Income Inequality, FDI, and the Incidence of Child Labor

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Abstract

This paper examines the effect of income inequality on the incidence of child labor when labor constraints are present. We allow for heterogeneity among households as they vary in non-child labor income. Parents, taking their wage as given, choose whether to employ their children, and if so, the number of work hours as opposed to hours attending school. This allows for the examination of both the intensive and extensive margins of the supply of child labor among households. As supported by some recent empirical findings, we find that greater (lesser) income inequality reduces the supply of child labor when adult wage income tends to be low (high). We then extend the paper to allow for decreasing returns to scale with respect to labor and adults and children being perfect substitutes. We find that an increase in the endowment of complementary foreign capital, through foreign direct investment, results in an increase in the wage of both adult and child laborers and will lead to a decrease in the incidence of child labor for reasonable parameter restrictions.

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1 Introduction

According to the International Labour Organization, there are approximately 265 million children classified as child laborers (ILO 2013). This phenomena is a stubborn problem that continues to plague the least developed countries and contributes to the perpetual cycle of poverty from that which many have been unable to exit. Although the incidence of child labor has been in decline over the past few decades, it still remains staunchly prevalent in the poorest nations. The number of economically active children accounts for approximately 14% of children between ages 5 and 14 in the world, but the percentage of child laborers in sub-Saharan Africa and Asia are 25% and 17%, respectively (ILO 2013). While the causes of child labor are well-known and rooted in extreme poverty, other factors, such as insufficient credit markets, effectiveness of schooling, and foreign direct investment to name just a few, have been examined in order to see whether these factors exacerbate the problem.

One factor that has been largely ignored, though, is how income inequality across households may contribute to the total quantity of child labor in a country. A priori, one would think that the relationship between income inequality and child labor would be dependent on a country’s average income. If average income is very low, a greater dispersion of income would lead to more households which supply little to no child labor to the market. Therefore, one would expect that the relationship between income inequality and child labor to be negative for very low income countries. The opposite holds true when average income is high. A greater dispersion of income leads to a greater quantity of poorer households which would increase the incidence of child labor. Therefore, the relationship between income inequality and child labor is expected to be positive for high income countries. As shown in Section 4 though, the data presents a different picture.

One reason why this might be the case, aside from measurement error which is common with child labor data, is the way in which household income is observed. The World Bank data, which we employ, calculates a country’s Gini coefficient using country household surveys which generally ask the income in a household for a given time frame. If income from child labor is reported for

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the household, then the presence of child labor will push the Gini coefficient downwards relative to the Gini coefficient for adult income across households. This endogeneity could explain the inconsistency that is observed in the data. To address this problem, this paper proposes a simple model with heterogeneous households. This allows us to quantify how a given distribution of adult income leads to the total supply of child labor, and how the income from child laborers alters the final distribution of income across households.

Preliminary results from calibration exercises show that the presence of child labor significantly bias the Gini coefficient downward and this effect is more pronounced for countries with very low income per capita. Although dealing with a different topic, the framework is similar to that of Arcalean and Schiopu (2015) in how they examine the relationship between inequality and education funding and how an increase in inequality can have different effects for different income levels.

This paper is organized as follows: Section 2 presents a simple model with heterogeneous households. It is assumed that households differ in non-labor income, which can be interpreted as wealth, and will therefore supply different quantities of child labor to the market. Changes in the distribution of non-labor income will then affect the incidence of child labor in equilibrium. The model is later modified with exogenous foreign capital in the production function which leads to decreasing marginal productivity of labor and the possibility of multiple equilibria. Section 3 conducts standard comparative static and numerical exercises to highlight the role played by some key parameters. Section 4 provides an overview of World Bank data with regards to child labor participation rates across countries. Due to address the endogeneity between child labor and income inequality, we calibrate the model for each available observation of child labor participation for different countries. Using the calibrated measure of adult income inequality, we find that a greater dispersion of adult income across households reduces the incidence of child labor for the poorest countries. This affect weakens as average income increases. The paper then concludes with some final remarks.

2 The Model

Household Supply of Child Labor

We assume that there exists a continuum of households, normalized to one,
which are composed of one adult and $C$ children. The adults provide one unit of labor and earn the adult wage $w_A$ and they decide how much labor their children provide. Each child provides one unit of child labor and earns a child wage of $w_C$ for the household. Children that are not employed go to school which cost the household $e \geq 0$ per child. The parent in each household chooses the level of consumption and the amount of children that are employed that maximize the following function:

$$U_i(x_i, c_i) = (x_i - \bar{x})^\alpha (C - c_i)^\beta,$$

where $x_i$ is household $i$'s consumption of a numeraire good, $\bar{x}$ represents the subsistence level of consumption of that good, and $c_i \in [0, C]$ represents the household's supply of child labor and $C$ the total number of children per household. This functional form makes use of the luxury axiom from Basu and Van (1998).\footnote{The luxury axiom is the assumption that non-work or schooling of children is a luxury good that is not afforded to households with low incomes. This implies that poverty is the main cause of the presence of child labor.} Assuming no savings/bequests, the household's budget constraint is equal to:

$$x_i + (C - c_i) e \leq w_A + c_i w_C + \omega_i,$$

where the left hand-side represents the household's expenditure on the numeraire good and schooling. The right-hand side represents the household's income from adult labor, child labor, and the household non-labor income, $\omega_i$, that varies across households. Non-labor income is distributed with probability distribution function $g(\omega_i)$ and cumulative distribution function $G(\omega_i)$ with support $\omega \in [\omega_l, \infty)$.\footnote{This formulation is similar to Lee and Roemer (1998) that employ a distribution of initial wealth across households and Arcalean and Schiopu (2015) that assume households are heterogeneous in income. Both papers assume a Pareto distribution for tractability. This paper will go a bit further by first assuming that non-labor income is distributed formerly before using simulations to derive results for other distributions.}

Maximizing (1) subject to the household's budget constraint yields the household's supply of child labor,

$$c_i = \beta \left( \frac{\bar{x} + Ce - w_A - \omega_i}{(a + \beta)(w_C + e)} \right)^{\beta};$$

where, again, $c_i$ is constrained above and below, $c_i \in [0, C]$. The extensive margin of child labor, denoted by $\bar{\omega} = \bar{x} - w_A + \frac{aw_C C}{\beta} + \frac{(a+\beta)Ce}{\beta}$, is the
threshold non-labor income such that a household’s supply of child labor is equal to zero \((c_i = 0)\). Households with non-labor income equal to or greater than \(\bar{\omega}\) will not provide any child labor. The threshold for the constrained household that provides the maximum amount of child labor, \(c_i = C\), is denoted by \(\omega = \bar{x} - w_A - Cw_C\). Households with non-labor income equal to or less than \(\omega\) will provide \(C\) units of child labor. Lastly, we also denote the household with non-labor income such that their all income, excluding that from children, \((w_A + \omega_i)\), is equal to the expenditure from consuming the subsistence level of the numeraire good, \(\bar{x}\), as well as affording schooling for all children, \(Ce\). That is, we define the household with non-labor income, \(\omega^*\), such that:

\[
\omega^* = \bar{x} + Ce - w_A
\]  

(4)

The household with non-labor income equal to \(\omega^*\) will supply \(c^* = \frac{\alpha C}{\alpha + \beta}\) units of child labor and this supply does not change with changes in the child wage \(\left(\frac{dc^*}{dw_C} = 0\right)\).

As shown in Figure 1, an increase in the adult wage, \(w_A\), or a decrease in subsistence consumption, \(\bar{x}\), will reduce the supply of child labor from all households that are no longer constrained as \(\omega\) falls. An increase in the child wage, \(w_C\), will reduce the supply of child labor for households with \(\omega \in [\bar{x}, \omega^*)\).
and increase the supply of child labor for households with $\omega \in (\omega^*, \bar{\omega}]$, where $\omega$ and $\bar{\omega}$ are decreased and increased, respectively, as shown in Figure 2. This result highlights the fact that the income effect from an increase in $w_C$ dominates the substitution effect for low-income households but the reverse is true for high-income households.

The increase in $\bar{\omega}$ represents an increase in the extensive margin of child labor (an increase in the number of households supplying children to the market) while the decrease in the average supply of child labor represents a decrease in the intensive margin. The net effect of an increase of the child wage on the incidence of child labor is dependent on the value of exogenous parameters.

**Demand for Child Labor**

Aggregate output produced takes the form of a Cobb-Douglas production function,

$$Q = AK^{1-\eta} (L + \gamma C^S)^\eta,$$

where $A$ represents total factor productivity, $L$ total adult labor supply, $C^S$ aggregate child labor supply, and $\gamma \in (0, 1)$ represents productivity differences between adult and child workers. The parameter $\eta \in (0, 1]$ and $\eta = 1$ corresponds to constant returns to scale and $\eta < 1$ decreasing returns to scale with respect to labor, respectively. We will focus for now on the case where employ-
ment of children does not have an effect on the wage paid to workers. The latter case, in which an increase in the employment of children reduces the adult wage as in Basu and Van (1998), will be addressed shortly. When labor is the only factor of production, the adult wage is equal to labor productivity, $A$, and the child wage is equal to $\gamma A$.

**Incidence of Child Labor**

The aggregate supply of child labor is found by aggregating the household supplies across the distribution:

$$ C^S = \int_0^\bar{\omega} c(\omega) g(\omega) \, d\omega = \int_0^\bar{\omega} C g(\omega) \, d\omega + \int_\omega^\bar{\omega} c(\omega) g(\omega) \, d\omega \quad (6) $$

For tractability, we assume a Pareto distribution of non-labor income with the following p.d.f. and c.d.f.:

$$ G(\omega_i) = \left( \frac{\omega_i}{\omega_{Max}} \right)^k, \quad (7) $$

$$ g(\omega_i) = \frac{k\omega_i^{k-1}}{(\omega_{Max})^k}, \quad (8) $$

with support $\omega_i \in [0, \omega_{Max}]$. The supply of child labor, (6), will then be equal to the following when there are no constrained households ($\omega = 0$):

$$ C^S = \int_0^\bar{\omega} c(\omega) g(\omega) \, d\omega \quad (9) $$

and the following when there are some households which are constrained ($\omega > 0$):

$$ C^S = \left( \frac{\omega}{\omega_{Max}} \right)^k C + \int_\omega^\bar{\omega} c(\omega) g(\omega) \, d\omega. \quad (10) $$

When the distribution of non-labor income is uniform, $k = 1$, the incidence of child labor simplifies to the following:

$$ C^S = \left\{ \begin{array}{ll}
\left( \frac{\omega}{\omega_{Max}} \right) C + \frac{1}{\omega_{Max}} \int_\omega^\bar{\omega} c(\omega) \, d\omega & \text{when } \omega > 0 \\
\frac{\beta(\gamma C - \beta) A + \alpha C(\gamma A + e) \omega - \frac{\bar{\omega}}{2}}{(\alpha + \beta)(\gamma A + e) \omega_{Max}} & \text{otherwise}
\end{array} \right. \quad (11) $$

where $\bar{\omega} = \bar{x} + \frac{(\alpha \gamma C - \beta) A}{\beta} + \frac{(\alpha + \beta)C}{\beta}$ and $\omega = \bar{x} - (1 + \gamma C) A$. Figure 3 depicts the relationship between the child wage and the incidence of child labor.
The parameter, $w^*_c$, corresponds to the child wage that minimizes the incidence of child labor. The higher the adult wage, equal to $A$, the lower the child wage that leads to a minimization of child labor as well as a shift downward of the curve, decreasing the incidence of child labor for any given child wage.

**Foreign Direct Investment**

In this section, we will re-introduce foreign direct investment by using the same production function as in (5) but assuming $\eta < 1$. Wages of adult workers and child laborers will depend on the ratio of total capital, assumed to be owned by foreigners, and the stock of total effective labor:

$$w_A = A \left( \frac{K}{1 + \gamma C} \right)^{1-\eta} \quad (12)$$

$$w_C = \gamma w_A = A \gamma \left( \frac{K}{1 + \gamma C} \right)^{1-\eta} \quad (13)$$

As $\eta$ gets closer to zero, the marginal productivity of labor falls faster with an increase in the supply of child laborers, holding foreign capital fixed. Figure 4 shows the equilibrium in the child labor market. One can see that as the demand for labor curve flattens, there can exist multiple equilibria as depicted in Basu and Van (1998).
An increase in foreign capital through FDI has two effects. The first is that the increase in capital per effective unit of labor increases the adult wage, and this shifts the supply of child labor downwards. The second effect is that the increase in foreign capital increases the demand for child labor for any given child wage. Figure 5 summarizes these effects that counter each other and leads to ambiguity.\footnote{This is consistent with the empirical findings of Busse and Braun (2004) when they examine the effect of FDI on child labor when holding income constant.}

The incidence of child labor is most likely to fall with an increase in foreign
direct investment when $\eta$ is less than unity and the child wage is fairly low. This is because when the child wage is low, an increase in $K$ will increase the demand for child labor, putting upward pressure on its return as well as on the return to adult labor. This in turn will decrease the supply of child labor. When $\eta < 1$, the decrease in child labor will further increase the adult wage, resulting in a further decrease in child labor that is not observed when $\eta = 1$.

3 Empirics

As mentioned in the introduction, the research strongly suggests that poverty is the root cause of child labor. Figure 6 highlights the correlation ($r = -0.43$) between GDP per capita (in $2005$) and the child labor participation rate, defined as the percentage of children aged 7-14 that are economically active.6

![Figure 6: GDP per capita and child labor participation rates across countries](image)

The plot between child labor participation and income inequality, proxied by a country’s Gini coefficient, is not nearly as clear as shown in Figure 7. Even after controlling for GDP per capita and regional fixed effects, the effect of income inequality on child labor is statistically insignificant.

6The data used comes via the World Bank Indicators which sources the data from the Understanding Children’s Work project, a research program that is coordinated jointly by the International Labour Organization, the World Bank, and UNICEF.
A possible reason for this result is the endogeneity between a household’s supply of child labor and the downward bias it produces in reported income inequality. Using the framework from the previous section, we will use the data from World Bank Indicators to calibrate the model for each observation of child labor participation rate available and derive an unbiased measure of adult income inequality across households. **Note: calibrations are being redone after finding a few coding errors so this section so the rest of this section will be rewritten as a result.
References


