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# How to Deal with Covert Child Labour, and Give Children an Effective Education, in a Poor Developing Country: An Optimal Taxation Problem with Moral Hazard

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# How to Deal with Covert Child Labour, and Give Children an Effective Education, in a Poor Developing Country: An Optimal Taxation Problem with Moral Hazard

## Abstract

Given that credit and insurance markets are imperfect, and given also that intra-household transfers, and much of the work a child does, are private information, the second-best policy uses a combination of need and merit based education awards, together with a mix of taxes on parental income, and on the return to educational investment. It also makes school enrollment compulsory and, if the child wage rate is sufficiently high, sets a ceiling, decreasing in parental income, on overt child labour.

JEL-Code: D82, H21, H31, I28, J24.

Keywords: child labour, education, uncertainty, moral hazard.

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# 1 Introduction

Developing country governments and international development agencies have long realized that human, more than physical, capital accumulation is the main-spring of economic and civil progress. Yet, many children in poor developing countries fail to complete even the primary education cycle, and some do not go to school at all. The reasons are well known.<sup>1</sup> Baland and Robinson (2000) demonstrate that child labour will be inefficiently high if parents are credit or bequest constrained.<sup>2</sup> As one could have expected in the light of a result in Loury (1981), that parental inability to diversify or insure against the risk of a low return deters educational investment, Pouliot (2006) shows that uninsurability causes child labour to be inefficiently high even if credit and bequests are interior. Similar considerations apply to the risk of a downturn in parental income. Evidence that parental inability to borrow discourages education, and encourages child labour, is reported by a host of authors, including Jacoby (1994), Jacoby and Skoufias (1997), and Fuwa et al. (2009). Evidence that parental inability to insure against the risk of a low return also discourages education is reported in Kodde (1986) and Johnson (1987). Evidence in Beegle et al. (2007), that parents respond to a downturn in their own income by making their children work more, suggests that households cannot insure against that kind of risk. Fitzsimons (2007) reports, however, that parents respond in this way to a downturn not in their own, but in village aggregate income, suggesting that idiosyncratic income shocks are neutralized by informal insurance arrangements at the local level.<sup>3</sup> As the government faces less risk than individual households (because idiosyncratic shocks wash out on average) and, partly thanks to that, has easier access to international money markets than most of households, the former can reduce the consequences of credit and insurance market imperfections by, in effect, insuring and lending to the latter. But there are two moral hazard problem.

Only a small part of the work children do in developing countries goes through the formal labour market.<sup>4</sup> Of the rest, a very small (but never small enough) part involves physically or morally damaging activities. These are the "worst forms" of child labour, which national governments are committed by international treaty to eradicate. But the great bulk of this informal work consists of activities, like helping in the home, or working in the family farm, conducted for and under the supervision of the children's own parents. While comparatively harmless in themselves, these activities conflict with education, and have thus an opportunity-cost in terms of forgone future earnings. A moral hazard problem arises from the fact that the policy maker has statistical information about the nature and extent of this work, but cannot regulate it directly, be-

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<sup>1</sup>See Cigno and Rosati (2005) for a systematic exposition.

<sup>2</sup>The latter reflects the impossibility of a legally binding contract between parents and young children. Cigno (2006) shows, however, that a self-enforcing, renegotiation-proof family constitution serves the same purpose as a contract.

<sup>3</sup>Evidence of such arrangements in a developing country are reported by, among others, Besley (1995) and Townsend (1994).

<sup>4</sup>See Cigno and Rosati (2005).

cause it does not know who does what. Something similar may be said if we look at the issue from the educational standpoint. As every parent or teacher knows, a child's scholastic performance depends not only on total study time (hours spent attending lessons, plus time spent doing homework), but also on how alert the child is during that time. In other words, the effectiveness of any given amount of time spent studying is affected positively by the amount of time the child spends resting, and negatively by the amount of time the child spends doing physically demanding work. As homework, rest and a good part of work time are not observable by the government, both the size and the effectiveness of total study time are then to be regarded as private information. If unobservables were positively correlated with observables, the government could stimulate effective total study time by rewarding school attendance (as in Mexico's PROGRESA, and other time-buying schemes of the kind), but there is evidence that the correlation is actually negative. Ravallion and Woodon (2000) find that the increase in school attendance elicited by an enrollment subsidy is four to eight times larger than the corresponding reduction in child labour. Conversely, Fuwa et al. (2009) estimate that a credit constraint reduces average school attendance by 60 percent, but raises child labour by double that percentage.

The other moral hazard problem arises from the fact that the government does not observe transfers between parents and children, and cannot thus be sure that a public subsidy intended for the latter will not end up as extra consumption for the former. The present paper sets out to characterize the second-best policy, and compare the outcome of this policy with two benchmarks, a low one represented by *laissez faire*, and a high one represented by the first best, in a situation where parents are better informed than the government about their own children's time allocation, and the government does not observe intra-household transfers. We take the return to education to be uncertain. Parental income may be uncertain too, but we will allow for that only informally towards the end of the paper, because it makes no qualitative difference to the policy prescription. We assume that parents can neither borrow, nor insure (allowing for partial, local-level mutual insurance arrangements makes no qualitative difference to the results). As the implications of an educational externality are well understood,<sup>5</sup> we abstract from it, but will find that the policy itself gives rise to a fiscal externality. As the worst forms of child labour raise moral issues that transcend the materialistic calculations underlying the present paper,<sup>6</sup> we leave them out of the analysis, but the policies we will propose would discourage child labour in all its forms. The policy optimization has an optimal taxation (or principal-agent) format.<sup>7</sup> As the focus is on poor developing countries, school age is taken to mean primary school age.<sup>8</sup> Assuming that children in that age

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<sup>5</sup> See, for example, Hanushek *et al.* (2003).

<sup>6</sup> But, see Dassy and Pallage (2005) for a strictly economic analysis.

<sup>7</sup> For a survey of the ways in which optimal taxation, or principal-agent, concepts can be used in a family policy context, see Cigno (2009).

<sup>8</sup> For an analysis focussed on a rich developed country, see, for example, Hanushek *et al.* (2003).

range are under parental control, we take it that the agents are their parents. Section 2 of the paper lays down the technical assumptions, and characterizes parental decisions. Section 3 examines the *laissez faire* equilibrium. Section 4 derives the first and second best policy. Section 5 discusses the results, and concludes.

## 2 Households

There is a large number of households, labelled  $i = 1, 2, \dots, n$ . Each household consists of a couple of adults, and one child. Neither the parents, nor the children, have access to credit and insurance markets. For brevity, we refer to the child in the  $i$ th household as  $i$ . There are two periods, labelled  $t = 1, 2$ . Children are of school age in period 1, and of working age in period 2. Parents are alive only in period 1. The income  $i$ 's parents would produce, in period 1, if  $i$  did not work for them ("parental income") is denoted by  $y_i$ . We assume that this income varies across households, but is exogenously given for each of them. Later in the paper, we will discuss the implications of allowing for this to be a random variable.

Let  $e_i$  denote  $i$ 's effective total study time. In general,  $e_i$  will be equal to  $i$ 's total study time, multiplied by a productivity factor increasing in  $i$ 's rest time, and decreasing in  $i$ 's work time. To simplify, we will measure  $e_i$  by the amount of time that  $i$  does not work. Denoting by  $L_i$  the amount of time  $i$  spends working in the child labour market, the amount of time she spends working for her parents will then be  $(1 - e_i - L_i)$ .<sup>9</sup> The former is paid at the child wage rate,  $w_1$ . The latter is unpaid, but raises household income by  $z(1 - e_i - L_i)$ , where  $z(\cdot)$  is a revenue function, increasing and concave, with  $z(0) = 0$ . Let  $w_2$  denote the unskilled adult wage rate. If  $i$  does not enroll for school,  $e_i$  will be equal to zero. She will then earn  $w_1$  in period 1, and  $w_2$  in period 2. If she enrolls for school, by contrast, she will earn  $L_i w_1$ ,  $0 \leq L_i \leq 1$ , in period 1, and  $w_2 + x_i$ , where  $x_i$  is the skill premium, in period 2.

While  $w_1$  and  $w_2$  are certain,  $x_i$  is not. In Levhari and Weiss (1974) the uncertainty arises from the fact that a child's learning ability is revealed only after the educational investment is made. In Razin (1976), it arises from imperfect information about the lifetime earning ability of a person with a given level of education. While learning ability (the rate at which a child accumulates human capital per unit of effective total study time) is clearly idiosyncratic, earning ability conditional on education (the rental price of the human capital accumulated through education) may depend not only on individual luck, but also on the state of the economy. As our present focus is on parental decisions, we will leave the effects of uncertainty about the future state of the economy for later discussion, and assume that  $x_i$  is i.i.d. over the closed interval  $[0, \bar{x}] \in R^+$ ,

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<sup>9</sup>Especially if the child is female, this work may consist of replacing her parents (typically her mother) in the performance of domestic chores, and thus allowing them to spend more time generating income. If the child is male, it is more likely to involve direct participation in an income generating activity run by the family.

with density  $f(\cdot|e_i)$  conditional on  $e_i$ , and  $f(\cdot|0) = 0$ . As  $x_i$  then reflects only  $i$ 's learning ability and effective total study time, we can use this variable to measure both  $i$ 's school result, and  $i$ 's skill premium.

To capture the fact that the more, and more effectively,  $i$  studies, the better are her chances of achieving a good result in her school career, and thus of attracting a high skill premium in the adult labour market, we will assume that the cumulative distribution of  $x_i$ ,  $F(x_i|e_i)$ , associated with a higher  $e^i$ , first-order stochastically dominates the one associated with a lower  $e^i$ ,

$$F_{e_i}(x_i|e_i) \leq 0. \quad (1)$$

For each  $e_i$ , there will be values of  $x_i$  such that (1) holds as an inequality. We impose the standard convexity-of-distribution-function (CDF) restriction that  $F(x^i|e_i)$  is convex in  $e_i$ , and equally standard monotone-likelihood-ratio (MLR) restriction that  $\frac{f_{e_i}(x_i|e_i)}{f'(x_i|e_i)}$  is increasing in  $x_i$ .

Ex post,  $i$ 's utility will be given by

$$U_i = u(c_{i1}) + u(c_{i2}),$$

where  $c_t^i$  denotes  $i$ 's consumption in period  $t$ . By postulating that utility depends only on consumption, we are implicitly assuming that work affects utility only indirectly, via present and future income. This is tenable only because we are abstracting from the worst forms of child labour. Assuming descending altruism, the ex-post utility of  $i$ 's parents will be given by

$$V_i = v(a_i) + \beta U_i, \quad 0 < \beta < 1,$$

where  $a_i$  denotes parental consumption, and the constant  $\beta$  is a measure of altruism. We further postulate that the functions  $u(\cdot)$  and  $v(\cdot)$  are increasing and concave, thus implying risk aversion, and that  $u'(0) = v'(0) = \infty$ , thus implying that the subsistence level of consumption is normalized to zero.

Let  $m_i$  denote the parental subsidy, and  $\gamma_i$  the government subsidy, received by  $i$  in period 1. Let  $\theta_i$  be a tax paid by  $i$  in period 2. Each of these transfers may be positive, negative or zero. Anticipating a result that will obtain in Section 4, we take  $\gamma_i$  to be independent of  $L_i$ , and  $\theta_i$  to be contingent on  $x_i$ . Let  $p$  denote the price of school enrollment. For the time being, we will take this to be equal to the average total cost of tuition, but later in the paper we will consider the possibility of a price subsidy. Parents make their decisions in period 1, after the government has announced its policy.

If  $i$  is not enrolled for school, and assuming, for the time being, that time allocation and intra-household transfers are not regulated by law,  $i$ 's parents will choose  $(L_i, m_i)$  so as to maximize

$$V_i \equiv v(y_i + z(1 - L_i) - m_i) + \beta [u(m_i + w_1 L_i) + u(w_2)],$$

subject to

$$L_i \geq 0. \quad (2)$$

The first-order conditions are

$$-v'(y_i + z(1 - L_i) - m_i)z'(1 - L_i) + \beta u'(m_i + w_1 L_i)w_1 + \xi_i = 0 \quad (3)$$

and

$$-v'(y_i + z(1 - L_i) - m_i) + \beta u'(m_i + w_1 L_i) = 0, \quad (4)$$

where  $\xi_i$  is the Lagrange-multiplier of (2), equal to zero if the constraint is not binding.

By contrast, if  $i$  is enrolled for school, and again assuming that time allocation and intra-household transfers are unregulated,  $i$ 's parents will choose  $(e^i, L^i, m^i)$  so as to maximize

$$E(V^i) \equiv v_i + \beta \left( u_{i1} + \int_{x_i} u_{i2} f^i dx_i \right),$$

where  $v_i \equiv v(y_i + z_i - m_i)$ ,  $z_i \equiv z(1 - L_i - e_i)$ ,  $u_{i1} \equiv u(m_i + w_1 L_i + \gamma_i - p)$ ,  $u_{i2} \equiv u(w_2 + x_i - \theta_i)$  and  $f^i \equiv f(x_i | e_i)$ , subject to (2). As  $E(V^i)$  is concave in  $e_i$  for the MLR and CDF assumptions, the first-order conditions are now

$$-v'_i z'_i + \beta \int_{x_i} u_{i2} f_{e_i}^i dx_i = 0, \quad (5)$$

$$-v'_i z'_i + \beta u'_i w_1 + \xi_i = 0 \quad (6)$$

and

$$-v'_i + \beta u'_{i1} = 0 \quad (7)$$

### 3 Laissez faire

In *laissez faire*, school enrollment is not compulsory,  $L_i$  is not regulated, and

$$\gamma^i \equiv \theta^i \equiv 0.$$

The pay-off of not enrolling  $i$  at school is

$$\pi(y_i) \equiv \max_{(L_i, m_i)} V(L_i, m_i), \text{ s.t. (2).} \quad (8)$$

That of enrolling her is

$$\pi^*(y_i, p) \equiv \max_{(L_i, e_i, m_i)} E(V^i), \text{ s.t. (2).} \quad (9)$$

The child will be enrolled if and only if  $\pi^*(y_i, p)$  is at least as large as  $\pi(y_i)$ . There is a value of  $y_i$ ,  $\tilde{y}$ , implicitly defined by

$$\pi^*(\tilde{y}, p) = \pi(\tilde{y}),$$

below which  $i$  is not enrolled. As  $\tilde{y}$  is the same for every  $i$ , because children are ex-ante identical, if any children do not go to school at all, it will then

be children whose parents have a low income. This result differs from the one in Ranjan (2001), where a child's learning ability is known, and the income threshold is consequently lower for parents of high-ability, than for parents of low-ability children.

In view of (3) – (4), if  $y_i$  is lower than  $\tilde{y}$ , either  $z'(1 - L_i) = w_1$  or  $L_i = 0$ . Conversely, in view of (6) – (7), if  $y_i$  is at least as large as  $\tilde{y}$ ,

$$\text{either } -z'_i + w_1 = 0 \text{ or } L_i = 0. \quad (10)$$

Suppose that  $w_1$  is so low, that  $L_i = 0$ . If  $y_i$  is lower than  $\tilde{y}$ ,  $i$  will then work full time for her parents. By contrast, if  $y_i$  is at least as high as  $\tilde{y}$ ,  $i$  will go to school, and her effective study time will be non-decreasing (the amount of work she does for her parents will be non-increasing) in  $y_i$ . Alternatively, suppose that  $w_1$  is sufficiently high for  $L_i$  to be positive. If  $y_i$  is lower than  $\tilde{y}$ ,  $i$  will not go to school, and the way she will divide her time between working for her parents and working for the market will depend only on  $w_1$ . Otherwise, she will go to school, and  $e_i$  will be non-decreasing in  $y_i$ . But the way she will divide the rest of her time between working for her parents and working for the market will again depend only on  $w_1$ .

As the expected return to education is the same for every  $i$ , and assuming this return to be positive, the efficient level of  $e_i$  will be positive, and the same for every  $i$ . The *laissez-faire* level of educational investment,  $e_i^{LF}$ , is thus inefficiently low in every household  $i$  where it depends on  $y_i$ .

*Proposition 1.* *In laissez faire, educational investment is inefficiently low. In households with parental income below a certain threshold, children do not enroll for school. Above that threshold, children enroll for school, and their effective education time increases with parental income.*

## 4 Government

If an action is private information, the government must give agents an incentive to undertake that action at the socially optimal level. If an action is common knowledge, by contrast, it does not make sense for the government to offer costly incentives, because the same result can be costlessly achieved by threatening agents with a sufficiently severe penalty if they do not.<sup>10</sup> In our context, effective study time, and transfers between parents and children, may be private information, but school enrollment and the amount of work a child does in the formal labour market are common knowledge. Having assumed that the expected return to education is positive for all children, the government will then make school enrollment compulsory, and fix  $L_i$ . Depending on whether  $(e_i, m_i)$  is common knowledge or private information, the government will either fix those variables too, or influence parental decisions by its choice

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<sup>10</sup>In principal-agent language, this is called a "forcing contract".

of  $(\gamma_i, \theta_i)$ . Having assumed imperfect credit and insurance markets, equity and efficiency cannot be separated. Therefore, we formulate the policy optimization as a welfare maximization problem.

Let the government's preferences be represented by the Benthamite social welfare function,

$$SW = \sum_{i=1}^n E(V_i). \quad (11)$$

Unlike parents, the government does not face any budget uncertainty, because parents and children are many, and risks are i.i.d.. Partly for this reason, the government is also free to borrow or lend in the international credit market. Making the usual "small country" assumption, we will treat the real interest rate as a constant, and normalize it to zero. As the optimization can determine only relative tax rates, we will normalize the one implicit in  $w_2$  to zero (and thus avoid having the account for the revenue). The government then chooses  $(e^i, L^i, m^i, \gamma^i, \theta^i)$ , for  $i = 1, 2, \dots, n$ , so as to maximize (11), subject to the budget constraint,

$$\sum_{i=1}^n \left( \gamma_i - \int_{x_i} \theta_i f^i dx_i \right) = 0 \quad (12)$$

and (2). If  $(e^i, m^i)$  is private information, the maximization will be subject also to incentive-compatibility constraints. As  $E(V^i)$  is concave in  $(e^i, L^i, m^i)$ ,  $SW$  will be concave too. For the i.i.d. assumption, the socially optimal  $(\gamma^i, \theta^i)$  can depend only on  $(e^i, m^i, x^i, y^i)$ , and not also on any  $(e^j, m^j, x^j, y^j)$ ,  $j \neq i$ .

## 4.1 First best

In first best, there are no incentive-compatibility constraints. In addition to making school enrollment compulsory, the government will then prescribe  $(e_i, L_i, m_i)$ , and use personalized lump-sum transfers  $(\gamma_i, \theta_i)$  for each  $i$  to re-distribute and insure. The first-order conditions for the maximization of (11) subject to (2) and (12) are (3), (7),

$$-v'_i z'_i + \int_{x_i} (\beta u_{i2} + \lambda \theta_i) f_{e_i}^i dx_i = 0, \quad (13)$$

$$\beta u'_{i1} - \lambda = 0 \quad (14)$$

and, for each possible realization of  $x_i$ ,

$$-(\beta u'_{i2} - \lambda) f^i = 0, \quad (15)$$

where  $\lambda$  is the Lagrange-multiplier of the government budget constraint.

We can see from (13) that the marginal opportunity-cost of  $e_i$ ,  $v'_i z'_i$ , is equated to the sum of the expected marginal benefit of this investment for  $i$ 's parents,  $\beta \int_{x_i} u_{i2} f_{e_i}^i dx_i$ , and of the expected marginal benefit of a larger tax revenue for society at large,  $\lambda \int_{x_i} \theta_i f_{e_i}^i dx_i$ . It is thus clear that effective study

time is higher in first best than in *laissez faire* because, in the latter, parents do not take account of the fiscal externality. As all children are ex-ante identical, (7) and (14) – (15) imply

$$a_i = a^{FB}, \quad c_{i1} = c_{i2} = c^{FB}, \quad e_i = e^{FB} \text{ and } m_i = m^{FB}.$$

Although  $e^{FB}$  is greater than  $e_i^{LF}$  for every  $i$ , there is nothing to say that it will be equal to unity. Not even an all-seeing, all-powerful government might want to eliminate child labour altogether.

*Proposition 2. In first best,*

- (i) *all school-age children attend school, and allocate their time between study and work activities in the same way;*
- (ii) *effective education time is greater than in laissez faire, but work time is not necessarily zero;*
- (iii) *the government uses personalized lump-sum taxes and subsidies to achieve perfect equity, full insurance, and perfect consumption smoothing.*

## 4.2 Second best

In second best,  $e_i$  and  $m_i$  are private information. We will refer to  $L_i$  as overt, and  $(1 - e_i - L_i)$  as covert child labour. In addition to making school enrollment compulsory, the government will now fix  $L_i$ , and announce how  $L_i$ ,  $\gamma_i$  and  $\theta_i$  are calculated on the basis of the information available at the relevant time. If it seems odd that a benevolent government would actually oblige children to do a certain amount of paid work, think of the second-best value of  $L_i$  as a legal maximum. Since  $\gamma_i$  is received in period 1, this government subsidy can depend only on  $(L_i, y_i)$ . The same applies also to the legal ceiling on  $L_i$ . Since  $\theta_i$  is payable in period 2, this tax can depend also on  $x_i$ .

The maximization of (11) is now subject not only to (2) and (12), but also to the incentive-compatibility constraints on  $(e_i, m_i)$ . Denoting by  $\phi_i$  the Lagrange-multiplier of (5), and by  $\mu_i$  that of (7), the first-order conditions are now

$$-[v'_i + (\mu_i + \phi_i z'_i) v''_i] z'_i - \phi_i v'_i z''_i + \int_{x_i} [(\beta u_{i2} + \lambda \theta_i) f^i_{e_i} - \phi_i \beta u_{i2} f^i_{e_i e_i}] dx_i = 0, \quad (16)$$

$$-(z'_i + \phi_i z''_i) v'_i + \beta (u'_{i1} - \mu_i u''_{i1}) w_1 + \xi_i - (\phi_i z'_i + \mu_i) v''_i z'_i = 0, \quad (17)$$

$$-v'_i + \beta u'_{i1} - \mu_i (v''_i - \beta u''_{i1}) - \phi_i z'_i v''_i = 0, \quad (18)$$

$$\beta (u'_{i1} - \mu_i u''_{i1}) - \lambda = 0 \quad (19)$$

and, for each possible realization of  $x_i$ ,

$$-\beta (f^i - \phi_i f^i_{e_i}) u'_{i2} + \lambda f^i = 0. \quad (20)$$

Let us start by characterizing the second-best policy schedules. Using (7), we can re-write (19) as

$$1 + \mu_i r_i = \frac{\lambda}{v'_i},$$

where

$$r_i \equiv -\frac{v''_i}{v'_i}$$

is the Arrow-Pratt measure of absolute risk aversion. Given that  $v'_i$  is decreasing, and assuming that  $r_i$  is non-increasing in  $y_i$ ,<sup>11</sup> we can then write

$$\gamma_i = \gamma(y_i), \quad (21)$$

where  $\gamma(\cdot)$  is a decreasing function. Condition (20) may be similarly re-written as

$$\beta \left( 1 - \phi_i \frac{f_{e_i}}{f^i} \right) = \frac{\lambda}{u'_{i2}}.$$

As  $u'_{i2}$  is increasing in  $\theta_i$ , and having assumed that  $\frac{f_{e_i}}{f^i}$  is increasing in  $x_i$ , we can then write

$$\theta_i = \theta(x_i), \quad (22)$$

where  $\theta(\cdot)$  is an increasing function.

Having established that  $\gamma(\cdot)$  is a decreasing function, and  $\theta(\cdot)$  an increasing one, it is clear that the policy redistributes from the rich to the poor, and provides insurance for all, as in first best. Comparing (19) with (14), and (20) with (15), however, it is also clear that the policy does not go as far as in first best. As it cannot use personalized lump-sum transfers, the government must in fact limit its recourse to distortionary policy instruments. As there is nothing to prevent  $\gamma_i$  from falling below zero for  $y_i$  sufficiently small, we can interpret this period-1 transfer as the difference between a flat-rate education grant, and a tax on parental income. Similarly, as there is nothing to stop  $\theta_i$  being negative for  $x_i$  sufficiently small, we can interpret this period-2 transfer as the difference between a tax on the individual skill premium, and a scholarship increasing in the individual school result. Stepping outside the formal model for a moment, we can think of the scholarship as being paid "at the beginning" of period 2, when the final school result is revealed,<sup>12</sup>, and of the tax as being collected "in the course" of that period as the skill premium gradually unfolds.

We now go on characterize the second-best  $L_i$ . Condition (17) may be re-written as

$$\text{either } -z'_i + w_1 = \phi_i z''_i - [\mu_i w_1 + (\mu_i + \phi_i z'_i) z'_i] r_i \text{ or } L_i = 0. \quad (23)$$

The LHS of the first equation in (23) is the same as in (10), but the RHS is a negative number, increasing in  $y_i$ , rather than zero as in the latter. If  $w_1$

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<sup>11</sup>Evidence of diminishing absolute risk aversion in an educational context is reported by Kodde (1986) among others.

<sup>12</sup>If partial school results are available in the course of period 1, the child could receive advances in the course, and the balance at the end, of that period.

is large enough for  $L_i$  to be interior, the marginal product of  $i$ 's covert child labour will then be higher than the child wage rate, and this type of labour will be decreasing in  $y_i$ . To see what happens to covert child labour when overt child labour is constrained to zero, we must look at what happens to effective study time.

Using the incentive-compatibility constraints, (16) and (18), simplify to

$$-(\mu_i + \phi_i z'_i) v''_i z'_i - \phi_i v'_i z''_i + \int_{x_i} [\lambda \theta_i f_{e_i}^i - \phi_i \beta u_{i2} f_{e_i e_i}^i] dx_i = 0 \quad (24)$$

and

$$(\mu_i + \phi_i z'_i) v''_i - \mu_i \beta u''_{i1} = 0. \quad (25)$$

Having found that period-1 redistribution stops short of full consumption equalization, it is clear from (24) – (25) that effective study time and parental transfers are not equalized across households. All these conditions say is then that children from poor households study and consume less than children from rich ones. But we can go a little further using the incentive-compatibility constraints.

Given the policy,  $(e_i, m_i)$  is determined by (5) – (7). Taking total differentials, and solving by Cramer, we find

$$\frac{de_i}{d\gamma_i} = \frac{v''_i z'_i \beta u''_{i1}}{H_i} > 0 \quad (26)$$

and

$$\frac{dm_i}{d\gamma_i} = -\frac{\beta u''_{i1}}{H_i} \left[ v'_i z''_i + v''_i (z'_i)^2 + \frac{\partial}{\partial e_i} E(MU_{e_i}) \right] < 0, \quad (27)$$

where  $H_i$  is the Hessian determinant (positive at a maximum), and

$$E(MU_{e_i}) \equiv \int_{x_i} u_{i2} f_{e_i}^i dx_i$$

the expected marginal utility of  $i$ 's effective education time, decreasing in  $e_i$ . It is clear from (26) – (27) that, if  $\gamma_i$  is positive,  $i$ 's parents will appropriate part of this subsidy, but will allow  $i$  to work less than he otherwise would. Conversely, if  $\gamma_i$  is negative,  $i$ 's parents will partially compensate  $i$  for this tax, but will make him work more.

On the one hand, as  $\gamma(\cdot)$  is a decreasing function, the policy then encourages educational investment in poor households, and discourages it in rich ones, because it relaxes the credit constraint in the former and tightens it in the latter. On the other hand, however, as  $\theta(\cdot)$  is increasing, the policy encourages educational investments in all households, because it makes this form of investment less risky for everybody. Therefore, the policy is likely to encourage all households except possibly the richest to invest in their children's education. This makes sense of the rule on overt child labour. In order to limit its recourse to distortionary taxation, the government must allow children from poor households to produce a certain amount of income. If  $w_1$  is high enough to make waged work worthwhile, the government will then impose a positive ceiling on

the amount of paid work children do, and make this maximum a decreasing function of parental income. If  $w_1$  is very low, by contrast, there is no point in imposing a ceiling on overt child labour, because covert child labour is more productive. As covert child labour cannot be regulated by law, however, the government will then lose a policy instrument. Other things being equal, a high child wage rate is better than a low one, not only because it expands the household budget set, but also because it brings more child labour out into the open.

*Proposition 3. In second best,*

- (i) all school-age children attend school;
- (ii) effective education time is higher than in *laissez faire* for most children;
- (iii) the government uses a combination of taxes, education grants, obligations and prohibitions to redistribute and insure, but stops short of perfect equity, full insurance, and perfect consumption smoothing.

### 4.3 Extensions

Would there be any point in the government subsidizing school enrollment, or taxing overt child labour? If  $\gamma(\cdot)$  and  $\theta(\cdot)$  are in place, the answer is clearly no. The answer may change, however, if  $\gamma(\cdot)$  is not available. In the absence of any form of subsidization, and given credit rationing, making primary school enrollment compulsory would in fact make the poorest households (those with parental income lower than  $\tilde{y}$ ) worse-off than in *laissez faire*. An enrollment subsidy would obviously raise welfare if it were financed by foreign donors. It would raise welfare also if it were financed by a tax on parental income, but would not be as good as our  $\gamma(\cdot)$ , because a price subsidy cannot be equal to more than a hundred per cent of the price, and that might not be enough. An enrollment subsidy financed by a poll tax would have no effect, because parents would then take a lump-sum subsidy with one hand, and pay a lump-sum tax of the same amount with the other. If  $\theta(\cdot)$  is not in place, an enrollment subsidy, however financed, will not be sufficient for a second best, and could actually reduce welfare, because it encourages school attendance at the expense of rest and homework. A tax on overt child labour would lower welfare in any case, because it would drive some of this labour underground.

In the analysis so far, we have assumed that parental incomes are certain, and individual skill premia subject only to idiosyncratic shocks. What difference would it make if not only  $x_i$ , but also  $y_i$ , were a random variable, and both were subject to aggregate, as well as idiosyncratic shocks? If  $x_i$  reflects the state of the economy when  $i$  enters the adult labour market, and that state is not known with certainty when  $e_i$  is chosen, the government must use its ability to borrow and lend for redistributing not only within, but also across cohorts. Formally, therefore, the government's time horizon must be extended from two to an infinite number of periods. That done, however, the policy schedules will

remain qualitatively the same as if the optimization concerned only two periods. The same applies if  $y_i$  also is a random variable, because  $\gamma(\cdot)$  will then serve the purpose of insuring parents against the risk of a downturn in their own income, as well as that of redistributing among them.

## 5 Conclusion

Given financial market imperfection, the *laissez-faire* level of effective education time is inefficiently low. In households where parental income lies below a certain threshold, children do not even enroll for school. As already established in the theoretical literature, and confirmed by the empirical one, the reason is not only that parents cannot borrow against the expected return to their educational investments, but also that they cannot insure against the risk of this return being low.

In first best, all children study at the efficient level, the same for all of them. But there is nothing to indicate that the efficient level of work time is zero. The government makes school enrollment compulsory, and uses personalized lump-sum transfers to achieve perfect equity, full insurance, and perfect consumption-smoothing. In second best, all children attend school, but effective study time is inefficiently low. The government makes school enrollment compulsory, and uses a combination of taxes on parental incomes and the children's skill premia, together with a mix of merit and need based education awards. If the child wage rate is sufficiently high, it also imposes a legal ceiling, decreasing in parental income, on overt child labour. This policy redistributes and insures, and relaxes the credit constraint, but does not go far enough to achieve perfect equity, full insurance, and perfect consumption-smoothing.

In reality, primary school enrollment is officially compulsory, and labour at a very young age officially forbidden, in most countries. In poor developing ones, however, education is subsidized, if at all, only through the price of school enrollment. As we have shown, enforcing school enrollment, or making the ban on child labour effective, without offering parents any kind of subsidy, in a situation where they can neither borrow nor buy insurance, would push social welfare below the *laissez-faire* level. An enrollment subsidy financed by a tax on parental income, or by foreign donations, might be better than nothing, but not enough for a second best.

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