The Role of Trade and Offshoring in the Determination of Relative Wages and Child Labour

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Abstract

Incorporating family decisions in a two-period.model of the world economy, we show that trade liberalization will raise the skill premium in developing countries where the initial share of skilled workers in the adult workforce is sufficiently high to attract from abroad production activities that have higher skilll requirements than the production activities previously carried out locally. In these countries, the child labour rate will definitelly fall. Elsewhere, trade liberalization will reduce the skill premium, but child labour may still fall because the income of poor households (and possibly also of rich ones) will rise. The empirical analysis confirms these predictions. Indeed it shows that liberalization reduces child labour everywhere, but will also induce the countries that started out with a relatively less (more) well-educated worforce to specialize more (less) in low-skill production activities than they would have done otherwise.

Key words: Trade barriers, technology transmission, skill endowments, skill premium, education, child labour.

JEL codes: D13, D33, F16, J13, J24.

1 Introduction

Since the middle of the last century, the world economy has witnessed an unprecedented expansion of international trade. In more recent decades, this has been accompanied by a reduction in the incidence of child labour. Is there a nexus between these phenomena? A stream of economic literature views child labour as a direct consequence of extreme poverty. According to this line of

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reasoning, if parental income is sufficient to keep the entire family above subsistence level, children will not work. If it falls below that level, however, all the children in the family will be made to work. For an overview of the theory, see Basu and Van (1998). For empirical work along these lines, see Edmonds (2005), and Edmonds and Pavcnik (2006). Another stream of economic literature views child labour as the outcome of parental optimization. According to this other line of reasoning, decisions concerning the allocation of a child's time rest on a comparison of the immediate benefits of child labour with the expected future benefits of education (see Cigno and Rosati 2003, 2005). The two approaches are not irreconcilable. If parents cannot borrow, current expenditure cannot exceed current income. In families where this constraint is binding, children will then work even if the expected return to education is higher than the return to labour. Without credit market imperfections, therefore, the allocation of the children's time between work and study would thus be the outcome of a portfolio decision, independent of parental income. With market imperfections, the decision is subject to a liquidity constraint (see Ranjan 2001, Dehejia and Gatti 2005, and Beegle et al. 2006). For families close to the breadline, the allocation will then depend essentially on parental income. As we move up the income scale, however, we may expect the link between child labour and parental income to become progressively weaker and eventually disappear. How does trade and offshoring come into the picture?

The opportunity to trade and invest across national borders enlarges the opportunity set and raises per-capita GDP. Other things being equal, liberalization may thus be expected to relax the liquidity constraints facing families with children, and bring about a reduction in child labour. Other things are not equal, however, because international trade and investment may alter relative wages. Heckscher-Ohlin theory predicts that, if a country opens itself up to trade, it will specialize further in the production of the goods that make more intensive use of its comparatively more abundant untradeable factor. If the untradeable factors are capital and labour as in the standard North-South model, liberalization will then induce the labour-abundant South to specialize further in the production of labour-intensive goods, and the capital-abundant North to specialize further in that of capital-intensive goods. The wage rate will consequently rise in the South and fall in the North (Stolper-Samuelson theorem). If the untradeable factors are skilled (more educated) and unskilled (less educated) labour as in Wood (1994), liberalization will induce the skill-abundant North to specialize further in the production of goods with a high skill content, and the skill-poor South to specialize further in the production of goods with a low skill content. With liberalization, therefore, the skilled wage rate will rise relative to the unskilled wage rate in the North, and fall in the South. This prediction does not appear to be borne out by the facts however. Empirical research shows that, in the 1980s and 1990s, increased openness was associated with a rise in the skilled-to-unskilled wage ratio (the "skill premium") not only in the North, but also in parts of the South, notably in middle-income Latin America (see Freeman and Oostendorp 2001, Feenstra and Hanson 1996, Robbins 1996, Wood 1997) and also in some low-income countries (see UNCTAD 1997).[1]

A limitation of the Heckscher–Ohlin framework is that it only envisages trade in final goods. In recent decades, however, there has been a very sharp increase in the volume of trade in intermediate goods, and in the relocation of the factories producing such goods from developed to developing countries ("offshoring"). As pointed out by Feenstra and Hanson (1996), and Zhu and Trefler (2005), if the productive activities so relocated were more skill-intensive than those originally carried out in the destination country, this will have caused the demand for skilled labour to shift upwards, and thus put upwards pressure on that country's skill premium. Depending on whether this or the Stolper-Samuelson-Wood effect prevailed, the skill premium could have thus risen or fallen. Conversely, if the relocated activities were less skill-intensive than those originally carried out in the destination country, this would have reinforced the Stolper-Samuelson-Wood effect, and the skill premium would have definitely fallen. Child labour could have fallen in either case, because liberalization could have raised the income and thus relaxed the liquidity constraint of the average family, but more likely if the skill premium and thus the incentive for parents to invest in their children's education has risen.

In Section 2 below, we report some broad facts concerning trade, FDI, relative wages, income, education and child labour in developing countries. In Section 3, we graft a family decision model on to a two-period model of the world economy incorporating the insights of recent trade theory. In Section 4, we bring the theory to the data. Section 5 concludes.

2 Stylized facts

The figures and tables referred to in this section are constructed using country data drawn from ILO, UNESCO, UNICEF, UNIDO, World Bank and the Barro and Lee dataset (detailed variable definitions and data sources can be found in Appendix 2). Figure 1 plots the child labour rate against the share of school-age children not enrolled at school. The correlation is positive but low. As pointed out by Cigno and Rosati (2002, 2005) among others, the correlation is low because many of the children enrolled at school in developing countries work at the same time. Further considering that, as stressed in Cigno (2012), school enrolment is not synonymous of school attendance, and school attendance is not synonymous of study effort (because working children have little time for rest and to do their home work, tend to be absent from school and are too sleepy and tired to take full advantage of school attendance when they do attend), it then follows that child labour rather than non enrollment is the best inverse proxy for effective educational investment.

Figure 2 plots child labour against the log of per-capita GDP. It also shows the child labour rate predicted by a Generalized Linear Model regression with a binomial distribution and a logit link function (see Papke and Wooldridge,

[1] Indeed, Leamer (1996, 1998) finds that unskilled wage rates did not fall even in the developed world.

1996). By construction, this model takes into account the nonlinearities arising from the fact that the dependent variable is constrained between 0 and 1. The correlation is negative but small, suggesting the presence of other important co-variates. As Table 1 shows, the marginal effect of per-capita GDP is clearly decreasing. For low-income economies (those with per-capita GDP below 1,000 dollars a year), a 1% increase in per-capita GDP is associated with a 10% reduction in child labour. For lower to middle income economies (those with per-capita GDP between 1000 and 4000 dollars), the marginal effect is less than half that estimated for poorer economies. For upper-middle income economies (those with per-capita GDP above 4000 dollars), the reduction is less than 4%, falling to about 2% for higher income countries. With reference to our introductory discussion about different ways of explaining child labour, it would thus appear that explanations based on income are important for very poor countries, where a large share of the population is close to the subsistence level (and the government's ability to remedy this by taxing and redistributing is severely limited), but other factors are more important in less poor countries.

Figure 3 plots child labour against a measure of trade openness (imports plus exports over GDP) lagged five years to allow for the effects of trade changes to work their way through the economy. The size of the dots refers to the country's skill endowment (measured as the average numbers of years at school of the population over the age of 25) again lagged five years. Like the correlation between child labour and income, the correlation between child labour and trade exposure is negative but low. If we focus on the larger dots, however, we get the impression that the correlation is higher in countries that started out with a large skill endowment than in countries that started out with a low one. It would thus seem that not only income, but also trade and skill endowments, have a beneficial effect on child labour. The literature suggests that foreign direct investment also may have a role. Over the past two decades, developing countries have indeed increased their ability to attract such investment. By 2013, these countries accounted for over a half of the FDI total (WIR, 2014), and even those, like Africa, that in earlier decades had remained on the sidelines of the globalization game, have recently started to take an active part. There is, however, no obvious correlation between this variable and child labour The next section will help us to formulate testable hypotheses.

3 Theoretical analysis

Consider a two-period, two-country model of the world economy. In each period $t = 1, 2$, each country $i = N, S$ (where N stands for North and S for South) is populated by a measure one of families. In period 1, each family consists of a working-age mother and her school-age son. The mother is endowed with one unit of time, and the child with θ units of adult-equivalent time ($0 < \theta < 1$). In period 2, each family consists of a working-age adult (the now grown-up son) endowed with one unit of time. A family is said to be of type H if the adult member is skilled, of type L if he or she is unskilled. We denote by a_t the share of skilled adults, and by $1 - a_t$ the share of unskilled adults, in the South's adult population in period t ($0 < a_t < 1$). In period 1, each Southern mother spends a fraction τ of her time endowment looking after her son ($0 < \tau < 1$), and supplies the rest inelastically to the labour market. In the same period, her son spends a fraction e of his adult-equivalent time endowment studying, and $1 - e$ working ($0 \leq e \leq \overline{e}$, with $\overline{e} < 1$). The outcome of education is uncertain (we can interpret this as saying that it depends on a random variable, the child's learning ability, unknown before the investment takes place). The amount of time $e\theta$ that a child spends studying in period 1 determines the probability that he will be a skilled worker in period 2. In the North, e is constrained to be equal to $\overline{e}$.(compulsory education). In period 2, each adult (no matter whether Northern or Southern) supplies his entire time endowment inelastically to the labour market.

There are two intermediate goods, x_1 and x_2, and three final goods, A, B and C. A is costlessly assembled from x_1 and x_2. B, C, x_1 and x_2 are produced using skilled and unskilled labour. We assume that B and C are non tradable. While B is produced and consumed only in the South, C is produced and consumed only in the North.[2] Of the intermediate goods, x_1 can be produced in either part of the world, but x_2 can be produced only in the North.[3] Trade barriers are prohibitively high in period 1, but it is common knowledge that these barriers will come down in period 2. This implies that, in period 1, the South can produce and consume only good B, because the production of good A would require an input of the intermediate good x_2, that cannot be imported from the North. By contrast, the North produces and consumes both A and C. In period 2, when trade opens, the South can start its production of A by importing x_2 from the North and paying for it by exporting part of its production of x_1. The North may continue to produce x_1 or relocate its production to the South.

Let q_{ti} denote the wage rate accruing to skilled labour, and w_{ti} the one accruing to unskilled labour, in country i in period t . Preferences, technology and relative factor endowments are assumed to be such that

$$\frac{q_{tS}}{w_{tS}} > \frac{q_{tN}}{w_{tN}}, \ t = 1, 2. \tag{1}$$

Put another way, we call North the country where skilled labour is so abundant, in period 1, that no matter how much the other country, called South, invests in its children's education in the course of period 1, it cannot catch up with the North by period 2. We further assume that there is no migration in either period.

In period 1, agents correctly anticipate period-2 prices and wages. Given this assumption, the equilibrium could be found in one shot (no backward-induction problem). For ease of exposition, however, we first look for the period-

[2] As in Wood (2002), we assume that the B-sector is not just subsistence agriculture, but includes also a "modern sector" producing goods of less than export quality.

[3] We can imagine that the technology used to produce x_2 cannot be imitated by competitors because it is a complex skill-intensive technology that does not generate informational spillovers; see Thoenig and Verdier (2003).

2 equilibrium taking period-1 decisions as parameters, and then solve for period-1 decisions. As child labour is concentrated mostly in developing countries, we focus on the South.

3.1 Period 2

The period-2 set-up builds on the theoretical insights of Tang and Wood (2000), Wood (2002) and Zhu and Trefler (2005). In Tang and Wood and Zhu and Trefler, however, the objective of the analysis is to examine, respectively, the effect of a reduction in the cost of cooperation and of the South's catching-up on wage inequality in both parts of the world. Here, by contrast, our aim is to establish the effect of period-2 cross-country trade and investment liberalization on the period-2 skill premium, because that will affect period-1 education and child labour decisions. As the analytical techniques used in this subsection are well established in the literature, we concentrate on the economic interpretation, and refer the reader to textbook expositions of the Hecksher-Ohlin model for technical details.

3.1.1 Production

In this period, the South can import x_2 from the North. This gives the former the opportunity of domestically producing the intermediate good x_1 by the constant-returns-to-scale technology

$$x_1 = L^{\varepsilon} H^{1-\varepsilon},\ 0 < \varepsilon < 1,$$

and then costlessly assembling the final good A from x_1 and x_2 according the constant-returns-to-scale technology

$$A = x_1^{\alpha} x_2^{1-\alpha},\ 0 < \alpha < 1.$$

The North may now choose to import x_1 from the South instead of producing it.

The period-2 cost-minimizing quantities of skilled and unskilled labour employed in country S to produce a unit of x_1 are, respectively,

$$h^*_{x_1} = (\frac{1-\varepsilon}{\varepsilon} \frac{q_{2S}}{w_{2S}})^{-\varepsilon} \tag{2}$$

and

$$l^*_{x_1} = (\frac{1-\varepsilon}{\varepsilon} \frac{q_{2S}}{w_{2S}})^{1-\varepsilon}. \tag{3}$$

The minimized period-2 unit cost of producing x_1 in country S is consequently

$$c_{1S} = w_{2S} l^*_{x_1} + q_{2S} h^*_{x_1}. \tag{4}$$

Denoting by c_{1N} the period-2 unit cost of producing x_1 in country N, and recalling that (1) holds, we can realistically assume

$$c_{1N} > c_{1S},$$

and thus that x_1 will be produced only in country S. We may interpret this as saying that the North's x_1 producers relocate their factories in the South.[4] As x_1 will be produced only in the South, and x_2 can be produced only in the North, we will then write, dispensing with country subscripts,

$$x_1^* = (\frac{1-\alpha}{\alpha}\frac{c_2}{c_1})^{1-\alpha} \tag{5}$$

and

$$x_2^* = (\frac{1-\alpha}{\alpha}\frac{c_2}{c_1})^{-\alpha}, \tag{6}$$

where x_1^* and x_2^* are the cost minimizing quantities of intermediate goods x_1 and x_2 employed in country S and N to produce one unit of good A.Note that c_2 denotes the minimized period-2 unit cost of x_2.[5] The period-2 unit cost of A is

$$c_A = x_1^* c_1 + x_2^* c_2. \tag{7}$$

Good B is produced by the constant-returns-to-scale technology,

$$B = L^{\beta} H^{1-\beta},\ 0 < \beta < 1, \tag{8}$$

where H_B denotes the quantity of skilled labour, and L_B the quantity of unskilled labour, employed in this activity. The cost-minimizing inputs of skilled and unskilled labour per unit of output are, respectively,

$$h_B^* = (\frac{1-\beta}{\beta}\frac{q_{2S}}{w_{2S}})^{-\beta} \tag{9}$$

and

$$l_B^* = (\frac{1-\beta}{\beta}\frac{q_{2S}}{w_{2S}})^{1-\beta}. \tag{10}$$

The period-2 unit cost of B will thus be[6]

$$c_B = h_B^* q_{2S} + l_B^* w_{2S}.$$

[4] In Tang and Wood (2000), this is induced by a fall in co-operation cost that makes it advantageous to transfer entrepreneurs, designers, engineers and other professionals from the North to the South. In Feenstra and Hanson (1996), offshoring is made profitable by the fall in in the cost of production of the South relative to that of the North. This fall is explained by capital flows lowering the interest rate in the South relative to the North. In Zhu and Tefler (2005) it is the Southern catch up that makes profitable relocating the production of some goods from the North to the South. All these arguments could be applied also to our model. For simplicity, however, we have directly assumed that trade liberalization makes it possible and advantageous for the North to import x_1 from the South.

[5] As we have not modelled the production of x_2, we do not have a cost function for it. We will thus treat c_2 as a parameter.

[6] Similar expressions may be derived also for the North for good C.

3.1.2 Consumption

In the South, the average family (recall that families are differentiated by skill level) solves

$$\begin{aligned} MaxU_{S2} &= \ln B + \gamma \ln A \\ \text{s.t. } Y_{S2} &= P_{B2}B + P_{A2}A, \end{aligned}$$

where U_{S2} is the son's utility, and

$$Y_{S2} = a_2 q_{2S} + (1 - a_2) w_{2S}$$

the average period-2 income[7]. Using the first-order conditions, we can derive the South's period-2 average demands for the two final goods,

$$\begin{aligned} A^D_{S2} &= \frac{\gamma}{1+\gamma}\left(\frac{Y_{S2}}{P_{A2}}\right) \qquad (11) \\ B^D_2 &= \frac{1}{1+\gamma}\frac{Y_{S2}}{P_{B2}} \end{aligned}$$

and for the two intermediate goods,

$$\begin{aligned} x^D_{S1} &= x^*_1 A^D_{S2} \qquad (12) \\ x^D_{S2} &= x^*_2 A^D_{S2}. \end{aligned}$$

Therefore,

$$\frac{A^D_{S2}}{B^D_2} = \gamma \frac{P_{B2}}{P_{A2}} \frac{Y_{S2}}{Y_{S2}} = \gamma \frac{P_{B2}}{P_{A2}} \qquad (13)$$

The average Northern family's optimization problem is

$$\begin{aligned} MaxU_{N2} &= \ln C + \gamma \ln A \\ \text{s.t. } Y_{N2} &= P_{C2}C + P_{A2}A, \end{aligned}$$

where U_{N2} is the son's utility, and, Y_{N2} the average period-2 income. Therefore, the North's demands are

$$A^D_{N2} = \frac{\gamma}{1+\gamma}\frac{Y_{N2}}{P_{A2}} \qquad (14)$$

$$C^D_{N2} = \frac{1}{1+\gamma}\frac{Y_{N2}}{P_{A2}} \qquad (15)$$

and

$$\begin{aligned} x^D_{N1} &= x^*_1 A^D_{N2} \qquad (16) \\ x^D_{N2} &= x^*_2 A^D_{N2} \end{aligned}$$

[7] Note that in the budget constraint we are using the balance-of-trade equilibrium condition.

3.1.3 Equilibrium

For the zero-profit condition, prices will be equal to unit costs. Therefore,

$$P_{A2} = c_A = x_1^* l_{x_1}^* w_{2S} + x_1^* h_{x_1}^* q_{2S} + x_2^* c_2 \tag{17}$$

and

$$P_{B2} = l_B^* w_{2S} + h_B^* q_{2S}. \tag{18}$$

Equilibrium in the South's labour markets further requires

$$a_2 = h_B^* B_2 + x_1^* h_{x_1}^* (A_{S2} + A_{N2}) \tag{19}$$

and

$$1 - a_2 = l_B^* B_2 + x_1^* l_{x_1}^* (A_{S2} + A_{N2}). \tag{20}$$

We have then four non-linear equations in four unknowns, A_{S2}, B_2, q_{2S} and w_{2S} [8]

We now make the following standard assumption.

Assumption 1. **No factor-intensity reversal (NFIR):** $\forall \frac{q_{2S}}{w_{2S}}$, either

$$\frac{x_1^* h_{x_1}^*}{x_1^* l_{x_1}^*} > \frac{h_B^*}{l_B^*} \tag{21}$$

or

$$\frac{x_1^* h_{x_1}^*}{x_1^* l_{x_1}^*} < \frac{h_B^*}{l_B^*} \tag{22}$$

Given NFIR, and noting that $x_2^* c_2 = (1 - \alpha) P_{A2}$, (17) $-$ (18) implies a two-way relationship between $\frac{P_{A2}}{P_{B_2}}$ and $\frac{q_{2S}}{w_{2S}}$ such that

$$\frac{P_{A2}}{P_{B2}} = \frac{1}{\alpha} \varphi(\frac{q_{2S}}{w_{2S}}),\ \varphi' > 0 \text{ for } (21),\ \varphi' < 0 \ i\text{for } (22) ... \tag{23}$$

Substituting from (23) into (13), and then into (19) $-$ (20), we obtain due equations in the two unknowns, q_{2S} and w_{2S}. Straightforward computation gives us the period-2 skill premium, $\frac{q_{2S}}{w_{2S}}$, as a function of of the period-2 labour force skill composition, a_2, and of the technological and preference parameters, α and γ,

$$\frac{q_{2S}}{w_{2S}} = G(a_2, \alpha, \gamma),\ G'_{a_2} < 0. \tag{24}$$

The function $G(.)$ will differ according to whether (21) or (22) holds true. Denoting the first case by the superscript U, and the second by the superscript D, it can be easily shown that, for any (a_2, α, γ),

[8] Similar equations determine A_{N2}, C_2, q_{2N} and w_{2N} in country N. For the sake of simplicity we skip the North equilibrium analysis, thus we take A_{N2} as a parameter.

$$G^U(a_2,\alpha,\gamma) > G^D(a_2,\alpha,\gamma),\ G'^U_\alpha > 0,\ G'^U_\gamma > 0,\ G'^D_\alpha < 0 \text{ and } G'^D_\gamma < 0. \quad (25)$$

If trade barriers did not come down in period 2, the South would continue to produce only good B as in period 1. Since, by Assumption 1, $\frac{h_B^*}{l_B^*}$ is either lower or higher than $\frac{x_1^* h_{x_1}^*}{x_1^* l_{x_1}^*}$ for all $\frac{q_{2S}}{w_{2S}}$, it then follows that, if the economy were to remain closed in period 2, the period-2 equilibrium skill premium would fall between $G^U(a_2,\alpha,\gamma)$ and $G^D(a_2,\alpha,\gamma)$. Denoting the closed economy case by the superscript M, we can then write

$$G^D(a_2,\alpha,\gamma) < G^M(a_2) < G^U(a_2,\alpha,\gamma). \quad (26)$$

3.2 Period 1

Having obtained $\frac{q_{2S}}{w_{2S}}$ as a function of a_2 under the assumption that the economy is open in period 2, we shall now go on to determine e and thus a_2 under this assumption, and under the competing assumption that the economy is closed not only in period 1, but also in period 2.

3.2.1 Consumption and education

In the current period, mothers inelastically supply all the time left over from child care to the labour market. To avoid carrying too many constants around, we set $\theta = \tau = \frac{1}{2}$. Recall that sons spend a fraction e of θ studying, and a fraction $1-e$ working.[9] A child spending $e\theta$ units of time studying in period 1 has a probability $\pi(e)$ of becoming a skilled adult worker in period 2.[10] For simplicity, we assume

$$\pi(e) = e.$$

As child labour is obviously unskilled, and having assumed that it is perfectly substitutable for unskilled adult labour at the rate θ, the opportunity-cost of education per unit of adult-equivalent time is w_{S1}. We abstract from other educational costs.

Recall that a fraction a_1 of Southern mothers is skilled, and a fraction $1-a_1$ unskilled. Let P_{B1} denote the price of good B in period 1. Given P_{B1}, q_{1S},

[9] As noted in the last section, the correlation between labour participation and non-school enrolment is positive but less than perfect. Here, however, e is the *fraction* of time that a child spends studying (including homework), rather than the share of school-age children enrolled for education. As we are talking of poor countries, it seems reasonable to simplify the analysis by assuming that the time left to a child after taking the minimum necessary amount of rest will be entirely spent studying or working. For a fuller analysis, see Cigno 2012 and references therein.

[10] That is true in the North as in the South. In the former, however, children are obliged to study full time.

w_{1S}, q_{2S} and w_{2S}, a type- j family ($j = H, L$) solves

$$\begin{aligned} MaxU_{S1}^{j} &= E\left[\ln B_j + \gamma(\ln k_j)\right] \\ \text{s.t. } 0 &\leq e_j \leq \bar{e} \\ R_j &= P_{B1}B_j, \end{aligned}$$

where U_{S1}^{j} is the mother's utility function, and

$$\begin{aligned} R_j &= \frac{1}{2}(w_{1S} + (1 - e_j)w_{1S}) \text{ if } j = L \\ R_j &= \frac{1}{2}(q_{1S} + (1 - e_j)w_{1S}) \text{ if } j = H \\ k &= q_{2S} \text{ with probability } e_j \\ k &= w_{2S} \text{ with probability } 1 - e_j. \end{aligned}$$

The dependence of U_{S1}^{j} on k reflects an altruistic interest in the child's future earning capacity and thus consumption.

At an interior solution,

$$B_{j1}^{D} = \frac{w_{1S}}{P_{B1} 2\gamma \ln\left(\frac{q_{2S}}{w_{2S}}\right)},\ j = H, L,$$

$$e_H^{*} = 1 + \frac{q_{1S}}{w_{1S}} - \frac{1}{\gamma \ln\left(\frac{q_{2S}}{w_{2S}}\right)} \tag{27}$$

and

$$e_L^{*} = 2 - \frac{1}{\gamma \ln\left(\frac{q_{2S}}{w_{2S}}\right)}. \tag{28}$$

Therefore, the South's aggregate period-1 demands for goods and education are, respectively,

$$B_1^{D} \equiv a_1 B_{H1}^{D} + (1 - a_1)\, B_{L1}^{D} = \frac{w_{1S}}{P_{B1} 2\gamma \ln\left(\frac{q_{2S}}{w_{2S}}\right)}$$

and

$$e^{*} \equiv a_2 = a_1 e_H^{*} + (1 - a_1)\, e_L^{*} = 2 + a_1 \left(\frac{q_{1S}}{w_{1S}} - 1\right) - \frac{1}{\gamma \ln\left(\frac{q_{2S}}{w_{2S}}\right)}. \tag{29}$$

There are also two possible corner solutions, one with $e_j = 0$ and the other with $e_j = \bar{e}$. For w_{1S} sufficiently low, the first one may realistically apply to type-L mothers, whose income would then be $R_L = w_{1S}$. That is interesting because, in such a case, a sufficiently large increase in income would raise the demand for education, and reduce the supply of child labour, as theorized by Ranjan (2001), and exemplified by our Table 1 and Figure 2.

Proposition 1 e_L^{*} *is nondecreasing (increasing for* w_{1S} *sufficiently low) in* R_L.

In what remains of this section, we will focus on the case where both family types are at an interior point.

3.2.2 Equilibrium

As we saw in the last subsection, the cost-minimizing inputs of skilled and unskilled labour per unit of B are, respectively,

$$h_B^* = (\frac{1-\beta}{\beta}\frac{q_{1S}}{w_{1S}})^{-\beta} \tag{30}$$

and

$$l_B^* = (\frac{1-\beta}{\beta}\frac{q_{1S}}{w_{1S}})^{1-\beta}. \tag{31}$$

Thus, perfect competition requires

$$P_{B1} = l_B^* w_{1S} + h_B^* q_{1S},$$

labour market equilibrium requires

$$\frac{1}{2}a_1 = h_B^* B_1 \tag{32}$$

and

$$\frac{1}{2}((1-a_1) + \frac{1}{2}(1-a_2)) = l_B^* B_1, \tag{33}$$

and goods market equilibrium requires

$$B_1 = B_1^D = \frac{w_{1S}}{P_{B1} 2\gamma \ln\left(\frac{q_{2S}}{w_{2S}}\right)}.$$

The period-1 equilibrium skill premium is determined by period-1 relative labour endowments. Using $(30)-(31)$, we find

$$\frac{a_1}{2-a_1-a_2} = \frac{h_B^*}{l_B^*} = \frac{1}{\frac{1-\beta}{\beta}\frac{q_{1S}}{w_{1S}}}.$$

Hence, solving for $\frac{q_{1S}}{w_{1S}}$,

$$\frac{q_{1S}}{w_{1S}} = \frac{\beta}{1-\beta}(\frac{2-a_1-a_2}{a_1}). \tag{34}$$

Substituting from (29) and (34), we obtain

$$a_2 = 2 + a_1\left[\frac{\beta}{1-\beta}(\frac{2-a_1-a_2}{a_1}) - 1\right] - \frac{1}{\gamma\ln\left(G^m(a_2)\right)},\ m \in \{U, M, D\}$$

whence

$$2 - a_1 - a_2 = (1-\beta)(\frac{1}{\gamma\ln\left(G^m(a_2,\alpha,\gamma\right)}). \tag{35}$$

Proposition 2 *There exists a unique equilibrium relationship* $a_2^m(a_1)$ *such that (i)* $a_{2_{a_1}}^{\prime m} < 0$, $m = U, M, D$, *and (ii)* $a_2^U(a_1) > a_2^M(a_1) > a_2^D(a_1)$ *for all* a_1.
Proof. *See Appendix 1.* ■

Recalling that $a_2 = e$, the first part of this proposition tells us that the higher is the South's skill endowment, the less will parents in the South invest in their children's education. That is because, for any given expectation of $\frac{q_2}{w_2}$, the more skill-abundant the South is (in period 1, when it is still a closed economy), the lower will $\frac{q_1}{w_1}$ be. Given that, in view of $(27) - (28)$, the amount H-type parents invest in their children's education is increasing in $\frac{q_1}{w_1}$, and the amount L-type parents invest is independent of it, aggregate educational investment is then decreasing in a_1 The second part of the proposition tells us that, given a_1, the expectation that barriers to foreign trade and investment will disappear in period 2 *may* reduce child labour in period 1. The reason, in this case, is that foreign trade and investment *may* raise $\frac{q_2}{w_2}$, and thus increase the incentive for parents in the South to invest in their children's education in period 1.

We have reached this conclusion, however, on the assumption (see the last line of Sub-subsection 3.2.1) that both family types are at an interior point. Suppose, instead, that poorer families, those where the mother is unskilled, are at a corner ($e_L = 0$). An increase in w_1 would then raise R_L. If the increase were sufficiently large, e_L would become positive.

3.3 Testable implications

The analysis so far has assumed that the South is a homogeneous entity. In reality, the South consists of different countries, all skill-poor compared with the North, but some more than others.[11] Suppose that the intermediate good x_1 (tradable in period 2) can be produced by a continuum of technologies indexed $0 < z < 1$. Given $\frac{q_2}{w_2}$, each unit of the good produced with technology z will employ $h(z)$ units of skilled labour, and $l(z)$ units of unskilled labour. Arrange inputs so that $\frac{h(z)}{l(z)}$ is increasing in z. Let $C(z)$ be the unit cost of producing a good of skill-intensity z. For any $\frac{q_2}{w_2} > 1$, $C(z)$ is increasing and continuous in z. Suppose there is one developed country labelled N, and two developing countries labelled S_1 and S_2, such that S_2 has the lowest and N the highest relative skill endowment. Then,

$$(\frac{q_2}{w_2})^N < (\frac{q_2}{w_2})^{S_1} < (\frac{q_2}{w_2})^{S_2}.$$

In Figure 6, adapted from a diagram in Feenstra and Hanson (1996), the straight lines C_N, C_{S_1} and C_{S_2} are the graphs of the cost function $C(.)$ for, respectively, N, S_1 and S_2. For $z < Z_1$, C_{S_2} lies below both C_N and C_{S_1}. For $z > Z_2$, C_{S_2} lies above both C_N and C_{S_1}. For intermediate values of z, C_{S_1} lies below both C_{S_2} and C_N. The two cut-off points are implicitly defined by, respectively,

$$C(z_2, (\frac{q}{w})_{S_2}) = C(z_2, (\frac{q}{w})_{S_1})$$

and

[11] The converse applies to the North, but this is of no consequence for the present argument.

$$C(z_1,(\frac{q}{w})_{S_1}) = C(z_1,(\frac{q}{w})_N).$$

The diagram tells us that trade liberalization will make it advantageous for the North to relocate the production of intermediate goods with skill intensity $Z_1 < z < Z_2$ to country S_1, and the production of intermediate goods with skill intensity $0 < z < Z_1$ to country S_2. In general, therefore, the better endowed with skilled labour a developing country is when it opens itself up to foreign trade and investment, the more skill-intensive will the production activities relocated to that country be,

$$y(a_1) \equiv \frac{x_1^* h_{x_1}^*}{x_1^* l_{x_1}^*} - \frac{h_B^*}{l_B^*},\ y'_{a_1} > 0. \tag{36}$$

Taken together with the Proposition 2, (36) implies that the better endowed with skilled labour a developing country is before liberalization, the higher will its skill premium be after liberalization. In view of Proposition 1, (36) has a further implication. Suppose that w_1 is low enough for e_L to be increasing in R_L. If the country's initial stock of skilled labour is sufficiently large (a_1 sufficiently high) for foreign trade and investment liberalization to raise $\frac{q_2}{w_2}$, the period-1 supply of unskilled labour will fall, w_1 and consequently R_L will rise, and child labour will definitely fall. Otherwise, $\frac{q_2}{w_2}$ will fall, the period-1 supply of unskilled labour will rise, w_1 and consequently R_L will fall, and child labour will definitely rise. These are testable propositions. Before taking the theory to the data, however, we must allow for the possibility that liberalization will enhance productivity and thus raise both q_t and w_t. If that is the case, R_L may rise and child labour fall even if $\frac{q_2}{w_2}$ falls. This possibility is not considered in our formal analysis, but may well be in the data.

4 Empirical analysis

In this section, we test our theoretical predictions using two different datasets (see Appendix 2 for precise variable definitions and data sources). The first dataset was constructed merging the WDI (World Bank) and UNESCO databases, which provide comparable information on trade, FDI and various measures of the skill endowment, with the Industrial Statistics Database of the United Nations Industrial Development Organization (UNIDO), which provides annual information on the manufacturing sector disaggregated at the 2-digit level of the International Standard Industrial Classification (ISIC) revision 2 for the 1963-2008 period. The second dataset was constructed matching and merging the data on child labour, trade, FDI and skill endowments provided by UNICEF, UNESCO, World Bank, ILO, and Barro and Lee (2010). To get a measure of the skill premium for each UNIDO country in each year, we divided the average wage rate in industries classified by the OECD as "high or medium-high technology" by the average wage rate in industries classified as "low technology". Child labour is measured as a percentage of children in the

5-14 age range recorded as working. Trade exposure (open) is measured as imports plus exports over GDP. The skill endowments are alternatively measured by the share of individuals with primary education only (edu_pri) and the share of individuals with at least secondary education (edu_sec) , by the survival rate to the final grade of primary education (edupri_sur), or by the average number of years in education (edu_years), in the population aged 25 or more.

Given that, according to our theoretical analysis, the child labour effects of exposing a country to foreign trade come through induced skill-premium and income changes, child labour, income and the skill premium should be estimated simultaneously. As we do not have a dataset containing both child labour and the skill premium, however, we had little choice but to separately estimate a child labour equation and a skill premium equation. We did not estimate an income equation, but included the log[12] of per capita GDP (lnGDP_pc) in the list of right-hand-side variables common to both equations. Being aware that income is potentially endogenous, we tried instrumenting it with its lagged value, which is highly correlated with the explanatory variable itself but uncorrelated with the error term. In both the skill premium and the child labour equations, our measures of trade openness and skill endowments lagged five years (L5_open, etc.), because it takes time for trade exposure to fully deploy its effects conditional on the skill endowments. To capture the conditionality, we tried interacting the lagged measure of trade exposure with the lagged measure of the skill endowments. As an additional control, we alternatively tried the Chinn-Ito index of foreign investment openness (kaopen) or the actual net inward foreign direct investment as a percent of GDP (fdi_perc). We would have liked to control also for the skill content of such investment, but we do not have comparable country-level data on it. As the year when the skill premium and the child labour rate are recorded varies from country to country (usually between 2007 and 2012) we used year dummies. The descriptive statistics shown in Table 2 highlight the disparity between the number of observations available for the skill premium and that available for child labour, and thus the difference between the size of the sample used to estimate the former and that used to estimate the latter.

Table 3 reports two alternative OLS estimates of the skill-premium equation. The explanatory variables are those already mentioned, including the lagged trade-lagged endowments interaction terms. As the dataset is assembled from different surveys concerning different years, we could only carry out cross-section estimates. In the first regression, L5edu_pri and L5edu_sec affect the skill premium negatively and significantly, but their interaction with L5open affects the said premium positively and significantly. Notice that the coefficient of the share of workers educated to primary level and no further is very similar to (actually slightly larger and more significant than) the coefficient of the share of workers with secondary or higher education. This suggests that what matters most for present purposes is the share of workers educated at least to primary level. As the second regression shows that dropping L5edu_sec raises the size

[12] Because we know from Table 1 that it affects child labour non-linearly.

and significance of the constant term at the expense of L5edu_prim, and of its interaction with L5_open, however, we preferred not to aggregate the two shares. Consistently with the theoretical prediction that the skill premium is affected by the (endogenously determined) skill intensity, rather than by the actual or potential volume of FDI , neither fdi_perc nor kaopen are significant. Income is never significant, and instrumenting it with its lagged value makes no qualitative difference to the estimates (IV estimates available on request).

According to the first of these regressions, the marginal effect of L5_open is equal to $-7.421 + 9.708$L5_edu_pri+9.146edu_sec. Therefore, trade exposure will raise a country's skill premium five years hence if that country' skill endowments at the date when the liberalization takes place satisfy

$$9.708\text{L5edu\_pri} + 9.146\text{L5edu\_sec} > 7.421. \tag{37}$$

Otherwise, the effect will be zero or negative. For a poor developing country where hardly anybody has secondary or higher education, (37) means that more than three quarters of the adult population must have completed primary education for the liberalization to have the effect of raising the skill premium.

Table 4 shows OLS and IV estimates of the child labour equation. The number of observations is relatively small. For most of the 108 countries with child labour data, we can construct L5edu_pri, but not L5edu_sec because there are no secondary education statistics. We thus use the lagged value of the most widely available statistic, namely the survival rate to the final year of primary education (L5edu_prisurv). Nothing of substance changes if we use L5edu_pri on its own, or L5edu_years instead. The sample gets even smaller if we want to introduce kaopen or fdi_perc. These data limitations prevented us from interacting trade with our skill endowment measure. Irrespective of whether income is taken to be exogenous or instrumented with its lagged value, and provided that we do not control for kaopen, child labour turns out to be negatively and significantly affected by per-capita income, lagged skill endowment and lagged trade openness.[13] Both kaopen and fdi_perc take significance away from ln_GDPpc. As the dependent variable, child labour, is bounded between 0 and 1, it would be better to use a Generalized Linear Model with a binomial distribution and a logit link function as in Section 2. The results obtained by this approach, shown in Table 5, are remarkably similar to those obtained using the other two methods, but give us the additional information that the best model (the one with the lower values of the model selection statistics, AIC and BIC) has neither kaopen nor fdi as an explanatory variable. This confirms our earlier remark that what matters is neither the actual nor the potential size of foreign direct investment, but rather its endogenously determined skill content.

Where countries satisfying (37) are concerned, the finding that trade exposure reduces child labour is clearly consistent with our estimates of the skill premium equation because, in those countries, trade exposure raises the skill premium. What about the finding that trade exposure reduces child labour

[13] Cigno et al. (2002) and Cigno (2003) find the same using a dichotomic index of trade openness instead of the trade ratio.

also in countries where (37) is not satisfied? The answer could be simply that data limitations prevented us from interacting L5_open with L5edu_pri and L5edu_sec. But there is another possible explanation. We have already pointed out (at the end of Subsection 3.3) that, if liberalization enhances productivity, exposure to foreign trade and investment may relax the liquidity constraints restricting the educational investment decisions of poor parents and thus reduce the child labour rate, even if it depresses the skill premium. Consistently with this argument, Table 1 shows that the marginal effect of per-capita income is higher in low-income countries, where it can be presumed that more households are liquidity constrained, than in high-income countries. But is it true that the skill premium actually rose, and the child labour rate actually fell, in countries satisfying (37), and that the skill premium actually fell, but the child labour rate did not necessarily rise, in countries not satisfying (37)?

To answer this question we need time-series data on *both* the skill premium and the child labour rate. Unfortunately, we have this information for only a few of the countries in our dataset (that is why we could only do cross-country estimates). In 2006, Costa Rica's skill endowments satisfied (37), and the estimated skill-premium equation consequently predicted that trade exposure would have a positive marginal effect (0.218). Over the subsequent five years, the skill premium did rise (by 2%). As real per-capita income rose (by 20.9%), however, the child labour rate fell (by a very substantial 36%). Turkey's 2007 skill endowments also were large enough for the skill-premium equation to predict a positive marginal effect (0.811). Over the subsequent quinquennium, the skill premium indeed rose by 5%. Despite a 12.7% increase in real per -capita income, however, the child labour rate remained practically the same (the number of working children fell substantially, but the number of children in the relevant age group rose by almost the same percentage). In all countries not satisfying (37) for which we have time-series-information, the skill premium fell as the estimated skill-premium equation predicts, but the child labour rate fell nevertheless, because per-capita income grew strongly. For example, Brazil's skill endowments were large enough, in 2007, for the skill-premium equation to predict a negative marginal effect of trade exposure (-0.632). Over the subsequent five years, the skill premium fell (by 12%). As real per-capita income grew by a robust 13.5%, however, the child labour rate fell (by 22%). Similarly, Iran's endowments were such, in 2005, that the skill premium equation predicted a negative marginal effect of trade exposure (-0.481). Over the subsequent five years, the skill premium fell (by 25%), but productivity rose (by 17.8%), and the child labour rate fell (by 15%). Mexico's 2006 skill endowments also were large enough to make the marginal effect of trade exposure negative (-0.037) . We cannot check whether the skill -premium actually fell in the course of the subsequent quinquennium because we have the necessary data for only one year, but we do know that real per-capita income increased (by 9%), and that the child labour rate fell by (23%). Such scattered time-series information as we have thus seems to confirm the cross-country estimates.

5 Conclusion

The theoretical part of our analysis used a bare-bones model of the family emphasizing educational decisions, immersed in model of the world economy emphasizing trade in intermediates and technology transfer via offshoring, to predict the child labour implications of liberalizing foreign trade and investment. We found that educational investment is increasing in the expected skill premium. If the parent's wage rate is sufficiently low for educational decisions to be liquidity constrained, educational investment is increasing also in the parent's income. The expectation that barriers to foreign trade and investment will come down in the future may raise or lower a country's skill premium depending on whether the country's initial stock of skilled labour is or is not large enough to attract productive activities from abroad that have a higher skill requirement than those originally carried out in the country. In the first case, child labour will definitely fall. In the second, it may. If liberalization enhances productivity, all wages will rise, and it is then more likely that the child labour rate will fall even if the skill premium will rise. These predictions are not rejected by the data. Cross-country analysis finds that trade exposure raises the skill premium in countries sufficiently well-endowed with skilled labour, and fall everywhere else, but child labour falls everywhere. The time-series data available for a few countries confirms that the skill premium actually rose or fell, and the child labour fell, in the way predicted by the cross-country analysis.

Where child labour is concerned, it would thus seem that liberalization is beneficial for all developing countries. It also creates a divide, however, between countries that, having started out with a sufficiently large number of skilled worker, will specialize in low-skill production activities less than they would have done without liberalization, and countries that, having started out on the wrong foot, will specialize even further in the production of low-skill goods. For the second group of countries, our Feenstra-Hanson and Zhu-Trefler inspired analysis yields qualitatively the same result as traditional Heckscher-Ohlin and Stolper-Samuelson theory. For the second, it yields the opposite result. Looking at the period immediately preceding the one included in our empirical analysis, the first group of countries bears strong similarities with the so-called Asian Tigers (Hong-Kong, Singapore, South Korea, Taiwan) that, in the middle of the 1960s and 1970s invested massively in education before liberalizing. That allowed Hong-Kong and Singapore to become major exporters of financial services, and South Korea and Taiwan of IT goods. Their example was followed a few years later by the so-called Tiger Cub countries (Indonesia, Malaysia, Philippines and Thailand). Those tigers and their cubs are now classified as emerging or newly industrialized countries.

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7 Appendix 1: Proof of Proposition 2

Re-write (35) as

$$F(a_1, a_2) = 2 - a_1 - a_2 - \frac{1-\beta}{\gamma \ln G^m(a_2, \alpha, \gamma)} = 0.$$

For the Dini implicit functions theorem, and given that

$$G'^m_{a_2} < 0 \text{ for } m \in \{U, M, D\},$$

$$\frac{da_2}{da_1} = -\frac{F'_{a_1}}{F'_{a_2}} = -\frac{1}{1 + (1-\beta)\frac{-\gamma \frac{G'^m_{a_2}(a_2,\alpha,\gamma)}{G^m(a_2,\alpha,\gamma)}}{(\gamma \ln(G^m(a_2,\alpha,\gamma))^2}} < 0.$$

Now let

$$H(a_2) = 2 - a_1 - a_2, \; H'_{a_2} < 0$$

and

$$K^m(a_2) = \frac{1-\beta}{\gamma \ln G^m(a_2, \alpha, \gamma)}, \; K'^m_{a_2} > 0.$$

For $0 < a_2 < 1$,

$$1 - a_1 < H(a_2) < 2a_1$$

and

$$0 < K^m(a_2) < \infty.$$

From monotonicity, $K^m(a_2)$ can cross $H(a_2)$ only once, and this will surely happen since $K^m \to \infty$ as $a_2 \to 1$. Finally noting that $K^U(a_2) < K^M(a_2) < K^D(a_2) \; \forall \; a_2$ the result $a_2^U(a_1) > a_2^M(a_1) > a_2^D(a_1) \; \forall \; a_1$ immediately follows.

8 Appendix 2: Definitions and sources

Definitions

Child labour is defined as the share of children aged 5–14 involved in child labour at the moment of the survey. A child is considered to be involved in child labour under the following conditions: (a) for children aged 5–11 if, during the reference week, if they did at least one hour of economic activity or spent at least 28 hours on household chores, (b) for children aged 12–14 if they did at least 14 hours of economic activity or spent at least 28 hours on household chores.

The skill premium is computed dividing the average wage in high and medium-high tech industries by average wage in low tech industries.

lnGDP_pc is the log of per capita GDP

open is the trade ratio (imports plus exports over GDP).

fdi_perc is net inward FDI as a percent of GDP

kaopen is the Chinn-Ito index of capital account openness.

Skill endowments are proxied by a number of different stock variables: **edu_pri** and **edu_sec** are, respectively, the shares of the population aged 25 or over with primary education only and with secondary or higher education; **edu_prisurv** is the survival rate to the last grade of primary school; **edu_years** is the population's average number of completed years of education.

L5open, L5edu_pri, etc. are open, edu_pri, etc. lagged 5 years.

Sources

Child labour. UNICEF-supported Multiple Indicator Cluster Surveys (MICS) and ILO-supported Statistical Information and Monitoring Programme on Child Labour (SIMPOC) surveys. The data were collected starting in the year 2000 in more than 50 surveys using a standard questionnaire, and using a standard definition of child labour to allow comparison. The surveys cover children aged 5 to 14. engaged in either "economic activities" (paid or unpaid work for someone who is not a member of the family) or in household chores such as cooking, cleaning and caring for younger children. See http://data.unicef.org/child-protection/child-labour, updated November 2014, and http://www.ucw-project.org/pages/interactive-map.aspx. http://www.ilo.org/ipec/Child labour statistics SIMPOC/Questionnaires surveys and reports/lang–en/index.htm contains time series for a limited number of countries.

Skill premium. Industrial Statistics Database of the United Nations Industrial Development Organization (UNIDO) including information on wages, employment, capital, value added and production disaggregated at the 2-digit level of the International Standard Industrial Classification (ISIC), revision 3.

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Trade and GDP. United Nations.

FDI. World Bank.

Capital account openness. Chinn and Ito (2006).

FIGURE 1: Child labour and non-school attendance

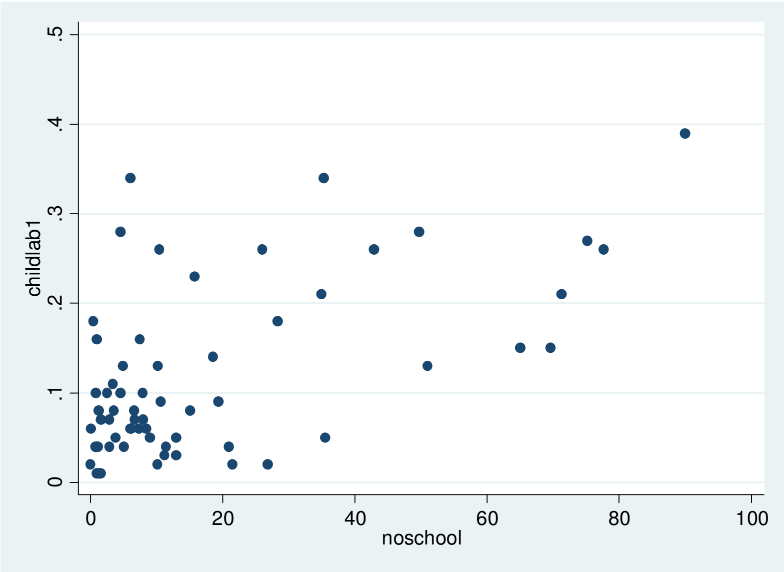

FIGURE 2: Child labour and per-capita GDP

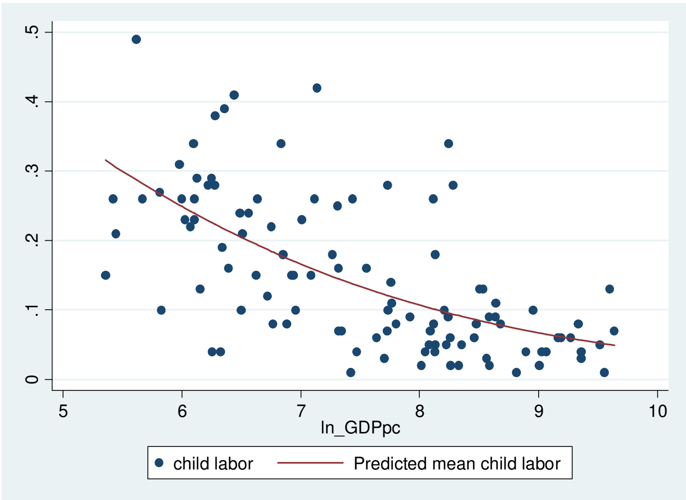

FIGURE 3: Child labour and trade openess

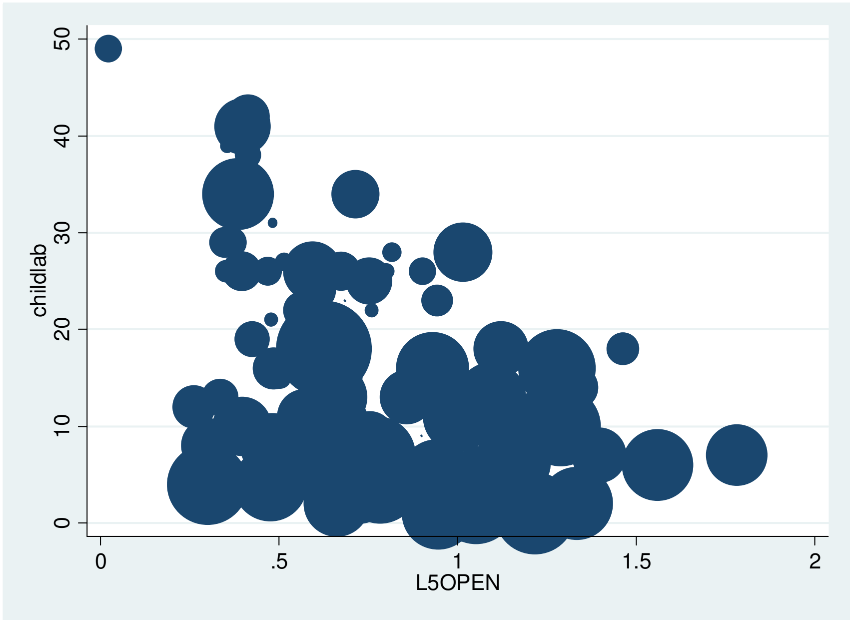

FIGURE 4: Skill endowment thresholds

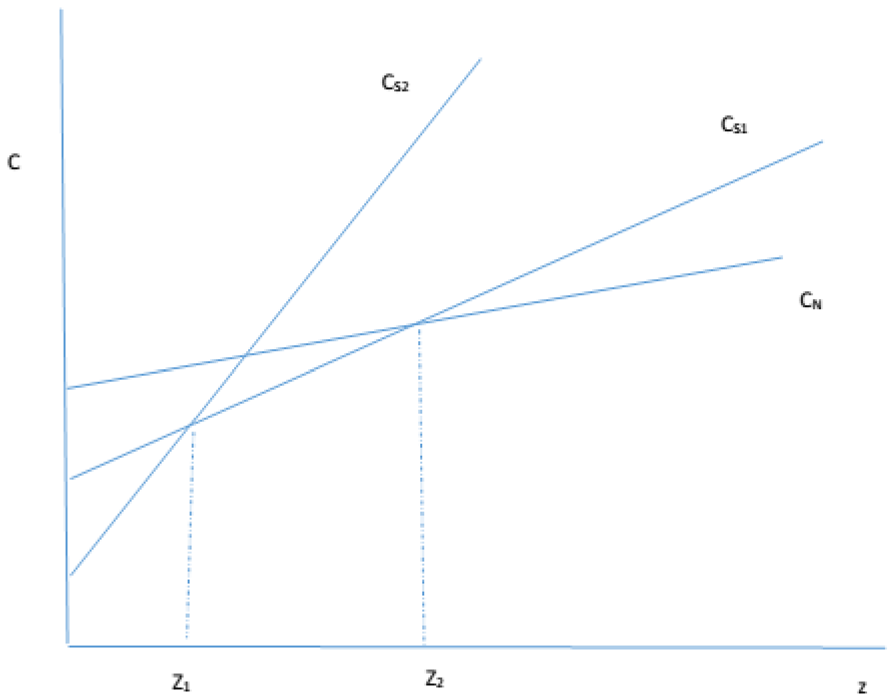

TABLE 1: Marginal child labour effects of per-capita GDP

GDP per capita ($)	dy/dx	Std. Err.	z	P>z	[95% Conf.	Interval]
100	-0.123	0.018	-6.92	0	-0.158	-0.088
200	-0.111	0.017	-6.43	0	-0.145	-0.077
500	-0.090	0.013	-6.71	0	-0.116	-0.064
1,000	-0.073	0.010	-7.60	0	-0.092	-0.054
2,000	-0.057	0.006	-9.32	0	-0.069	-0.045
3,000	-0.049	0.004	-10.88	0	-0.057	-0.040
5,000	-0.039	0.003	-13.53	0	-0.045	-0.034
10,000	-0.029	0.002	-16.50	0	-0.033	-0.026
20,000	-0.021	0.002	-14.05	0	-0.024	-0.018

TABLE 2: Descriptive statistics

Variable	**Observations**	**Mean**	**Std. Deviation**	**Min**	**Max**
childlab (%)	**108**	**14.796**	**10.955**	**1**	**49**
skill premium	**3828**	**1.27**	**0.675**	**0**	**18.108**
ln_GDPpc	**2691**	**8.282**	**1.660**	**4.383**	**12.109**
edu_pri	**663**	**0.297**	**0.176**	**0**	**0.89**
edu_sec	**657**	**0.433**	**0.172**	**0.005**	**0.802**
edu_years	**8550**	**8.24**	**3.061**	**1.1**	**14.2**
edu_surv	**1234**	**0.833**	**0.179**	**0.222**	**1**
open	**1666**	**0.976**	**0.616**	**0.145**	**4.858**
kaopen	**6250**	**-0.001**	**1.525**	**-1.864**	**2.439**
fdi	**2203**	**5.244**	**9.884**	**-161.242**	**172.716**

TABLE 3: Skill premium equation, OLS estimates

	REG 1	REG 2
Ln_GDPpc	0.071 (0.162)	0.052 (0.132)
L5edu_pri	-12.851*** (2.707)	-5.198*** (1.626)
L5edu_sec	-11.771*** (3.313)	
L5_open	-7.421*** (2.731)	-1.573*** (0.629)
L5edu_pri X L5_open	9.708*** (3.370)	4.108*** (1.845)
L5edu_sec X L5_open	9.146** (3.869)	
kaopen	0.131 (0.146)	
fdi_perc		-0.005 (0.009)
const.	11.174*** (2.526)	3.337*** (i.499)
n. of obs	216	225
year dummies	YES	YES

Robust standard errors in parentheses.

* p<0.05, ** p<0.01.***p<0.001

TABLE 3: Child labour equation, OLS and IV estimates

	OLS REG 1	OLS REG 2	OLS REG 3	IV REG 1	IV REG 2
ln_GDPpc	-0.0241** (0.0097)	-0.0171 (0.0119)	-0.0202* (0.014)	-0.0180 (0.0138)	-0.0220* ((0.0132)
L5edu_prisurv	-0.243*** (0.0673)	-0.274*** (0.0685)	-0.264*** (0.0681)	-0.271*** (-0.0779)	-0.257*** (0.0766)
L5open	-0.0668*** (0.0242)	-0.0936** (0.0361)	-0.0888** (0.0345)	-0.0932** (0.0372)	-0.0881** (0.0358)
kaopen		0.001 (0.007)		0.0012 (0.007)	
Fdi_perc			-0.0024** (0.0011)		-0.0024* (0.0013)
const.	0.566*** (0.0519)	0.563*** (0.065)	0.589*** (0.0647)	0.567*** (0.0754)	0.596*** (0.0754)
n. of obs.	82	57	56	57	56
year dummies	YES	YES	YES	YES	YES

Robust standard errors in parentheses.

* p<0.05, ** p<0.01.***p<0.001

TABLE 4: Child labour equation, glm LOGIT estimates

	LOGIT REG 1	LOGIT REG 2	LOGIT REG 3
ln_GDPpc	-0.233** (0.095)	-0.148 (0.111)	-0.168 (0.113)
L5edu_prisurv	-1.618*** (0.543)	-1.868*** (0.561)	-1.767*** (0.555)
L5open	-0.571** (0.238)	-0.791*** (0.332)	-0.714** (0.320)
kaopen		0.0233 (0.0556)	
fdi			-0.0184** (0.00921)
const.	1.538*** (0.418)	1.304*** (0.520)	1.428*** (0.544)
n. of obs.	82	57	56
year dummies	YES	YES	YES
AIC	0.65	0.75	0.75
BIC	-340	-207	-202

Robust standard errors in parentheses.

* p<0.05, ** p<0.01.***p<0.001