Economics Bulletin

Volume 37, Issue 3

Human capital and fertility: child vs adult survival

Tamara Fioroni
University of Verona

Abstract

In this paper, we investigate the impact of child and adult survival on human capital accumulation and fertility in a model in which parents face a trade-off between investment in education and child labour. We show that adult and child survival have opposite effects on human capital accumulation. In fact, while a rise in adult longevity always has a positive impact on human capital accumulation, the rise in child survival by increasing the monetary returns of child labour, renders quantity more attractive than quality. Therefore different combinations of child and adult survival can lead to different scenarios. Thus, while policies aimed at increasing adult longevity can be an important contributing factor to improvement in education and the reduction of child labour, however, policies aimed at increasing child survival alone may be insufficient if they are not associated with ones that regulate child labour.

Citation: Tamara Fioroni, (2017) "Human capital and fertility: child vs adult survival", *Economics Bulletin*, Volume 37, Issue 3, pages 1982-1995
Contact: Tamara Fioroni - tamara.fioroni@univr.it.
Submitted: February 11, 2017. **Published:** August 31, 2017.

1 Introduction

The motivation behind this paper is the observation that although child labour has shown a decreasing trend over the last two decades (from 16% in 2000 to 10.6% in 2012), it remains still all too common in the world. In 2016 approximately 158 million children between the ages of 4 and 14 were at work with the highest incidence existing in Sub-Saharan Africa (UNICEF 2016).[1]

There are many theoretical and empirical models which analyse the causes of persistent child labour at low income levels. A strand of the literature, as for example Baland & Robinson (2000), Basu (1999) and Ranjan (2001), identifies credit market imperfections associated with poverty as being the principal contributor to child labour. Alternative researches suggest 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 & Pavcnik 2005; Foster & Rosenzweig 1996 and Ravallion & Wodon 2000.

In this paper we study how child and adult mortality impact on child labour and human capital accumulation. In particular, we refer to the literature which studies the evolution of child labour, fertility and human capital in the process of development as, for example, among others, Doepke (2004), Doepke & Zilibotti (2005) and Hazan & Berdugo (2002). However, these contributions do not consider the impact of mortality on child labour. We also make reference, therefore, to the theoretical literature on mortality and human capital accumulation. In the main, these contributions have either examined the impact of life expectancy, adult mortality and child mortality in distinct ways or they have treated these measures as interchangeable. On the one hand, the literature focusing on the impact of life expectancy and adult survival on human capital accumulation is based on the argument, dating back to Ben-Porath (1967), that improvements in longevity promote human capital accumulation "because they increase the horizon over which benefits from investments in human capital can be enjoyed, therefore increasing the returns to education. "(Soares, 2005, p.581). In short, higher longevity reduces the rate of depreciation of investment in education and increases its return (see, for example, De la Croix & Licandro 1999, Boucekkine et al. 2002, Boucekkine et al. 2003, Cervellati & Sunde 2005, 2011, Lagerlof 2003, Weisdorf 2004 among others).

On the other hand, the literature studying the link between child mortality and human capital accumulation is based on the quantity-quality trade-off and finds contrasting results. Kalemli-Ozcan (2002), for example, argues that in the presence of uncertain mortality, there is a precautionary demand for children so as to ensure a certain number of surviving children. Thus, lower child mortality decreases the uncertainty regarding the number of surviving children which, in turn, leads to a reduc-

[1] In particular, UNICEF reports that in 2016, 28% of children aged between 5 and 14 were at work in Sub-Saharan Africa, 10% in the Middle East and North Africa and East Asia and the Pacific, and 9% in Latin America and the Caribbean

tion in the demand for children and to an increase in educational investment. Hazan & Zoabi (2006) show that greater longevity of children does not cause any increase in the level of education chosen by the parents because it does not change the relative return between education (quality) and fertility (quantity). Finally Doepke (2005) and Azarnert (2006) argue that lower child mortality may actually lead to a decrease in educational investment because it renders it more expensive to educate all surviving children. In other words a substitution effect occurs: as child mortality decreases, net fertility rises and investment in the human capital of each child decreases. [2]

This paper is closer in thinking to Soares (2005) and Cervellati & Sunde (2015) which consider the distinct effect of child and adult survival on human capital accumulation. However, contrary to these papers we introduce child labour, whereby, in making education choices for their children, parents face the trade-off between human capital accumulation and child labour. The importance of the child labour mechanism is due to the fact that, even in the presence of free education, the economy can show high levels of working children. In fact, even in this case, parents can still choose not to send their children to school because of the indirect cost linked to the foregone loss of earnings incurred while children are at school rather than at work.

This fact finds empirical support in developing countries where high levels of child labour persist even after the introduction of free primary education. For example, in Malawi although free primary education was introduced in 1994, in 2004 and 2006 the level of child labour was 42.6% and 40.3% respectively (WDI 2017[3]). In Kenya, free education was introduced in 2003 and in 2009 the level of child labour totalled 34.4%. In Tanzania free primary education was introduced in 2001 and child labour was 31% in 2006 and 29.4% in 2011. Uganda introduced primary education in 1997 and child labour equalled 38.2% in 2006 and 36.7% in 2012. Finally, in Zambia free primary education was introduced in 2002, and the level of child labour was 47.9% in 2005 and 34.4% in 2008 (see Riddell 2003).

We demonstrate that adult and child survival have opposite effects on human capital accumulation. In fact, while a rise in adult longevity always has a positive impact on human capital accumulation, child mortality reduction has a negative impact because by increasing the monetary returns on child labour renders quantity more attractive than quality. Thus, given the opposite impact of child and adult survival on education, different combinations of these two can lead to different scenarios.

This paper is organised as follows: Section 2 presents the model; Section 3 analyses the impact of adult and child survival on the dynamics of human capital; Section 4 presents some empirical

[2]Doepke (2005), analysing England during the period $1861-1951$, shows that, all things being equal, the reduction in child mortality should have lead to an increase in net fertility rates.

[3]The data refers to children in employment, total (% of children ages 7-14). In particular, children in employment are defined as children involved in economic activity for at least one hour in the reference week of the survey.

evidence, Section 5 concludes.

2 The Model

In every period, the economy produces a single material good, the price of which is normalised 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. Each agent, at time t, has an endowed level of human capital h_t, determined from previous generations decisions. 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, i.e. the quantity of children, and the income of each child surviving to adulthood, h_{t+1}, i.e. the quality of children. Parents care not only about child mortality but also about the life expectancy that each child will enjoy as an adult p, that is, the period during which they can take full advantage from the benefits of the investment in human capital (see Soares 2005). Given that, at the moment when the education decision is made, the number of children who survive to childhood is already known, then they appear without uncertainty in the utility function. On the other hand, the adults who maximize their utility function do not know how many children will survive to adulthood, therefore the utility that they derive from children that do survive to adulthood is an expected utility, i.e. $pU(h_{t+1})$. Thus the utility function of parents is therefore given by:

$$U_t = U(c_t, \pi n_t) + pU(h_{t+1}), \tag{2}$$

which assuming logarithmic utility takes the form:

$$U_t = (1-\beta)\log(c_t) + \beta[\log(\pi n_t) + p\log(h_{t+1})], \tag{3}$$

where β captures the relative weight given to both quality and quantity of children.

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]

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

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 realised (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:

$$c_t = h_t(1-zn_t) + \theta\pi n_t(1-e_t) - de_t\pi n_t, \tag{4}$$

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 (even if $e_t = 0$):

Assumption 1

$$zh_t - \theta\pi + e_t\pi(\theta + d) > 0, \tag{5}$$

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

Suppose that human capital of children h_{t+1} is an increasing, strictly concave function of the time devoted to school, that is:

$$h_{t+1} = h(e_t), \tag{6}$$

where $h(0) = 1$, $h'(e_t) > 0$ and $h''(e_t) < 0$.

2.1 Optimal choice

The first order condition for n_t and e_t are respectively:

$$\frac{(1-\beta)}{c_t}[zh_t - \theta\pi + e_t\pi(\theta+d)] = \frac{\beta}{n_t} \tag{7}$$

$$\frac{(1-\beta)}{c_t}\pi n_t(\theta+d) = \beta p\frac{h'(e_t)}{h(e_t)} \tag{8}$$

Equation (7) 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 (8) 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.

[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 & Doepke (2004) and Doepke (2004).

From eqq. (8) and (7) we get :

$$\frac{ph'(e_t)}{h(e_t)} - \frac{\pi(\theta+d)}{zh_t - \theta\pi + e\pi(\theta+d)} \begin{cases} \leq 0 & \text{if } e_t = 0 \\ = 0 & \text{if } e_t > 0 \end{cases} \tag{9}$$

which states that an interior solution for education arises if the marginal rate of substitution between education and fertility is equal to the ratio between the cost of education and the cost of fertility. From eqq. (7) and (9) fertility is given as follows:

$$n_t = \begin{cases} \dfrac{\beta h_t}{zh_t - \pi\theta} & \text{if } e_t = 0 \\ \\ \dfrac{\beta h_t}{zh_t - \pi\theta + e_t\pi(\theta+d)} & \text{if } e_t > 0 \end{cases} \tag{10}$$

From eq. (9) notice the opposite effects of adult and child survival on education. Adult survival, indeed, promotes investment in education because it positively affects the marginal utility of education. By contrast, child survival, on the one hand, affects the marginal utility of fertility and education in a symmetric way, on the other hand it increases the relative cost of education with respect to fertility. Thus, through a substitution effect, fertility increases and the investment in the human capital of each child declines (see Doepke 2005).

If we were to assume that child mortality is realized after educational choice, then, in accordance with the neutrality result emphasized by Hazan & Zoabi (2006), it does not affect education choice.

These results are summarised in the following proposition.

Proposition 1 *Under assumption 1 the interior optimal level of education increases with respect to parents' human capital and adult survival and decreases with respect to child survival, that is:*

$$\frac{\partial e_t}{\partial h_t} > 0; \frac{\partial e_t}{\partial \pi} < 0; \frac{\partial e_t}{\partial p} > 0 \tag{11}$$

Proof. We define the following function:

$$G(e_t) = ph'(e_t)(zh_t - \theta\pi + e\pi(\theta+d)) - h(e_t)\pi(\theta+d) \tag{12}$$

Notice that to have an interior solution, under Assumption 1, $h(e_t) - ph'(e_t)e_t > 0$. Then:

$$\frac{\partial G_t}{\partial e_t} = ph''(e_t)(zh_t - \theta\pi + e\pi(\theta+d)) - \pi h_e(\theta+d)(1-p) < 0 \tag{13}$$

since from eq. (6) $h''(e_t) < 0$.

$$\frac{\partial G_t}{\partial h_t} = ph'(e_t)z > 0 \tag{14}$$

$$\frac{\partial G_t}{\partial \pi} = -ph'(e_t)\theta - (\theta + d)[h(e_t) - ph_e(e_t)e_t] < 0 \tag{15}$$

$$\frac{\partial G_t}{\partial p} > 0 \tag{16}$$

■

2.1.1 The dynamics of human capital

According to an extensive literature, human capital accumulation can be expressed as follows (see, for example, Galor 2005, Galor & Moav 2006, Hazan & Zoabi 2006):

$$h_{t+1} = (b + e_t)^{\gamma} \tag{17}$$

Thus optimal education and fertility are given as:

$$e_t = \begin{cases} 0 & \text{if } h_{\text{MIN}} \leq \tilde{h} \\ \dfrac{p\gamma(zh_t - \theta\pi) - b\pi(\theta + d)}{\pi(\theta + d)(1 - p\gamma)} & \text{if } \tilde{h} \leq h_t \leq \bar{h} \\ 1 & \text{if } h_t \geq \bar{h} \end{cases} \tag{18}$$

and

$$n_t = \begin{cases} \dfrac{\beta h_t}{zh_t - \pi\theta} & \text{if } h_t \leq \tilde{h} \\ \dfrac{\beta h_t(1 - p\gamma)}{zh_t - \pi\theta - b\pi(\theta + d)} & \text{if } \tilde{h} \leq h_t \leq \bar{h} \\ \dfrac{\beta h_t}{zh_t + \pi d} & \text{if } h_t \geq \bar{h} \end{cases} \tag{19}$$

where:

$$\tilde{h} = \frac{\pi[\theta(b + p\gamma) + bd]}{zp\gamma} \tag{20}$$

$$\bar{h} = \frac{\pi[d(1 - p\gamma + b) + \theta(1 + b)]}{zp\gamma} \tag{21}$$

From eq. (18) it is important to highlight the role of child labour. In fact, if child labour were absent from the model (i.e. $\theta = 0$), where free education exists i.e. $d = 0$ parents, irrespective of their level of income, would choose the maximum level of education, i.e. $e = 1$ and the minimum level of fertility, i.e. $n = \beta/z$ The presence of child labour, however, lowers the cost of children and therefore leads to a higher fertility rate and a low level of education even in the presence of free education ($d = 0$). This result is in accordance with the empirical evidence as discussed in the introduction.

Moreover, regarding the issue of fertility, we can see from equation (8) and (18) that if child labour were absent from the model, at a low level of income i.e. $h_t \leq \tilde{h}$ fertility would be constant. However, the presence of child labour implies a positive relationship between income and fertility when $e_t = 0$ in accordance with Malthusian stagnation.

From eqq. (17) and (18) the dynamics of human capital is given by:

$$h_{t+1} = \begin{cases} b^{\gamma} & \text{if } h_{\text{MIN}} \leq h_t \leq \tilde{h}, \\ \left[\dfrac{p\gamma(zh_t - \theta\pi) - p\gamma b\pi(\theta + d)}{\pi(\theta + d)(1 - p\gamma)}\right]^{\gamma} & \text{if } \tilde{h} \leq h_t \leq \bar{h}, \\ (1+b)^{\gamma} & \text{if } h_t \geq \bar{h}; \end{cases} \tag{22}$$

Given the opposite impact of adult and child survival on education, different combinations of adult and child survival can lead to different scenarios as shown in Fig.1.

When adult survival is sufficiently low, that is $p < p_L = \frac{b\pi(\theta+d)}{\gamma(b^{\gamma}z - \theta\pi)}$ the economy shows a locally stable equilibrium with full-time child labour, and possibly one unstable and one stable equilibrium with $0 < e_t < 1$. In this latter case, the initial level of human capital is fundamental as it establishes the features of the long-run equilibrium.

When adult survival is $p_L < p < \frac{\pi(\theta+d)(1+b)}{\gamma[z(1+b)^{\gamma}+d\pi]} = p_H$, the economy shows one stable equilibrium where children are partially sent to school. [7] Finally, when adult survival increases above the level p_H the economy always converges to the stable equilibrium h_H characterised by high income, low fertility rate and full investment in child quality [8].

In Fig. 1 we show some possible economic trajectories.

The points J, S, K all illustrate the case of an economy with an initially low level of both adult and child survival but which subsequently follow different paths.

The trajectory starting from point J considers simultaneous improvements in adult and child survival rates, but with an overall prevalence of advances in adult survival with respect to the ones in child survival. Along trajectory J the economy transits from a zero to a full investment in education equilibrium.

---

[7] We assume that $b^{\gamma}z > \theta$.

[8] We assume that $p_H(1) > p_L(1)$

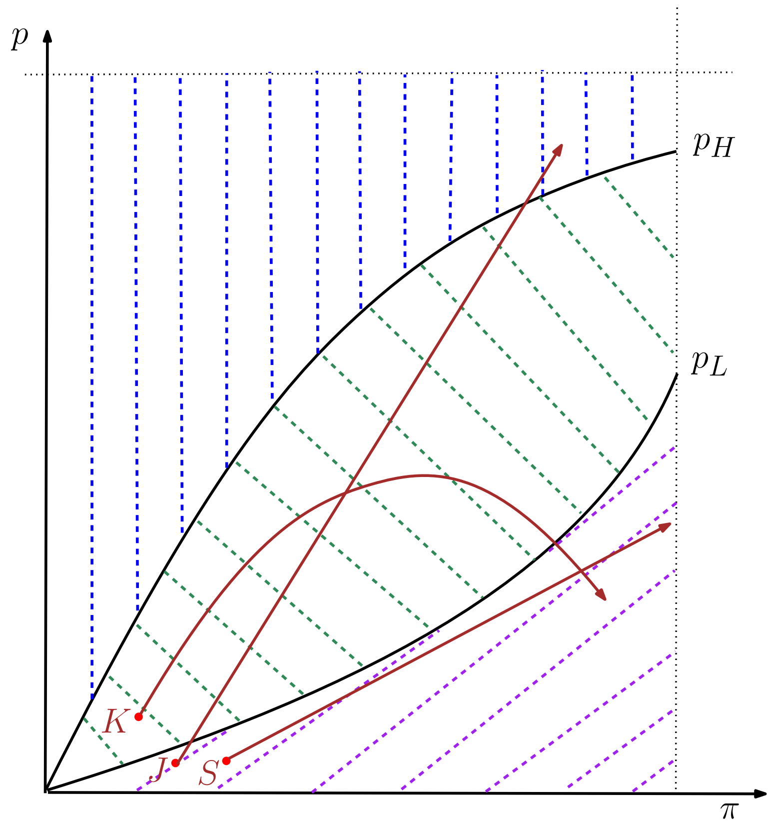

Figure 1: Adult versus child mortality and human capital accumulation.

Consider now an economy starting from point S with both an increase in adult and child survival but with the increase in child survival being higher than the increase in adult survival. In this case, the economy can stagnate in a low development trap. The negative effect on education, due to the increase in child survival, indeed, is only partially compensated by the positive effect due to the limited improvements in adult survival.

The trajectory starting from point K considers the case of an economy characterised, in a first phase, by the joint increase in adult and child survival which allows the transition from full-time child labour to partial school attendance. In a second phase, although child survival is still increasing, the decrease in adult survival pushes back the economy towards a low equilibrium of stagnation.

Policies aimed at reducing either the education cost (d), or regulating child labour (i.e to decrease θ), lower both p_L and p_H and favour, therefore, the transition to full investment in education even in the cases of the trajectories starting from points K and S.

Although among developing countries there is considerable variation in the incidence of child labour and school attendance, the trajectories shown in Fig. 1 recall the path of adult and child survival followed by some developing countries.

In particular, in Fig 2 we show, on the left hand side, the path of child and adult survival rates and on the right hand side, the path of primary school enrollment, in selected developing countries during the period 1960 to 2010. The data is taken from the World Bank Development Indicators 2015. We use the data on net enrollment rate (i.e. the ratio of children of official school age who are enrolled in school over the population of the corresponding official school age.) as a proxy for the prevalence of child labour because of the shortage of data available. However, in order to be as informative as possible we also show the data, where available, in the countries analysed. In particular, the diamonds on the right hand side of Fig. 2 show the only data available on child labour.

Ethiopia (until 2000) and Nigeria, are reminiscent of trajectory S because during period in question show an absolute gains in child surivial higher than the absolute gains in adult survival (0.1 and 0.07 in Ethiopia until 2000, 0.2 and 0.11 in Nigeria). Both countries, in fact, in 2000 show a relatively low enrollment rate in primary education (40% in Ethiopia and 61% in Nigeria) and high child employment (56% in Ethiopia in 2005 and 41% in Nigeria in 2007).

Tanzania and the Central African Republic show a path similar to that described by the trajectory starting from point K. In Tanzania the decreasing adult survival rate (from 0.62 in 1970 to 0.55 in 2000) combined with increasing child survival (from 0.78 in 1970 to 0.86 in 2000) is associated with the decrease in primary school enrollment (it starts to decline from 1980, in which it is about 70%, reaching only 49% in 1999). The same occurs in the Central African Republic where the enrollment rate increases between 1970 and 1985 (from about 50% in 1970 to 61% in 1985) and then starts to decline reaching 49% in 2005. Moreover, both countries show a relatively high level of child labour

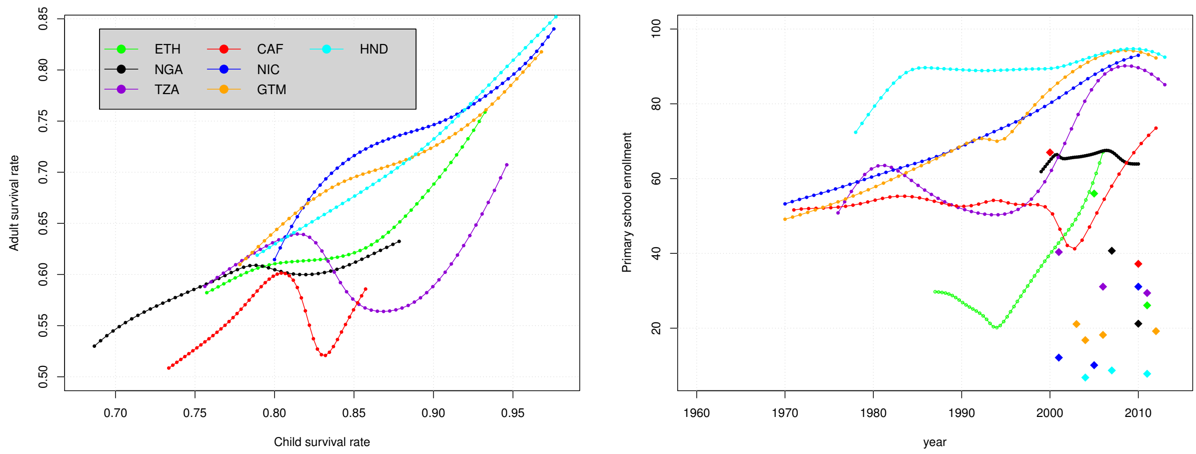

Figure 2: Adult, child survival, primary school enrolment and child labour in selected developing countries (1960-2010). Nonparametric kernel smoother. Sources: World Development Indicators, 2015, http://databank.worldbank.org/.

in 2000 (40% in Tanzania and 67% in the Central African Republic) [9].

Finally Guatemala, Honduras and Nicaragua may represent an example of the trajectory from point J. Each of these countries, indeed, shows a considerable increase in the enrollment rate from the 1970's to 2010 (from about 50% – 60% to over 90%) and a relatively low level of child labour (16% in Guatemala in 2004, 7% in 2004 in Honduras and 10% in 2005 in Nicaragua).

3 Conclusions

This paper contributes to the literature by analysing the different effects of adult and child survival on human capital accumulation and fertility in a model that takes into account the trade-off between investment in education and child labour. We find that the relationship between investment in education and adult longevity is always positive. In contrast, the relationship between education and child survival is negative. The basic intuition behind this result is that the rise in child survival increases the monetary returns of child labour, thereby rendering, at the lowest levels of income, quantity more attractive than quality.

To sum up, our model suggests that policies aimed at increasing adult longevity can be an important contributing factor to the reduction of child labour (see, for example, Chakraborty & Das 2005;

[9] Fortson (2011) provides a detailed empirical analysis showing that areas with higher levels of HIV experienced relatively larger declines in schooling. He points out: "Children in areas with higher levels of HIV fare worse along a number of dimensions: they are less likely to attend school, less likely to complete primary school, and progress more slowly through school.". See also Ferreira et al. (2011).

Cipriani 2015).

On the other hand, the rise in child survival alone, at low levels of development, may be insufficient in stimulating fertility reduction and full investment in education, if it is not associated to policies aimed at either reducing the cost of schooling or regulating child labour.

References

Azarnert, L. V. (2006), 'Child mortality, fertility and human capital accumulation', *Journal of Population Economics* **19**(2), 285–297.

Baland, J. & Robinson, J. (2000), 'Is child labor inefficient?', *Journal of Political Economy* **108**(4), 663–679.

Basu, K. (1999), 'Child labor: Cause, consequence, and cure, with remarks on international labor standards', *Journal of Economic Literature* **37**(3), 1083–1119.

Ben-Porath, Y. (1967), 'The Production of Human Capital and the Life Cycle of Earnings', *Journal of Political Economy* **75**, 352–365.

Boucekkine, R., Croix, D. D. & Licandro, O. (2002), 'Vintage human capital, demographic trends, and endogenous growth', *Journal of Economic Theory* **104**, 340–375.

Boucekkine, R., la Croix D., D. D. & Licandro, O. (2003), 'Early mortality declines at the dawn of modern growth', *Scandinavian Journal of Economics* **105**(3), 401–418.

Cervellati, M. & Sunde, U. (2005), 'Human Capital Formation, Life Expectancy and the Process of Development', *American Economic Review* **95**, 1653–1672.

Cervellati, M. & Sunde, U. (2011), 'Life Expectancy and economic growth: the role of the demographic transition', *Journal of economic growth* **16**, 99–133.

Cervellati, M. & Sunde, U. (2015), 'The economic and demographic transition, mortality and comparative development', *American Economic Journal Macroeconomics* **7**(3), 189–225.

Chakraborty, S. & Das, M. (2005), 'Mortality, fertility, and child labor', *Economics Letters* **86**, 273–278.

Cipriani, G. P. (2015), 'Child labour, human capital and life expectancy', *Economics Bulletin* **35**(2), 978–985.

De la Croix, D. & Doepke, M. (2004), 'Public versus Private education when differential fertility matters', *Journal of Development Economics* **73**(2), 607–629.

De la Croix, D. & Licandro, O. (1999), 'Life Expectancy and Endogenous Growth', *Economic Letters* **65**, 225–263.

Doepke, M. (2004), 'Accounting for fertility decline during the Transition to Growth', *Journal of Economic Growth* **9**, 347–383.

Doepke, M. (2005), 'Child Mortality and fertility decline: Does the Barro-Becker fit the facts', *Journal of Population Economics* **18**(2), 337–366.

Doepke, M. & Zilibotti, F. (2005), 'The Macroeconomics of Child Labour Regulation', *American Economic Review* **95**(5), 1492–1524.

Edmonds, E. & Pavcnik, N. (2005), 'Child Labor in the Global Economy', *Journal of Economic Perspectives* **19**(1), 199–220.

Ferreira, P. C., Pessôa, S. & Dos Santos, M. R. (2011), 'The impact of aids on income and human capital', *Economic inquiry* **49**(4), 1104–1116.

Fortson, J. G. (2011), 'Mortality risk and human capital investment: The impact of hiv/aids in sub-saharan africa', *The Review of Economics and Statistics* **93**(1), 1–15.

Foster, A. D. & Rosenzweig, M. R. (1996), 'Technical change and human-capital returns and investments: Evidence from the green revolution', *American Economic Review* **86**(4), 931–953.

Galor, O. (2005), 'From Stagnation to Growth: Unified Growth Theory', *in The Handbook of Economic Growth (A 'Classical' Prespective)* **1**, eds by Philippe Aghion and Steven Durlauf, 171–293.

Galor, O. & Moav, O. (2006), 'Das Human-Kapital: A Theory of the Demise of the Class Structure', *Review of Economics Studies* **73**(1), 85–117.

Hazan, M. & Berdugo, B. (2002), 'Child Labour, Fertility, and Economic Growth', *The Economic Journal* **112**(482), 810–828.

Hazan, M. & Zoabi, H. (2006), 'Does longevity cause growth? a theoretical critique', *Journal of Economic Growth* **11**(4), 363–376.

Kalemli-Ozcan, S. (2002), 'Does the mortality decline Promote Economic Growth?', *Journal of Economic Growth* **7**, 411–439.

Lagerlof, N. P. (2003), 'From Malthus to Modern Growth: Can Epidemics Explain the three Regimes', *International Economic Review* **44**, 755–777.

Ranjan, P. (2001), 'Credit constraints and the phenomenon of child labor', *Journal of Development Economics* **64**, 81–102.

Ravallion, M. & Wodon, Q. (2000), 'Does child labour displace schooling? evidence on behavioural responses to an enrollment subsidy', *The Economic Journal* **110**(462), 158–175.

Riddell, A. (2003), 'The introduction of free primary education in sub-saharan africa', *Background paper prepared for EFA GMR 2003* .

Soares, R. (2005), 'Mortality Reductions, Educational Attainment and Fertility Choice', *American Economic Review* **95**(3), 580–601.

Strulik, H. (2004), 'Child Mortality, Child Labour and Economic Development', *The Economic Journal* **114**(497), 547–568.

UNICEF (2016), 'https://data.unicef.org/topic/child-protection/child-labour/'.

Weisdorf, J. L. (2004), 'From stagnation to Growth: Revisiting three historical regimes', *Journal of Population Economics* **17**, 455–472.