Health and Child Labour

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Abstract

In this paper, we investigate the impact of child and adult survival on child labour. We find that, while a rise in adult longevity always has a negative effect on child labour because it increases the returns in education, the impact of child mortality reduction depends on the initial level of income. At a low income level, where parents choose zero or a very low level of education for their children, an increase in child survival, *ceteris paribus*, renders quantity more attractive than quality because it decreases the net cost of having children. Our results are in line with empirical evidence that suggests a non linear relationship between child labour and child survival. We therefore offer an additional explanation for the persistence of child labour at stagnant per capita income levels.

Keywords: Child Labour, Fertility, Health.
JEL code: I10, I20, J13.

1 Introduction

Although child labour has shown a decreasing trend over the last two decades (from 16% in 2000 to 10.6% in 2012 [1]), available evidence suggests that it remains still all too common in the world. In fact, according to the International Labour Organization (2013), in 2012, approximately 168 million children between the ages of 5 and 17 are at work (this accounts for almost 11 per cent of all children in this age group across the world), with the highest incidence existing in Sub-Saharan Africa (21% compared with 9% in Asia, the Pacific, Latin America and the Caribbean, and with 8% in the Middle East and North Africa).

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[1]See ILO, 2013.

Many theoretical and empirical models have been produced in order to study the causes of persistent child labour at low income levels.

A strand of the literature, as for example Baland and Robinson (2000), Basu (1999) and Ranjan (2001), identifies credit market imperfections associated with poverty as being the principal contributor to child labour. Alternative research suggests that other socio-economic factors such as low returns to attending school, low employment opportunities, poor quality or expensive schools may play a crucial role in the persistence of child labour (see among others Edmonds and Pavcnik, 2005; Edmonds, 2008; Foster and Rosenzweig, 1996 and Ravallion and Wodon, 2000).

This paper contributes to this literature by identifying an additional mechanism which, by operating through child and adult mortality, can contribute to the persistence of child labour at low income levels. In particular, we develop a two periods overlapping generation model where parents choose the number of children and whether or not to send them to work. Each child is subject to a probability of dying during childhood and those who survive have a risk of dying during adulthood (their working life). Child and adult mortality are assumed to be exogenous, in agreement with an extensive literature in this area (see, among others, Preston, 1975; Easterlin, 2004; Livi Bacci, 2007 and Cutler et al., 2006).[2]

We demonstrate that while a rise in adult longevity always has a negative impact on child labour , the effect of child mortality reduction depends on the initial level of income. At a low income level, where parents choose zero or a very low level of education for their children, the relationship between child labour and child survival is positive because the rise in child survival decreases the net cost of having children and hence parents prefer quantity over quality.

In contrast, at a high level of income, the amount invested in education is sufficiently high to lead to an increase in the cost of having children as child survival increases. This leads parents to choose fewer children and therefore quality becomes more important than quantity.

As depicted in figure 1 our results are in line with the empirical evidence. In particular, in figure 1, according to Cigno et al. (2002), we use the data on children not attending school as a proxy of child labour because of the lack of available data on child labour (that is 100-net enrollment reported in the World Development Indicators, 2014[3]). Even if this measure can be

[2]In particular, these authors argue that income is not the sole factor to affect mortality. There are other contributing factors exogenous to the country's level of income affecting mortality, such as the diffusion of health technology and new methods of preventing the transmission of disease. These include clean water supply and education in personal hygiene.

[3]In particular, the adjusted net enrollment is the number of pupils of the school-age group for primary education, enrolled either in primary or secondary education, expressed as a percentage of the total population in that age group (World Development Indicators, 2014).

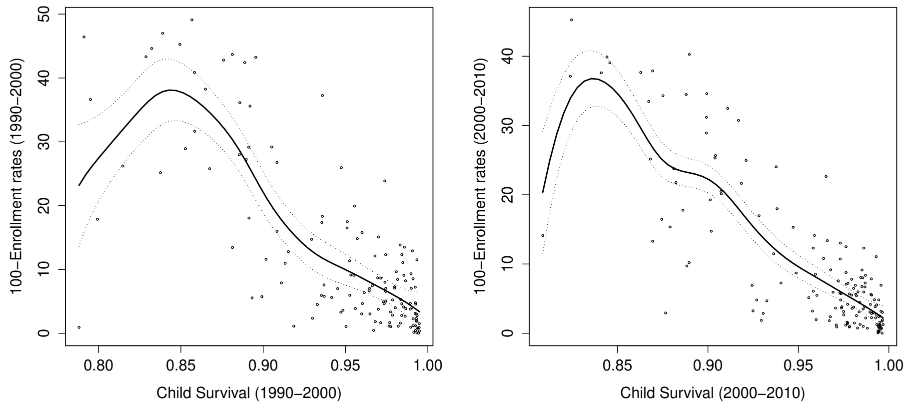

Figure 1: Nonparametric kernel smoother, average values 1990-2000, 2000-2010. Source: Data are from World Development Indicators (2014). Note: The confidence interval indicates the degree of variability in the estimate

considered over generic in that a child not attending school is not necessarily working, it is easier to monitor children not attending school than children who are working. Moreover, the data on children out of school should also give a measure of children working within the household or employed in unofficial sectors who are not taken into account in the number of children economically active (see Cigno et al., 2002). The intuition for the non linear relationship shown in figure 1 is that in the increasing segment the positive impact of child survival on child labour should be higher than the negative effect of income and adult survival on child labour. Future research will be devoted to a more detailed empirical analysis.

A country study reveals that the nonlinear relationship between child labour and child survival holds for some poor and middle income countries in the period 1970-2000. In particular, Tanzania and Togo are two examples, as shown in figure 2, in which the availability of the data allows us to analyze this relationship for a sufficiently long period.

An alternative explanation for the rise in child labour could be the effect of globalization. However, many theoretical contributions, as for example Cigno et al. (2002), Edmonds and Pavcnik. (2004), Edmonds and Pavcnik (2005), find a negative relationship between trade and child labour because the positive effect of international trade on per capita income leads to lower child labour.

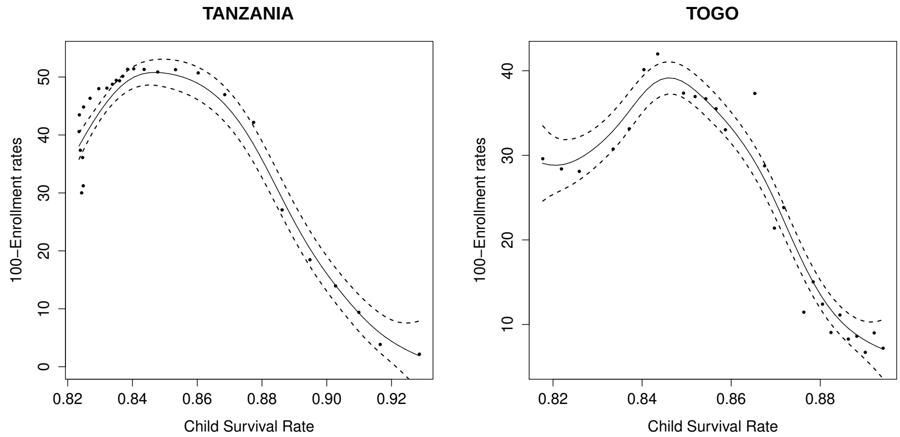

Figure 2: Nonparametric kernel smoother. Source: Data are from World Development Indicators (2014). Note: The confidence interval indicates the degree of variability in the estimate

2 The Model

In every period, the economy produces a single material good, the price of which is normalized to 1. Production is conducted using both children who supply unskilled labour, i.e. L_t^c, and adults who supply skilled labour, i.e. $L_t h_t$, where h_t is the human capital level. For simplicity, we propose a linear production function:

$$Y_t = w(\theta L_t^c + L_t h_t), \tag{1}$$

where $\theta < 1$ is the efficiency of child labour relative to adult labour and w is the technological parameter which is assumed equal to unity.

Agents live for two periods: childhood and adulthood. All decisions are made in the adult period of life. Parents have n_t children who face a probability of dying during early childhood before any investment in their education has taken place, i.e. $1 - \pi$. Each surviving child becomes, in turn, an adult who has a probability of dying during adulthood, i.e. $1 - p$. Adults derive utility from consumption, the number of children surviving to adulthood, i.e. quantity of children, and the income of surviving children in adulthood, h_{t+1}, i.e. the quality of children. The utility function of parents is therefore given by:

$$U_t = (1 - \beta)\log(c_t) + \beta[\log(\pi n_t) + \pi p \log(h_{t+1})], \tag{2}$$

where, in agreement with Soares (2005), we assume that the effective discount rate applied to children's human capital is endogenous and depends, in a linear way, on child and adult survival probability. This implies that parents care not only about child mortality but also about the life expectancy that each child will enjoy as an adult, that is, the period during which they can take full advantage from the benefits of the investment in human capital (see Soares, 2005).

Parents allocate their income h_t across consumption c_t, child rearing and education spending per child e_t. In particular, raising each born child takes a fraction $z \in (0,1)$ of an adult's income.[4]

Parents choose the allocation of the time endowment of children between schooling $e_t \in [0,1]$, and labour force participation $(1-e_t) \in [0,1]$ once child mortality has been realized (see for example Azarnert, 2006; Strulik, 2004; Kalemli-Ozcan, 2002).[5] The direct education cost per child is indicated by d.[6] Thus the total cost of education, i.e. $\theta + d$, is given by the opportunity cost that is the foregone earnings of the child and the direct cost of schooling. We assume that children do not consume. Parents face, therefore, the following budget constraints:

$$c_t = h_t(1 - zn_t) + \theta\pi n_t(1 - e_t) - de_t\pi n_t, \tag{3}$$

subject to the inequality constraints $0 \leq e_t \leq 1$ and $0 < n_t \leq \frac{1}{z}$.

To ensure that parents have a finite number of children the net cost of children should be positive:

Assumption 1

$$zh_t - \theta(1 - e_t)\pi + de_t\pi > 0, \tag{4}$$

which imposes a lower bound on income, that is $h_t > \theta\pi/z = h_{\text{MIN}}$.

Human capital of children h_{t+1} depends on the parent's human capital, i.e. h_t, and the time devoted to school e_t, that is:

$$h_{t+1} = (b + e_t)^{\gamma}(h_t)^{1-\gamma}, \tag{5}$$

where $b \geq 0$ and $\gamma \in (0,1)$. The presence of b implies that children are born with some basic human capital which can be increased by schooling (see De la Croix and Doepke, 2004; Galor and Tsiddon, 1997).

Under assumption 1 the first order conditions for an interior solution are:

$$\frac{(1-\beta)}{c_t}[zh_t - \theta\pi + e_t\pi(\theta + d)] = \frac{\beta}{n_t}, \tag{6}$$

$$\frac{(1-\beta)}{c_t}\pi n_t(\theta + d) = \frac{\beta\gamma\pi p}{b + e_t}. \tag{7}$$

[4]Including the assumption that surviving children require an additional fraction of adult time does not change the main results of the paper.

[5]We assume that survival from school age to adulthood is certain.

[6]This cost could be given by the average human capital of teachers as in De la Croix and Doepke (2004) and Doepke (2004).

Equation (6) states that to maximize utility parents choose the number of children in such a way that the net marginal cost of an additional child, in terms of the loss of utility of consumption, equals the marginal benefit. In the same way, equation (7) shows that parents maximize their utility when the marginal cost of educating children equals the marginal benefit from the expected higher income of their children.

Equation (7) shows that there is a distinct difference in the way in which child and adult survival affect the educational optimal choice. Indeed, on the one hand, child survival positively affects both the marginal cost of education (since education choice concerns only surviving children) and the marginal utility from education (since higher child survival reduces the risk of investment in education). On the other hand, adult longevity has a positive impact only on the marginal utility of children's human capital but it does not affect the marginal cost of education. This difference, as shown below, crucially affects the impact of child and adult survival on the dynamic of human capital accumulation.

Equations (6) and (7) can be explicitly solved for optimal fertility and education:

$$n_t = \frac{\beta h_t(1 - p\gamma\pi)}{zh_t - \theta\pi - b\pi(\theta + d)}, \tag{8}$$

$$e_t = \frac{p\gamma(zh_t - \theta\pi) - b(\theta + d)}{(\theta + d)(1 - p\gamma\pi)}. \tag{9}$$

When income is sufficiently low, i.e. $\hat{h} \leq h_t \leq \frac{\theta(b+p\gamma\pi)+db}{zp\gamma} = h_2$, parents prefer their children to work, i.e. $e_t = 0$, and have a higher number of children, that is[7]:

$$n_t = \frac{\beta h_t}{zh_t - \theta\pi}. \tag{10}$$

Finally when income is sufficiently high, i.e. $h_t \geq \frac{\theta(1+b)+d(1-p\gamma\pi+b)}{zp\gamma} = h_3$, children's time is no longer allocated to sending them out to work, i.e. $e_t = 1$.

Let us first consider the effect of mortality reduction on parental optimal choices when parents do not invest in children's education, i.e. $h_t < h_2$.

In this case an exogenous increase in adult survival probability lowers the threshold level h_2 at which parents start to invest in their children's education. Indeed, the rise in adult longevity, by increasing the marginal benefit of the investment in children's human capital, stimulates the investment in education even at lower income levels.

On the other hand, if child survival increases, the birth rate goes up and the threshold level of human capital h_2 increases. The reason for this is that when income is at its lowest level, we enter a vicious circle whereby an increase in child survival, by increasing the productivity

[7]When $h_{\text{MIN}} \leq h_t \leq \hat{h} = \frac{\theta\pi}{z(1-\beta)}$ fertility reaches its upper bound, i.e. $n_t = 1/z$.

of child labour, lowers the cost of raising children, i.e. $zh_t - \theta\pi$, rendering a higher number of children relatively more desirable because of the presence of child labour which generates a potential increase in household income. In fact, if child labour were absent from the model, i.e. $\theta = 0$ (see Doepke and Zilibotti, 2005), as is evident from equation (10), the optimal number of children would not be affected by a reduction in child mortality. We summarize these results in the Proposition below:

Proposition 1 *Supposing that assumption 1 holds, when child labour is at its maximum level an increase in adult survival probability lowers the income level h_2 at which parents start to invest in children's education. If however, it is child survival that increases, parents choose a higher number of children and to increase child labour.*

At the interior solution, where $h_2 < h_t < h_3$, an increase in adult survival implies a reduction of fertility and child labour supply. Indeed, the increase in adult longevity increases the benefits of investing in education and thereby leads parents to choose fewer yet better educated children. On the other hand, a decrease in child mortality has a nonlinear effect on parental optimal choices. In particular, there exists a threshold level of h_t, i.e $\underline{h} = \frac{\theta(1+b)+db}{zp\gamma}$, such that if $h_2 < h_t < \underline{h}$ a rise in child survival negatively affects the investment in education.[8]

The basic motivation of this result is that when $e_t > 0$, the rise in child survival has two opposite effects on the net cost of children. On the one hand, it has a negative effect because it increases the productivity of child labour. On the other hand, it has a positive effect because it increases the the total cost of education. Thus, when the investment in education is sufficiently low, the first effect dominates the second, leading to an increase in child labour supply jointly with fertility. At this low level of income quantity is more essential than quality. When income reaches a certain threshold, i.e. $h_t > \underline{h}$, the investment in the education of children is high enough to lead to an increase in the cost of having children as child survival rises. Therefore parents choose to have fewer children and quality becomes more important than quantity.

Notice that if it were not for the presence of child labour this nonlinear effect would not exist. Indeed in the absence of child labour, that is $\theta = 0$, as can be seen from equation (9), an increase in child survival always leads to an increase in children's education. We collect these results in the Proposition below.

Proposition 2 *Under assumption 1, at the interior solution, where $h_2 < h_t < h_3$, an increase in adult survival probability always reduces fertility and child labour. In contrast, the effect of child survival depends on the initial level of income. There exists a threshold level of h_t,*

[8]Simple calculations show that $h_2 < \underline{h} < h_3$.

such that if $h_2 < h_t < \underline{h}$ *a rise in child survival negatively affects the investment in education and increases the optimal number of children, i.e. quantity is more important than quality. If, instead,* $\underline{h} < h_t < h_3$ *quality becomes more important than quantity.*

We now turn to the global dynamics of human capital, which by using equations (5) and (9) is represented as follows:

$$h_{t+1} = \begin{cases} b^\gamma h_t^{1-\gamma} & \text{if } 0 \leq h_t \leq h_2, \\ \left[\dfrac{p\gamma(zh_t - \theta\pi) - p\gamma\pi(\theta + d)b}{(\theta + d)(1 - p\gamma\pi)}\right]^\gamma h_t^{1-\gamma} & \text{if } h_2 \leq h_t \leq h_3, \\ (1 + b)^\gamma h_t^{1-\gamma} & \text{if } h_t \geq h_3; \end{cases} \tag{11}$$

Firstly, we analyze the dynamics of human capital with respect to adult longevity. As shown in figure 3 when adult survival is sufficiently low, that is $p < \frac{(\theta+d)(1+b)}{\gamma[z(1+b)+d\pi]} = p_L$, the economy shows a locally stable equilibrium of stagnation, i.e. $h_L = b$, where parents choose full-time child labour and devote their income entirely to consumption and having the maximum number of children.

When adult survival is $p_L < p < \frac{b(\theta+d)}{\gamma(bz-\theta\pi)} = p_H$, the economy shows multiple equilibria[9], i.e. an economy that starts with a human capital level below $\tilde{h} = \frac{[\theta(1+b)+bd]p\gamma\pi}{zp\gamma-(\theta+d)(1-p\gamma\pi)}$ converges to the stagnant equilibrium h_L. Instead, when the initial level of human capital is above $\tilde{h}$ the economy converges to the equilibrium $h_H = 1 + b$ characterized by zero child labor and a low fertility rate. Finally, when adult survival increases above the level p_H the equilibrium h_L disappears and the economy always converges to the equilibrium h_H.

Let us now consider the effect of child mortality reduction. Various scenarios can arise depending on the extent of adult survival. When the economy only shows the equilibrium h_L and the actual level of adult longevity is not very low [10], the rise in child survival, *ceteris paribus*, can lead to the emergence of multiple equilibria. Indeed, the fact that $\partial p_L/\partial\pi < 0$ allows that when π reaches a certain level, the actual level of p becomes higher than p_L.

When the economy shows multiple equilibria, i.e. $p_L < p < p_H$, the rise in child survival is not sufficient on its own to allow the transition to an economy characterized by only one stable equilibrium with no child labour.[11] Finally, when the economy only shows the equilibrium h_H, if the actual level of adult survival is insufficiently high[12] the rise in child survival may lead to

[9] We assume that $bz > \theta$.

[10] That is p is higher than the value assumed by p_L when $\pi = 1$, i.e. $p > \frac{(\theta+d)(1+b)}{\gamma[z(1+b)+d]}$.

[11] This is because $\partial p_L/\partial\pi < 0$ and $\partial p_H/\partial\pi > 0$.

[12] That is p is lower than the value assumed by p_H when $\pi = 1$, i.e. $p < \frac{b(\theta+d)}{\gamma(bz-\theta)}$.

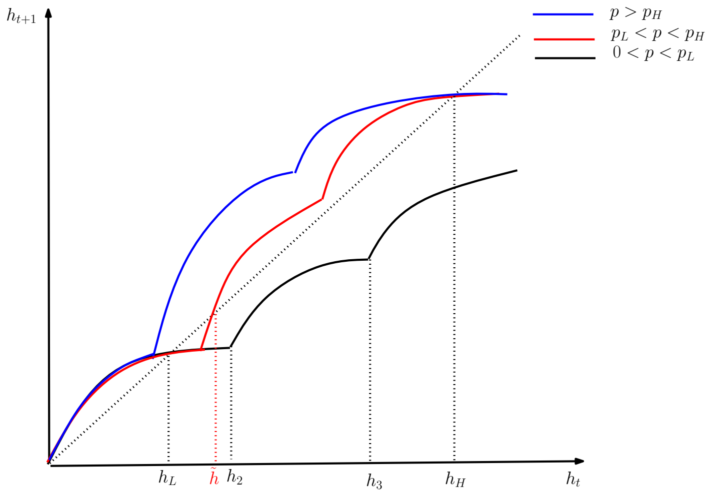

Figure 3: Human Capital Dynamics

the appearance of the low equilibrium h_L alongside the existing equilibrium h_H.

To sum up, our model suggests that policies aimed to increase adult longevity can be an important contributing factor in the reduction of child labour (see, for example, Chakraborty and Das, 2005). On the other hand, the rise in child survival associated with a stagnant per capita income may provide an additional explanation for the persistence a high level of child labour in low income countries.

3 Conclusions

This paper contributes to the literature on child labour by analyzing the different effect of adult and child survival on child labour.

We find that the relationship between child labour and adult longevity is always negative. In contrast, the relationship between child labour and child survival is positive at low levels of income and negative when income is sufficiently high. The basic intuition behind this result is that the rise in child survival increases the productivity of child labour. This leads, at low income levels, to a reduction in the cost of raising children, thereby rendering quantity more attractive than quality. Our results are in line with the empirical evidence which shows an inverted U shaped relationship between child labour and child survival.

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