(r_C)/r_C$ by setting the marginal efficiency of child labor equal to its average efficiency. Equation (17) also implies that the elasticity of nutritional efficiency with respect to the wage received and consumed by the child is equal to unity. It determines the equilibrium value of the nutritional efficiency wage r_C^* (we use superscript * to denote the equilibrium value of the corresponding variable), and arises in most nutritional-wage models (e.g., Stiglitz, 1976, page 187). It follows that the cost of hiring a child worker is also fixed and equal to θr_C^*.

The next step is to determine the equilibrium wage of unskilled adult workers, which is obtained by combining equations (13), (15), and (17)

$$r_L = \frac{\theta r_C}{\beta h(r_C)} = \frac{\theta}{\beta h_1(r_C)}\,. \tag{18}$$

The economic interpretation of equation (18) is straightforward. When a firm hires a child-worker, it pays θr_C dollars and receives $\beta h(r_C)$ unskilled adult equivalent units of labor. If instead, the firm hires one unit of unskilled adult labor, it pays r_L dollars. Unskilled adult labor and adult-equivalent child labor are identical in production. Consequently, at the interior equilibrium, the cost of hiring an extra unit of child labor (measured in adult equivalent units $\beta h(r_C)$) equals $\theta r_C / \beta h(r_C)$ and must be equal to wage of an unskilled adult worker, r_L. Basu and Van (1998) obtained a similar condition in the absence of nutritional child wages. Observe though that the wage of unskilled adult labor depends only on the nutritional efficiency wage and technological parameters.

Writing equation (17) as $r_L^* = \theta / \beta h_1(r_C^*)$ implies that the unskilled adult labor wage increases in the nutritional wage r_C^* and parameter θ; and declines in parameter β. Unskilled adult workers benefit from high nutritional wages, r_C^*; from high degree of child "exploitation" by guardians, θ; and from low child-labor productivity , β.

Next, we calculate the equilibrium wage offered to agrarian skilled adult labor. Combining (14) and (15) yields the standard relationship

$$\frac{(1-\alpha)}{\alpha}\frac{(L+\beta h(r_C)C_x)}{H_x} = \frac{w_x}{r_L}, \tag{19}$$

which states that the relative wage of skilled adult workers w_x / r_L is proportional to the unskilled labor intensity with the factor of proportionality given by the ratio of factor-cost shares $(1-\alpha)/\alpha$. As the relative wage of skilled adult workers rises, firms hire more (relatively cheaper) unskilled adult and child workers. Solving equation (19) for $[L+\beta h(r_C)C_x]/H_x$ and substituting the resulting expression into (15) yields the zero-profit condition

$$p_x = \alpha^{-\alpha}(1-\alpha)^{(a-1)} r_L^{\alpha} w_x^{1-\alpha}.$$

Solving the zero-profit condition for w_x generates an expression for the inverse demand for skilled adult workers in the agrarian sector:

$$w_x = (1-\alpha)\alpha^{\alpha/(1-\alpha)}(p_x)^{1/(1-\alpha)}\left(r_L\right)^{-\alpha/(1-\alpha)}. \tag{20}$$

It is clear from (20) that this inverse demand curve is horizontal and declines in the wage of unskilled adult labor. The horizontal demand curve stems from the presence of nutritional efficiency wages and child-labor surplus.

Equations (17), (18) and (20) determine the equilibrium values of the nutritional efficiency wage r_C^*, the wage of unskilled adult labor r_L^*, and the wage of agrarian skilled adult labor w_x^*. The assumption that all adult workers are fully employed means that the demand for unskilled adult labor equals its supply L. Solving (19) for the number of child-workers and using (18) to substitute r_C^* yield the demand for child labor

$$C_x = \frac{\alpha}{(1-\alpha)} \frac{w_x}{\theta r_C} H_x - \frac{L}{\beta h(r_C)} . \tag{21}$$

Equation (21) states that the demand for child labor is an increasing function of the number of agrarian skilled adult workers H_x and a decreasing function of the supply of unskilled adult labor measured in child-labor equivalent units, $L / \beta h(r_C)$. Because the nutritional efficiency wage pins down all three wages in the agrarian sector, the equilibrium levels of child-labor and agrarian skilled adult labor become complements!

Finally, notice that if the right-hand-side of (21) is non-positive, there is no demand for child labor. Consequently, equation (21) defines the following market participation condition for child workers [13]

$$w_x \geq (1-\alpha) p_x \frac{L^{\alpha}}{H_x^{\alpha}} . \tag{22}$$

In the absence of child-labor (say, due to compulsory education or a child labor ban), condition (22) holds as equality and corresponds to the inverse demand for agrarian skilled adult labor. This condition can also be derived by setting $C_x = 0$ in (14). We will revisit this point later in conjunction with the analysis of a child-labor ban.

2.4 Sectoral Allocation of Skilled Adult Labor

We assume that skilled adult workers can move freely between the agrarian and modern sectors. As a result, the following full-employment condition equalizes the economy-wide demand for skilled adult labor to its supply

$$H = H_x + H_y , \tag{23}$$

where H denotes the economy's fixed endowment of skilled adult labor. Lemma 1 then allows us to express the demand for skilled adult labor in the modern sector as

$$w_x = M(H_y; A, K) , \tag{24}$$

where $M_1 < 0,\ M_2 > 0$ and $M_3 > 0$.

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[13] Setting $C_x \geq 0$ and using (20) yields $\frac{\alpha}{(1-\alpha)} \frac{\beta h(r_C)}{\theta r_C} w_x H_x \geq L$. Substituting in (17) generates $\frac{\alpha}{(1-\alpha)} \frac{w_x H_x}{r_L L} \geq 1$. Solving for r_L in (19) and substituting into the above expression yields condition (22).

Similarly, equations (18) and (20) define a horizontal inverse demand function for agrarian skilled adult labor

$$w_x = N(p_x;\theta;\alpha)\,, \tag{25}$$

where $N_1 > 0,\ \ N_2 < 0,\ \ N_3 > 0$. An increase in the relative price p_x shifts higher the inverse demand for agrarian skilled adult labor, whereas an increase in the "child exploitation" parameter θ increases the cost of child labor to employers and has the opposite effect. An increase in the intensity of child labor captured by parameter *a* increases the productivity of skilled adult workers and shifts upward the inverse demand for agrarian skilled adult labor. The first two properties are obvious from inspection of (18) and (20) , whereas the last one can be derived by differentiating equation (20).

Equations (23), (24), and (25) constitute a system of three equations in three unknowns w_x, H_x and H_y. These equations determine the allocation of skilled adult labor between the two sectors and the skilled adult labor wage in the agrarian sector. Figure 1 illustrates the geometric solution to the above system of equations and will be used to analyze the model's comparative-static properties. The length of the horizontal segment 0_x0_y in Figure 1 measures the economy's endowment of skilled adult labor, H . The two vertical axes measure the skilled labor wage in units of good Y . Points 0_x and 0_y correspond to the origins of the agrarian and the modern sectors respectively. The horizontal curve w_xw_x is the graph of equation (25) and illustrates the inverse demand for agrarian skilled adult labor.

The curve labeled BM is the graph of equation (24) and expresses the demand for skilled adult labor in the modern sector as a function of w_x. Equation (7) and Lemma 1 imply that the efficiency wage gap $w_y - w_x > 0$ is an increasing function of w_x. These properties are reflected in the upward-sloped curve EC which is located above and is steeper than curve BM . In other words, as the labor employed in the modern sector H_y declines, the wage gap (the vertical distance between curves EC and BM increases. Finally, the downward-sloped curve *LL* is the graph of the market participation condition for children, which corresponds to the lower boundary of (22). In the absence of child labor, the equilibrium allocation of resources is given by the intersection of curves LL and BM at point N .

If equation (22) holds as a strict inequality (e.g., for sufficiently low values of L), then the unique intersection of curves BM and w_xw_x at point D determines the allocation of skilled adult labor between the agrarian and modern sectors. In Figure 1, distance $0_x\mathrm{G}$ corresponds to the equilibrium employment of agrarian skilled adult labor, and distance $\mathrm{G}0_y$ measures the skilled adult labor employed in the modern sector. The efficiency wage w_y is determined by point F which corresponds to the intersection of a vertical line passing through point D and curve CE. Once the allocation of skilled adult labor and wages w_x and w_y are determined, the model's other endogenous variables are determined as well through the corresponding equations.

3. Comparative Statics

The model generates a rich pattern of wages and employment and can be used to analyze the effects of several policies. We start with the effects of globalization, followed by the impact of domestic policies and regulations, on the incidence of child labor and the wage structure.

3.1 Globalization

3.1.1 International Trade: This global link operates through changes in the country's terms of trade, captured by the relative price of the agrarian good p_x. Without loss of generality, consider first a decline in p_x. This decline can be triggered by a number of mechanisms. For instance, if the economy exports good Y, then an improvement in the country's terms of trade caused by global trade liberalization is equivalent to a decline in p_x. Another mechanism that can cause a decline in p_x can be described as follows: Assume that the small country exports the agrarian good X and that trade sanctions or an effective global campaign to label child-labor intensive goods causes a global drop in their demand. The reduction of global demand for good X would cause a decline in p_x. In either case, a drop in p_x shifts the inverse demand for agrarian skilled adult labor downward in Figure 1, causing a decline in w_x and a corresponding reduction in the number of agrarian skilled adult workers H_x. Equation (21) implies that the number of children employed C_x declines as well. One can readily see from Figure 1 that a decline in w_x increases the number of skilled adult workers employed in the modern sector H_y, raises output Y, and causes a decline in the efficiency wage w_y, the wage gap $w_y - w_x$, and the value of effort w_y / e (see Lemma 1). The nutritional efficiency wage and the wage of unskilled adult workers are not affected by a decline in p_x.

Consequently, this dimension of globalization reduces the dispersion of wages between unskilled and skilled workers. If trade liberalization reduces the demand for child-labor intensive goods, it reduces the incidence of child labor without affecting the wage offered to working children. It is also obvious from Figure 1 that a sufficient decline in p_x can shift the horizontal demand for skilled adult labor below point N eliminating completely the demand for child-labor. Of course, the reverse effects can occur if trade liberalization causes an increase in the relative price of the agrarian good p_x. In other words, the nature of trade liberalization and the structure of comparative-advantage are important features of the international economics of child labor.

3.1.2 International Labor Migration: The model is well suited to analyze the effects of international labor migration. We focus on the impact of emigration in order to be consistent with the empirical literature which documents the prevalence of child labor in poor countries like India and China. Emigration of children can be modeled as a reduction in the economy's endowment of child labor C. A small reduction in C does not affect the initial allocation of resources, nor does it have an impact on prices and wages. As more children leave the country, the number of children employed remains the same, but the measured incidence of child labor increases because the share (not the absolute number) of working children increases.

The above-mentioned property allows us to consider the impact of a more realistic migration pattern, namely emigration of families consisting of, say, unskilled adult workers and children. This pattern of emigration can be analyzed by considering a simultaneous reduction in the endowment of unskilled adult workers L and the aggregate supply of children C. As long as the final equilibrium is characterized by underemployment of children ($C_x < C$), a decline in C does not affect any endogenous variable in the model. However a decline in L increases the equilibrium number of working children without affecting the rest of the endogenous variables. To see this property, observe that the demand of agrarian skilled adult labor, which is given by equation (25), does not depend on the supply of unskilled labor. Therefore all curves in Figure 1 remain invariant to a reduction in L, and equation (21) yields $\partial C_x / \partial L = -1/\beta h(r_C^*) < 0$. As a result, emigration of unskilled adults and children causes a rise in the number and the proportion of working children. Emigration of unskilled labor can indeed exasperate the problem of child labor by increasing the demand for working children.

Consider last the effects of emigrating skilled adult workers by examining the impact of a reduction in the economy's endowment of skilled adult labor H. This means that the horizontal distance $0_x 0_y$ in Figure 1 is reduced by the number of skilled adult emigrants. A decline in H does not affect the structure of wages in this small open economy. Therefore the skilled adult wage in the agrarian sector w_x remains the same, and so do employment and wages in the modern sector. All the adjustment occurs in the agrarian sector whose employment H_x and output X decline. Equations (21) and (23) imply $\partial C_x / \partial H = -\alpha w_x^* / (1-\alpha)\theta r_C^* < 0$, that is, the number of children employed in the agrarian sector C_X contracts as skilled adult workers leave the country. This result is robust to whether or not skilled workers emigrate with their children or without them since a marginal reduction in C does not affect the number of children employed. Consequently, the effects of skilled adult emigration are qualitatively similar to the effects of population contraction in a Lewis type small open economy with unlimited supply of (child) labor.

As in the case of international trade, the effects of emigration on child labor depend on the pattern of migration: relaxing migration restrictions on skilled adult workers, especially in advanced countries, would result in skilled workers moving from poor countries, where child labor is more prevalent, to rich countries where child labor is not such a common practice. This dimension of globalization is therefore beneficial to the global reduction of child-labor employment. However, the model predicts that relaxation of unskilled labor migration restrictions will result in a higher incidence of child labor.

3.1.3 Foreign Direct Investment (FDI): The effects of FDI can be analyzed by considering an increase in the endowment of capital K employed in the modern sector. In this case, both EC and MB curves in Figure 1 shift upward, with the former shifting more than the latter due to efficiency-wage considerations, causing an expansion in modern-sector employment H_y without affecting the skilled adult labor wage in the agrarian sector w_x. As a result, the equilibrium wage gap $w_y - w_x$ remains the same (see equation (7)) but there is a movement of skilled workers from the agrarian to the modern sector. The output of the latter expands at the expense of agrarian output and employment of both unskilled adult workers and working children. The arrival of multinationals does not affect the structure of wages or the value of effort, but reduces the incidence of child labor.

3.2 Domestic Policies and Regulations

The literature on child labor has analyzed a number of domestic policies aimed at reducing directly the demand or supply of child workers, such as banning child labor, increasing the returns to education, providing free meals to children, and offering direct income subsidies to families with children. The static nature of the present model does not permit the analysis of educational policies that work through dynamic channels and differences between the social and private returns to education. However, the model can be used to analyze wage subsidies offered to families with children and a ban on child labor.

3.2.1 Child-Wage Subsidies: Recall that each child worker receives the nutritional wage r_C, which takes the form of food or clothing, and the employer pays a cash premium $(\theta - 1)r_C$ to the child's guardian. Suppose now that the government (or an international organization) offers a specific subsidy to every child in the amount s that takes the form of a daily meal (say lunch), which covers part of each child's nutritional needs. Consequently, a firm pays θr_C per child worker in exchange of $h(r_C + s)$ efficiency units of child labor. In order to avoid corner solutions, we assume that, even in the presence of a subsidy, the firm has an incentive to offer a strictly positive child wage, that is $r_C + s < \overline{r}_C$.

The employer maximizes the following subsidy-ridden profit function

$$\pi_x = p_x \left(L + \beta h(r_C + s)C_x\right)^{\alpha} \left(H_x\right)^{1-\alpha} - \theta r_C C_x - r_L L - w_x H_x \tag{26}$$

taking the specific subsidy as given. Observe that the only difference between equations (12) and (26) is that in the latter the argument in the efficiency-wage function is augmented by the specific subsidy s. Consequently, the efficiency-wage function appears as $h(r_C + s)$ in the solution to the subsidy-ridden maximization problem. Equation (17) is transformed into $h_1(r_C + s) = h(r_C + s)/r_C$ and can be used to determine the subsidy effects on the child wage and the efficiency level. Observe that the introduction of a specific subsidy raises the equilibrium efficiency units per dollar spent on child labor. This requires an increase in the marginal efficiency and a reduction in the effective nutritional wage $r_C + s$ due to concavity of function $h(\cdot)$. In other words, the child wage r_C declines more than the specific subsidy s. The subsidy-ridden equation (18) can be written as $r_L = \theta / \beta h_1(r_C + s)$ and implies that the unskilled adult labor wage is reduced as well.[14] In the present model unskilled adult workers and working children are perfect substitutes, and therefore a reduction in the child-wage must reduce the equilibrium wage of unskilled adult workers.

The subsidy does not affect the zero-profit condition $p_x = \alpha^{-\alpha}(1-\alpha)^{(a-1)} r_L^{\alpha} w_x^{1-\alpha}$, which implies that the subsidy-induced reduction in r_L must increase the wage of skilled workers w_x. In Figure 1, curve $w_x w_x$ moves higher and generates a shift of employment from the modern to the agrarian sector resulting in a higher value of H_x. It is obvious then from equation (21) that the specific subsidy increases the incidence of child labor by increasing the relative wage of skilled adult workers w_x / r_L and the agrarian employment of skilled adult labor H_x and by decreasing the efficiency of child labor $h(r_C + s)$.

Furthermore, the subsidy-ridden increase in w_x raises the efficiency wage gap $w_y - w_x$ and reduces the value of effort w_y / e. Consequently, within the present framework, a policy aiming at helping children ends up increasing the demand for child labor, wage inequality among skilled adult workers, and effort per dollar. In contrast, it is straightforward to establish that an increase in the cash premium received by the child's guardian, captured by an increase in parameter θ, generates the opposite general-equilibrium effects: A decline in the skilled adult wage w_x, in the efficiency wage gap $w_y - w_x$, and in the effort per dollar e / w_y.

3.2.2 Child-Labor Regulations: The economics of child labor has devoted considerable effort to the positive and normative analysis of child-labor regulations that erect legal barriers (i.e., reducing the time that children are allowed to work, compulsory education, declaring certain occupations hazardous for children), or banning child employment altogether. The present model is suited to analyze the general-equilibrium effects of an effective ban on child labor. Starting at an equilibrium with working children depicted by point D in Figure 1, a complete ban on child labor changes the shape of the inverse demand curve for agrarian skilled adult labor from the horizontal line $w_x w_x$ to the downward-sloped curve LL. Wages become fully flexible and the model is transformed into one of a small open economy with an interindustry wage gap generated by an effort-based efficiency wage. This regime change is depicted in Figure 1 by moving from point D to point N and implies a reduction in the reservation wage w_x and the wage gap $(w_y - w_x)$. The zero-profit condition $p_x = \alpha^{-\alpha}(1-\alpha)^{(\alpha-1)} r_L^{\alpha} w_x^{1-\alpha}$ holds even in the absence of child labor and implies that a child-labor ban raises the wage of unskilled adult workers and reduces the wage of skilled adult workers.

4. Discussion

Are the model's key predictions empirically relevant? We take this opportunity to briefly comment on whether or not the model's properties are consistent with the available evidence and the analysis of several empirical studies on the determinants and effects of child labor. Consider first the evidence on the dramatic reduction in the incidence of child labor over the period 2000-2004 documented by the ILO (2006) report. In the present model, several policy-related-parameter changes affect the equilibrium value of child labor. For instance, the incidence of child labor declines as the

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[14] Differentiating totally equation $h_1(r_C + s) = h(r_C + s)/r_C$ yields $dr_C / ds = [h_1(r_C + s)/r_C h_{11}(r_C + s)] - 1 < -1$. In addition, total differentiation of $r_L = \theta / \beta h_1(r_C + s)$ combined with the previous expression for dr_C / ds yields

price of child-labor intensive products falls; as more skilled adult workers emigrate from poor countries; as the flow of unskilled workers leaving poor countries declines; as more multinationals shift their production to modern (child-labor free) sectors in developing countries; as governments impose child labor bans; and as governments reduce the amounts of subsidized meals to working children that make child labor even cheaper for employers. Many of these changes have been occurring simultaneously in the past and are documented in the latest ILO report.

Consider next the findings of Edmonds and Pavcnik (2002) who used household survey data to analyze the effects of globalization on child labor in Vietnam. Their main conclusion is that between 1993 and 1998 two trade liberalization attempts (increase in rice export quotas) increased the average price of rice by about 30 percent. This increase was associated to a 10 percent reduction in the probability of a child entering the labor force. At first sight, this finding seems to contradict our model's prediction that an increase in the price of the agrarian good raises the incidence of labor. This paradoxical outcome can be resolved by observing that the negative correlation between the price of rice and the probability of work for children holds for children engaged in work activities within their household (i.e., agricultural activities or household chores like cleaning, cooking etc). In the case of urban children who are employed outside their household (which fits more with the approach of the present model in which the demand for child labor is generated by profit-maximizing firms), a 30 percent increase in the price of rice is associated with a 5 percent increase in the incidence of child labor. This finding is consistent with the model's prediction. In addition, when these authors control for child and adult wages the correlation between the price of rice and child-labor incidence becomes insignificant. This result is also consistent with the model's focus on wages as the main channel through which globalization affects the incidence of child labor. Edmonds and Pavcnik (2002, Table 1) also report that between 1993 and 1998 the child wage increased by about 11 percent whereas the wage of adult workers increased by 30 percent confirming the child wage stickiness relative to adult wages. Finally, the authors find that the supply elasticity of child labor is much higher than the supply elasticity of adult workers.

We also want to comment on three recent empirical studies which have analyzed the relationship between the incidence of child labor and foreign direct investment (Kucera, 2002; Busse and Braun, 2004; Braun, 2006). These studies have used cross-sectional and panel data sets to test the hypothesis that a high incidence of child labor suppresses the wage of unskilled labor and therefore reduces the costs of production for multinational firms. In other words, these authors are interested in

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$dr_L / ds = -r_L / r_C < 0$.

testing the hypothesis that economies with high incidence of child labor provide cost advantages to multinationals. These studies found a statistically insignificant correlation between wages and child labor and a significant negative correlation between inward FDI and the incidence of child labor. In addition, Braun (2006) finds weak evidence for the hypothesis that child labor can discourage FDI by reducing the formation of human capital (caused by lower school attendance of children). According to Braun, the negative correlation between skilled labor and child labor only applies to high-skill levels and it is reversed for low-skill levels. These findings seem to contradict the predictions of models that assume flexible wages and focus on long-run supply-side determinants of child labor. In the present model variations in the incidence of child labor do not affect the unskilled adult wage, which is fixed by the nutritional efficiency wage offered to children. In addition, our model predicts that an increase in the sector-specific capital stock, caused by an inflow of FDI, reduces the agrarian output and the demand for child labor without having an impact on the economy's wage structure. These predictions are in line with the empirical studies on FDI and child labor.

Finally, we would like to mention that our analysis of a child-labor ban has interesting implications for the political economy of child-labor regulations: According to the model, unskilled workers (who are usually unionized and compete against child workers) would support legislation that bans child labor, whereas skilled workers would oppose such legislation. This result is consistent with the analysis of Doepke and Zilibotti (2005) who use a dynamic model with endogenous educational and fertility-based decisions to analyze the political economy of child-labor laws. It also highlights a potential conflict between high-income families consisting of skilled workers and non-working children and those with unskilled parents and working children. A ban on child labor reduces the income of a skilled-labor family, but has an ambiguous affect on the family income of the latter: it increases the wage of unskilled parents but eliminates the wage of working children including the wage portion that goes to the guardian's pocket. Therefore, families headed by unskilled parents with staying-at-home children would support a ban on child labor because it increases their family income, whereas families headed by unskilled parents with working children might oppose or support restrictions on child labor depending on the model's parameters. Since the proportion of working children is less than 50 percent, one could predict that the majority of families headed by unskilled parents would support a ban on child labor. This prediction is supported by an ILO report (ILO, 2006) which states that the trade union movement was influential in supporting legislation to reduce the incidence of child labor in the 1990s since the basic values of the trade union movement stand in complete opposition to child labor.

5. Concluding Remarks

The paper developed a tractable general-equilibrium model of a small-open economy which incorporates efficiency wages and child labor. The model was based on the following premises. First, we abstracted from altruistic motives in a poor family's decision to send its children to work. This deviation from what has become a standard assumption in the economics of child labor (i.e., Basu and Van (1998) and Doepke and Zilibotti (2005) among many others) was motivated by our desire to examine its robustness, explore the implications of a simple bargaining model of the household, and to endogeneize the incidence of child labor. Second, we assumed that children work only in the agrarian sector. This assumption is consistent with the empirical literature on child labor which reports that the vast majority of children engage in agricultural activities. Third, the model introduced child-labor considerations into a standard dual economy characterized by an endogenous wage differential between the agrarian and modern sectors. These three premises differentiated our approach from the rest of the literature and helped us to highlight several demand-side factors that condition the impact of international and domestic policies on child labor.

The modeling of child-labor as a perfect substitute for unskilled adult labor coupled with nutritional efficiency wages generates wage rigidity in the agrarian sector, and transforms the economy into a "dual" one with unlimited supply of child labor. Our analysis identifies conditions under which globalization can reduce the incidence of child labor: Trade policies that benefit the modern sector, relaxation of restrictions on international migration of skilled adult workers, and more foreign direct investment in the modern sector reduce the demand for child labor without worsening the wage income distribution. Trade policies that encourage more production of child-labor intensive products, emigration of unskilled adult workers and taxes that discourage foreign investment in the modern sector increase the incidence of child labor without improving the wage income distribution. The model was also used to shed light on the effects of two controversial domestic policies. Direct subsidies to working children increase the incidence of child-labor by lowering the cost of hiring children; and a ban on child labor benefits unskilled adult labor and hurts skilled adult workers.

Several of the above findings depend on specific assumptions about functional forms. For instance, the assumption of a Cobb-Douglas production function for the agrarian good can be readily relaxed without affecting the main results. One could also relax the assumption of an exogenous premium above and over the nutritional wage which is paid to the child's guardian by introducing Nash-bargaining considerations and endogenous reservation incomes in the game between the employer and the child's guardian. One could readily introduce formally a multi-member family structure that would permit the analysis of intra-family exploitation and the effects of globalization on family income and welfare. Finally, one could combine the demand structure of the present model with supply-side elements and credit constraints to develop more realistic open-economy models that can be used to study the nexus of globalization and child labor.

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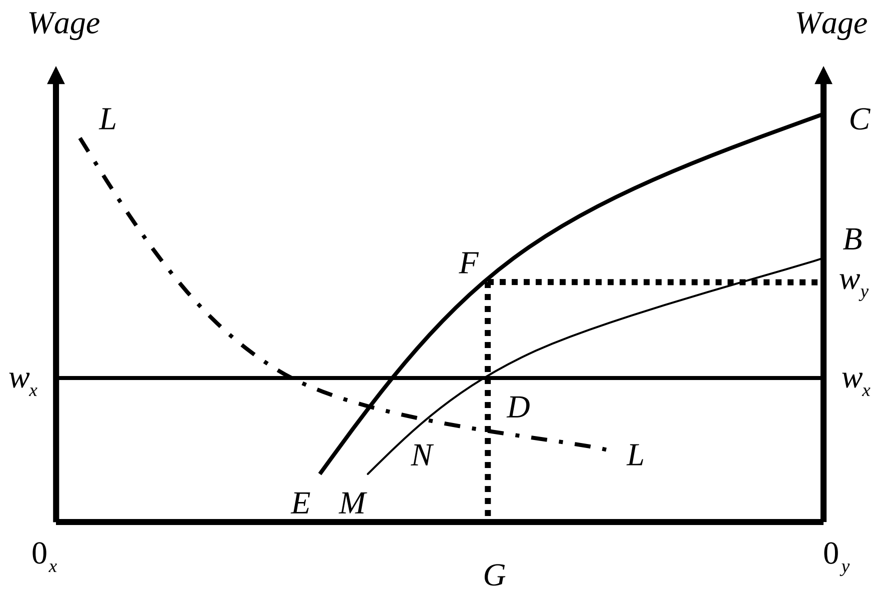

Figure 1: Sectoral Allocation of Skilled Adult Labor