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Will Trade Sanctions Reduce Child Labour?

The Role of Credit Markets¤

By

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Abstract

We examine the interaction between credit markets, trade sanctions and the incidence of child labour in a two good, two period model with unequally wealthy households. Compared to ¯nancial autarky, a domestic credit market leads to unambiguously less child labour among borrowers (who are likely to be households with low parental income). However, child labour among lenders may increase. Trade sanctions increase child labour if the `income e®ect' is su±ciently large, a possibility that is particularly high for households with low parental income, but decreases as their access to credit improves, from ¯nancial autarky to domestic credit to international borrowing.

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1 Introduction

According to recent estimates, there are about 75 million children in the world who are economically active (see Ashagrie (1993), Grootaert and Kanbur (1995) and ILO (1996)).[1] The ¯gure is clearly very high and unacceptable: there is no debate about it. However, the important questions are about the reasons for the existence of child labour and the policies that should be adopted for its elimination.

Child labour is of course not a new phenomenon and there is a substantial literature, both relatively historical and contemporary, dealing with it albeit with a focus that has shifted over the years (see Basu (1998) for an extensive survey). For example, the classic study by Cain (1977) for the village Char Gopalpur in Bangladesh was an attempt to explain high fertility rates among the poor families of that village. By contrast, the theoretical and empirical (micro-econometric) studies that have resurfaced with a vengeance in recent years have focused directly on the issue of child labour and on policies for dealing with it. This is somewhat surprising as, although the absolute number of child workers is quite high, the participation rate of children has in fact been declining quite steadily. Over the last forty ¯ve years or so, the participation rates among children aged 10-14 years have come down from about 27% to 13%. The ¯gure for Asia, where most of child labour originates, has come down even more steeply from 36% in 1950 to about 13% in 1995 (see ILO (1996)).[2]

The interesting question is why in recent years there has been an increase in concern over child workers in developing countries while the problem itself has steadily declined. The globalisation of the international economy and, in particular, agreements (or compromises) reached at the Uruguay Round of the GATT, have possibly got something to do with this. As Basu (1998) notes, `This has, in turn, brought two di®erent kinds of people on the same platform | individuals who are genuinely

[1] According to ILO convention, a person of age less than 15 years of age is treated as a `child', and a child is deemed `economically active' if he or she does work on a regular basis for which he or she is remunerated or which results in output which reaches a market (see Basu (1998, p.4)).

[2] In 1861, 30% of British children aged 10-14 years were economically active. It is to be noted that the per-capita income for Britain in 1861 in today's price was more than twice the current per-capita income of some of the South Asian countries where the participation rate now is about 15%.

concerned about the plight of children in poor countries and those who comprise the forces of protectionism in developed countries.' (Basu (1998, p.1)). One can possibly go a step further and say that the protectionist forces are in fact hijacking the genuine concerns of the altruistic individuals. The increase in academic research on the subject is to a great extent a reaction to e®orts by the United States of America and the European Union to add | allegedly after intense lobbying from the protectionist forces | `international labour standards' and a `social clause' in the World Trade Organisation charter (see Bhagwati (1995), Fields (1994), Maskus and Holman (1996), Rodrik (1996), Srinivasan (1996) and Basu (1998 and 1999)).

Although academic economists have mixed views about the appropriateness of trade sanctions as an instrument to address the issue of child labour, such instruments are already being used extensively, both formally and informally. For example, in the United Kingdom several NGOs are involved in the naming and shaming of stores that sell `unethical' products, i.e., products produced in the developing countries with the use of child labour.[3] To summarise this line of discussion, international trade is an important part of the present debates on child labour, although it does not feature explicitly in many of the formal analyses of the problem, and trade instruments are being and will increasingly be used by the developed world to address the problem at hand.

Apart from international trade, another important aspect of the use of child labour is that the problem is essentially a dynamic one. By not sending a child to school, but to work instead, a family is foregoing future income for present ones, as an educated child is likely to earn more in the future.[4] If the family has access to credit at `reasonable' terms, then it may not have to forego present consumption signi¯cantly, and the decision to send a child to school may not be a painful one. The working of credit markets should therefore be an important element in the analysis of child

[3]Some of these NGOs are directly sponsored, inter alia, by the Confederation of British Industries and the Trade Union Congress.

[4]In a recent paper, Ravallion and Wodon (1999) have argued, with micro-level data from Bangladesh, that the choice may not be just between education and labour, but between education, leisure and labour. Bhalotra (1999) with similar micro-level data from Pakistan argues that it is acute poverty which makes the opportunity cost of sending a child to school very high.

labour.

Parental attitudes are also important determinants of child labour. If parents care only about the pecuniary returns from education and such returns are independent of the time-use decisions taken by individual households, then allowing them access to credit markets will mean that each parent either educates all children full time or, if the pecuniary bene¯ts are low, not at all. The pecuniary bene¯ts to education can be low if the market rate of interest is high relative to the wage premium children receive as a result of having undertaken schooling. However, if parents derive subjective utility from children going to school or disutility from them working, they may allocate a positive amount of the latter's time towards schooling even if market interest rates are too high to warrant this on purely pecuniary terms.

In fact, the rate of return to basic, primary-level education as provided to poor children in many developing countries can indeed be very low, not only because of high rates of interest but also due to the poor quality of education.[5] That in such situations poor families send any child to school must be a testimony to the fact that those poor families gain some satisfaction purely from seeing their children receive an education.[6]

This paper focuses on the role of credit markets and examines their impact on the incidence of child labour in a model in which parents have a subjective bias against child labour. It also examines the e®ect of trade sanctions on child labour under various scenarios about the credit market. We develop a two period, two good model in which there are two types of families: rich and poor. Each family has a ¯xed number of children and decides how many of the children should go to school in the ¯rst period. The children who do not go to school, work and receive income. By

[5] The rate of return to education is de¯ned as the ratio of additional income to income foregone. It has been estimated that primary education in India raises future wage rates by about 20% (see The Probe team (1999, p.21)). If we assume that primary education lasts for ¯ve years and the higher wages are received over an inde¯nite time period after the completion of primary education, it can be shown that if the relevant discount rate of a household is more than 3.7%, a 20% wage premium will not be enough to make primary education pro¯table from a purely pecuniary point of view. See also Saha and Sarkar (1999) for evidence on the low rate of return on primary education.

[6] A recent survey conducted in Indian villages found that economic motives are not the only reasons why poor families want their children to go to school (see The Probe team (1999, chs. 2 and 3)).

going to school a child becomes skilled and earns a higher wage in the second period. One of the goods is produced by unskilled workers and the other by skilled ones. The country is a net exporter of the goods produced by unskilled labour.

We show that a perfectly functioning domestic loan market can, under plausible conditions, cause credit to °ow from rich households to poor ones. As a consequence, schooling will unambiguously increase among poor children, although in some circumstances it may decrease among rich ones. We also show that trade sanctions may increase the incidence of child labour among very poor households, even if they have access to credit in world markets. The possibility of this perverse e®ect decreases, however, with better credit opportunities.

The notion that credit opportunities may in°uence child labour has also been pursued by other authors. Jacoby and Skou¯as (1997) argue that while trading on Arrow-Debreu markets might allow households to perfectly smooth consumption in the face of uncertain income, ¯nancial autarky, at the other extreme, would lead them to use child labour as an instrument of self-insurance. These authors, however, do not study the role of trade policy in in°uencing child labour.

Recently, Ranjan (1999) has explicitly studied the connection between trade sanctions, child labour and credit markets. This study, however, compares ¯nancial autarky only with perfect access to international credit and does not consider the general equilibrium e®ects that can arise in a domestic credit market based on heterogeneous households. Moreover, it only identi¯es circumstances in which trade sanctions have no e®ect in reducing child labour, not circumstances in which trade sanctions have perverse e®ects. Furthermore, whereas the trade sanctions considered in Ranjan (1999) are permanent, we consider temporary sanctions.

Both studies cited above omit education as an argument in parental utility functions. As discussed above, given access to market credit, this formulation makes impossible a partial division of children's time between labour and education. One implication is that so long as a given household faces a perfectly elastic supply of loans, no policy variable - be it a trade sanction or an educational reform - will have

a marginal e®ect on its children's labour (except in knife-edge cases). This possibly exaggerates the impact of access to market credit on individual decisions concerning child labour.

The alternative formulation of assuming a subjective parental bias in favour of education allows for a situation in which whether or not parents have access to market credit, they may divide their children's time (albeit to di®erent extents) between labour and schooling. This enables marginal comparisons to be made, as in this paper, concerning the e®ects of policy variables on child labour under various scenarios about the availability of credit.

The model is spelt out in section 2. Section 3 examines how the working of credit markets a®ects the incidence of child labour. We compare three cases: (i) unfettered access to international credit markets, (ii) complete absence of credit markets, and (iii) no access to international credit markets, but a domestic credit market in which the rich save and the poor borrow. Section 4 examines the e®ects of trade sanction on child labour under the three scenarios about the credit market. Section 5 concludes.

2 The basic framework of analysis

We consider a small economy which trades with the rest of the world. It has a two-period horizon, indexed by $t = 1; 2$ respectively. The economy produces two goods per period. Goods labelled 1 and 2 are produced during $t = 1$ while goods labelled 3 and 4 are produced during $t = 2$. P_i $(i = 1; 2; 3; 4)$ denotes the price of good i in the world market.

Production is described by a ¯xed-coe±cients Leontief technology which uses labour as the only input. Workers are either skilled or unskilled and cannot substitute for each other in production. Goods 1 and 3 are produced by skilled labour, goods 2 and 4 by unskilled. Units are normalised so that one unit of each good requires one unit of the relevant labour. Perfect competition among ¯rms ensures that workers are

paid their marginal revenue product; hence, the wage rate of skilled workers is P_1 at $t = 1$ and P_3 at $t = 2$; the corresponding wage rates of unskilled workers are P_2 and P_4. Skilled workers receive higher wages than unskilled ones, so that $P_1 > P_2$, $P_3 > P_4$. In each period the economy is assumed to be a net exporter of the good produced by unskilled workers.

The economy is made up of a collection of households, each headed by a single parent. There are an identical number, N, of children per household.[7] Each child is born unskilled but can receive training during $t = 1$. Children who receive full-time training become skilled adults at $t = 2$ and receive wages P_3. Children who do not receive training work full-time during $t = 1$ as child labourers and earn P_2; upon becoming adults they remain unskilled and earn P_4. The training decision is made for each child by his parent. Each household's training decision can be characterised by a fraction, e, with Ne children receiving an education, and $N(1 - e)$ having to work as child labourers.

The parent in each household may either be skilled or unskilled, a status which is exogenous and cannot be altered through training. Households headed by a skilled parent will be indexed by superscript `s', while households headed by an unskilled parent will be indexed by superscript `u'. M^h denotes the number of households of type h; A^h represents non-labour income (derived from non-human assets such as land) at $t = 1$ while B^h represents non-labour income at $t = 2$, of a household of type h; $(h = s; u)$. Since households headed by a skilled parent are likely to also have higher wealth and therefore higher non-labour incomes, we assume that $A^s > A^u$, $B^s > B^u$.

Each parent's preferences are represented by a utility function over the four consumption goods and a measure of the aggregate educational level of children.

$$v^h = v^h(c_1^h; c_2^h; c_3^h; c_4^h; Ng^h(e^h)); \quad h = s; u; \tag{1}$$

where v^h is the utility level, c_i^h is the consumption of good i $(i = 1; ¢¢¢; 4)$ and e^h is the proportion of children receiving an education in household h $(h = s; u)$. Con-

[7] This assumption that the number of children per family is the same for the two types of families is made for algebraic simplicity and can be relaxed without altering any of the qualitative results.

sumption goods are assumed to be non-rivalrous within the household, but rivalrous across households. This allows us to abstract from the intra-household distribution of resources. Unless otherwise stated, preferences will be assumed to be identical across households, so the superscript `h' on v and g will be suppressed in most of the following discussion.

The utility function v is increasing and concave in its arguments. The sub-utility function, g is also increasing and concave. The inclusion of education in the utility function is consistent both with the assumption that parents receive utility from seeing their children educated and that they receive disutility from subjecting their children to labour. The concavity of v with respect to education re°ects decreasing marginal utility of education and/or increasing marginal disutility of child labour.

Households face the following budget constraints:

$$P_1 c_1^h + P_2 c_2^h \quad \cdot \quad A^h + Y^h + N(1 - e^h)P_2 + b^h \tag{2}$$

$$P_3 c_3^h + P_4 c_4^h + r b^h \quad \cdot \quad B^h + Z^h + N e^h P_3 + N(1 - e^h)P_4: \tag{3}$$

The variables not de¯ned previously are: b, which represents household borrowing at t = 1; Y, which denotes the parent's labour income at t = 1; Z, which denotes the parent's labour income at t = 2; r, which denotes the interest factor, i.e. principal plus interest. b, Y and Z are each indexed by household type. Note that $Y^s = P_1$, $Y^u = P_2$, $Z^s = P_3$, $Z^u = P_4$.

The household's optimisation problem will vary with the credit opportunities available to it. We examine three cases:

² all households can borrow or lend freely in a perfect credit market, linked to international capital markets, where the interest factor is exogenous and equal to r_w;

² there is a complete absence of borrowing or lending opportunities, both domestically and in world markets;

² all households can participate in a domestic credit market, but cannot borrow from or invest in foreign capital markets.

Evidence suggests that credit opportunities in rural parts of the developing world take the form of informal loan from rich to poor households (see Besley (1995)). In this sense the third case most closely corresponds to reality. However, the first is a goal which all countries should aspire to.

Our analysis of each case proceeds as follows. We first study the household's educational choice as a function of given market prices, which include, from the household's point of view, the interest factor, r. We then study the determination of the equilibrium interest factor itself, which will depend on the relevant credit scenario. Unless otherwise stated, our results pertain to the following simplification of the utility function:

$$v^h = w^h(c_1^h; c_2^h; c_3^h; c_4^h) + N g^h(e^h): \tag{4}$$

The separability of utility between education and consumption goods is mainly a matter of analytical and expositional convenience. Indeed, some of the main results of this paper could be strengthened if, for example, complementarity were to be allowed for between education and the consumption of skill-intensive goods (see footnote 27).

Unless necessary for making comparisons, household indices will be suppressed. Needless to say that actual values of the household's choice variable will be different, depending on differences in the values of certain exogenous household characteristics. Facing an interest factor, r, a given household's budget constraints can be aggregated over the two periods:

$$\begin{aligned} &P_1c_1 + P_2c_2 + \frac{P_3}{r}c_3 + \frac{P_4}{r}c_4 \cdot A + Y \\ &+N(1 - e)P_2 + \frac{B}{r} + \frac{Z}{r} + Ne\frac{P_3}{r} + N(1 - e)\frac{P_4}{r}: \end{aligned} \tag{5}$$

The household's problem consists of choosing c_i, $i = 1; ¢¢¢ ; 4$, and e in order to maximise equation (4) subject to equation (5), and to the constraint, $e \in [0; 1]$.

Subsequent analysis is made easier and more compact if we express the optimisation problem in terms of the dual approach. The dual problem is one of minimizing the present value of total expenditure on consumption:

$$\min_{c_1;c_2;c_3;c_4} E = P_1c_1 + P_2c_2 + \frac{P_3}{r}c_3 + \frac{P_4}{r}c_4;$$

subject to:

$$w(c_1; c_2; c_3; c_4) + Ng(e) \geq v:$$

The solution of this problem is represented by an expenditure function, denoted by $E(P_1;\ P_2;\ P_3=r;\ P_4=r;\ v - Ng(e))$, which has well known properties. In particular, E is increasing in all positive arguments, has a negative second derivative with respect to the first four arguments and a nonnegative second derivative with respect to the fifth.[8]

The inter-temporal budget constraint (6) can be rewritten in terms of the expenditure function as[9]

$$A + Y + N(1 - e)P_2 + \frac{B}{r} + \frac{Z}{r} + Ne\frac{P_3}{r} + N(1 - e)\frac{P_4}{r}$$
$$= E\left[P_1; P_2; \frac{P_3}{r}; \frac{P_4}{r}; v - Ng(e)\right]: \qquad (6)$$

Since the households take the interest rate as given while deciding on the level of education, e, for the children, the optimal choice of e is found by maximising v subject to equation (6). That is, the first order condition can be found by differentiating (6) and setting $\partial v/\partial e = 0$. Assuming a positive choice of e, the first-order condition can be written as:

$$E_5 g'(e) + \frac{(P_3 - P_4)}{r} \geq P_2; \qquad (7)$$

with a strict inequality if $e = 1$. E_5 is the inverse of the marginal utility of income (shadow price of wealth): it represents the extra income needed to increase utility by

[8] The partial derivative of an expenditure function with respect to the price of a good gives the Hicksian compensated demand function for that good. Moreover, the the matrix of second order partial derivatives of the prices is negative semi-definite. For this and other properties of expenditure function see, for example, Dixit and Norman (1980).

[9] From now on we assume that the budget constraint is binding.

one unit. The condition states that given an interior choice, the marginal bene¯t of a slightly higher fraction of children going to school, e, must equal its marginal cost. The bene¯t is re°ected in the expression on the left-hand side of the equation. An increase in e leads to a marginal increase in g(e), resulting in a gain equal to $E_5 g'(e)$ in units of income. It also leads to a direct increase in income at t = 2 by the amount of the skill premium $P_3 - P_4$, which is then discounted back to t = 1 via the interest factor. On the other hand, an increase in e results in a loss of income at t = 1, due to the foregone wages of an unskilled child worker, P_2. The right-hand side of equation (7) represents this cost.

Equation (7) can be rearranged:

$$E_5 g'(e) \gtrless P_2 - \frac{(P_3 - P_4)}{r}:$$

In this form, the left-hand side represents the pecuniary equivalent of the marginal utility of education while the right-hand side represents the income loss or gain arising from the e®ect of educating an extra child on the intertemporal budget constraint. For an interior choice of e, it is necessary that the left-hand side is positive. This requires that each child's education results in an overall loss of income for the household. This in turn is likely to happen when the return to skill acquisition is low, i.e. $P_3 - P_4$ is low or r is high. A corner solution, e = 1, is by contrast consistent with positive and high pecuniary returns to schooling.

The educational decision is also in°uenced by E_5, the inverse marginal utility of income, quite independently of the net returns to education. Given a net return to education, parents with higher incomes and/or higher non-human wealth will have a higher E_5 (due to a lower marginal utility of income) and will choose e to be higher than parents with low incomes and/or wealth. Indeed, rich enough parents will choose e to be unity even if the pecuniary return to education is itself negative.

It only remains to consider the three scenarios vis-a-vis the credit markets.

2.1 Perfect international credit markets

With perfect credit markets internationally, the equilibrium interest factor will trivially be equal to the world interest factor. Hence, $r = r_w$. The entire system can be represented by equations (6) and (7) plus the following equation:

$$r = r_w; \tag{8}$$

Equations (6) and (7) jointly determine e and v as functions of r and the other exogenous variables. Equation (8) then determines r.

Once v, e, and r have been determined, the borrowing/lending decision of each household may be expressed as:

$$b = \frac{Z + B + NeP_3 + N(1 - e)P_4 - P_3E_3 - P_4E_4}{r}; \tag{9}$$

since $E_i = @E=@P_i = c_i$ $(i = 1; ¢¢¢ ; 4)$ (see footnote 8). For purposes of comparison, the values of e, b and v that result in this case will be identi¯ed as e_w, b_w and v_w respectively.

2.2 Financial autarky

In the complete absence of credit opportunities, outcomes can be characterised by an implicit interest factor which makes the household content to consume its income in each period. This interest factor equals the marginal rate of substitution between consumption levels at t = 1 and t = 2, and will be referred to as an `autarky interest factor', denoted by r_a.[10] The joint determination of v, e and r_a is achieved by simultaneously solving equations (6) and (7) (with r_a replacing r in both) and the following:

$$B + Z + NeP_3 + N(1 - e)P_4 - P_3E_3 - P_4E_4 = 0: \tag{10}$$

Equation (10) simply states that total income at t = 2 is equal to total expenditure in the same period. In addition to the autarky interest rate, denoted r_a, the values of other endogenous variables will be labelled as e_a and v_a in this case.

[10] Since r_a varies with income, it will di®er across the two classes. Where this di®erence matters, r_a^h will denote the autarky interest rate for type h (h = s; u).

2.3 Perfect domestic credit markets

Finally, we consider a situation in which the economy is closed to capital °ows (but not to trade) but there exists an internal credit market in which households can exchange loans. It is under this scenario that the heterogeneity of households becomes meaningful; if all households were the same, equilibrium outcomes under a domestic credit market would be the same as under autarky.

The equation determining the interest factor in this case is:

$$M^s b^s + M^u b^u = 0;$$

which, written explicitly, implies,

$$\begin{aligned} & M^s \{P_3[E_3^s - N e^s] + P_4[E_4^s - N(1 - e^s)] - B^s - Z^s\} \\ & = M^u \{B^u + Z^u + P_3[N e^u - E_3^u] + P_4[N(1 - e^u) - E_4^u]\}: \end{aligned} \tag{11}$$

Equations (6) and (7) in this case are solved separately for skilled and unskilled households in order to yield v^s, v^u, e^s. e^u as functions of r, which is now the same for the two groups of households. Then, noting the functional dependence of e^u amd e^s on r, equation (11) yields r. The endogenous variables in this case will be denoted e_d^s, e_d^u, r_d, v_d^u and v_d^s respectively.

This completes the description of our framework of analysis.

3 Credit markets and child labour

In this section we shall compare the incidence of child labour, given by $1 - e$, in each of the three credit market situations.

Under perfect credit markets, educational outcomes depend on the world inter-

est rate, r_w. From equation (7), if:[11]

$$r_w < \frac{P_3 - P_4}{P_2 - E_5 g'(1)} \Rightarrow e_w = 1$$

$$r_w = \frac{P_3 - P_4}{P_2 - E_5 g'(e)} \Rightarrow e_w \in (0;1)$$

$$r_w > \frac{P_3 - P_4}{P_2 - E_5 g'(0)} \Rightarrow e_w = 0$$

Note that if education were not an argument of parental utility, then an interior choice of e would result only in the knife edge case where $r_w = (P_3 - P_4)/P_2$. As it stands, there is a range of values of r_w compatible with $e_w \in (0;1)$. If r_w lies above this range, then zero education is chosen.

We now analyse how educational outcomes under financial autarky (subsection 2.2) compare with the two scenarios in which credit is available. In particular, we shall analyse how child labour outcomes might change when, starting from financial autarky, either (i) the economy is opened up to capital flows from overseas, or (ii) a domestic credit market is opened up.

We start by determining the partial equilibrium effect on a given household's equilibrium of a change in the interest factor, r. Totally differentiating (6) and (7), we obtain

$$r^2 E_5 dv = [P_3 E_3 + P_4 E_4 - Z - B - N e P_3 - N(1-e)P_4]dr \qquad (12)$$

$$r^2 \left[E_5 g'' - N(g')^2 E_{55}\right] de + r^2 g' E_{55} dv$$

$$= [g'(P_3 E_{53} + P_4 E_{54}) + (P_3 - P_4)]\, dr \qquad (13)$$

In differentiating equation (6), the term involving de drops out due to the envelope condition. Hence, equation (12) can be solved for dv as a function of dr. This can be summarised by:

$$\frac{dv}{dr} = -\frac{b}{rE_5}$$

[11] The value of E_5 will differ across the inequalities, but to simplify notation, this is not explicitly spelled out.

where the coe±cient of dr in equation (12) is related to b via equation (9). This comparative static e®ect re°ects the well known notion that the welfare of a lender rises and that of a borrower falls with an increase in the interest rate. Allowing for this in equation (13), the solution for de can be written as:

$$\frac{de}{dr} = \frac{g^0(P_3E_{53} + P_4E_{54} + rb(E_{55}=E_5)) + (P_3 - P_4)}{r^2[E_5g^{00} - N(g^0)^2E_{55}]}$$

The denominator is clearly negative. As for the numerator, the terms E_{53} and E_{54} re°ect income e®ects on goods 3 and 4 and as such are positive under the assumption of normality. $(P_3 - P_4)$ captures the skill premium facing children and is also positive. Hence, $b \geq 0$ is a su±cient condition for an increase in the interest rate to lower the educational level. If $b < 0$, it is still possible for the above comparative static relationship to hold, but also possible for the reverse to hold.

In order to study the response of b to a change in r, equation (9) can be di®erentiated:

$$\begin{aligned} r^3\frac{db}{dr} &= r^2[N(P_3 - P_4) + (P_3E_{35} + P_4E_{45})Ng^0]\frac{de}{dr} \\ &+ [-b(1 - c_y^3 - c_y^4)r^2 + (P_3)^2E_{33} + P_3P_4E_{34} + (P_4)^2E_{44}]; \end{aligned}$$

where c_y^i $(= P_iE_{i5}=(rE_5)$ is the value of the marginal propensity to consume good i $(i = 3; 4)$.

It is clear that, starting from an initial equilibrium in which $b = 0$, $db=dr$ will be negative as $(P_3)^2E_{33} + P_3P_4E_{34} + (P_4)^2E_{44} < 0$.[12]

Now, suppose that a household, h, which has hitherto faced ¯nancial autarky is allowed to trade on an international credit market with given interest factor r_w. Suppose $r_a^h > r_w$. Since the borrowing function is always negatively sloped at the autarky point, this household must become a borrower. Along with the change in the interest factor facing the household, and the fact that $de=dr < 0$ for a borrower, this implies the following result:

[12]Noting that E_3 and E_4 are homogeneous of degree zero in the four prices and then using Euler's equation, we can write the denominator as $-(P_3=r)(P_1E_{31} + P_2E_{32}) - (P_4=r)(P_1E_{41} + P_2E_{42})$; which is negative assuming intertemporal substitutability in consumption.

Proposition 1: Suppose that $r_a^h > r_w$, $h = s;u$. Then, $e_w^h > e_a^h$.

Proposition 1 implies that access to credit at an interest rate lower than the household's own autarky interest rate will induce the household to educate more children (as the return to education increases) and to o®set the resulting loss in ¯rst-period income by borrowing from the market. This e®ect works independently for each household, depending on its own discount factors; the di®erences between rich and poor households play no role in this comparison.

On the other hand, di®erences across households play an important role in comparing outcomes under autarky with those under a domestic credit market. In particular, di®erences in non-labour income can in°uence the comparison. We focus on non-labour income in the initial period, A. It can easily be shown that

$$\frac{dv}{dA} = \frac{1}{E_5} > 0$$

$$\frac{de}{dA} = i\,\frac{g^0 E_{55}}{E_5(g^{00}E_5 \; i \; N g^0 E_{55})}$$

Hence, for a given interest rate, higher initial wealth results in less child labour and more education for children. If skilled workers have su±ciently high wealth, they might send all their children to school even if the pecuniary returns to education are negative. Alternatively, it would not be unrealistic to assume that rich households have access to better quality education and enjoy greater pecuniary returns than poor ones. This would add further motivation to the higher educational choice of rich hosueholds, but we have ignored this possibility as super°uous for deriving our main results. Hence, on the basis of di®erences in parental income and wealth, we assume from hereon that under both autarky and the presence of an international credit market, skilled households send all their children to school while unskilled households only send a fraction.

Turning to general equilibrium analysis, in the absence of a credit market the implicit interest factor for each household, r_a, is determined by equation (10). Di®er-

entiating this equation, it is easy to show that

$$\frac{dr_a}{dA} = \frac{(r_a)^2 N (P_3 - P_4) + P_3 E_{35} + P_4 E_{45}}{P_3^2 E_{33} + 2P_3 P_4 E_{34} + P_4^2 E_{44}} \frac{de}{dA} < 0$$

where the denominator is negative (see footnote 12). A similar derivation can be used to show that $dr_a=dY < 0$, $dr_a=dZ > 0$, $dr_a=dB < 0$. Comparing across households, although skilled households have higher initial wealth and higher parental income in the first period, they also have higher parental income in the second period. Hence, it is theoretically possible that they might have a higher autarky interest rate than unskilled households, although this would likely be untrue in practice. For this reason, we focus on the case where unskilled households have higher autarky interest rates.

Proposition 2: Suppose that $r_a^u > r_a^s$, Then, provided equilibrium exists upon opening a domestic credit market, there is an equilibrium in which unskilled households borrow from skilled ones. In this equilibrium, $e_d^u > e_a^u$.[13]

Proof: When a credit market opens up, in equilibrium the interest rate equalises for both types of households. Given existence, there has to be an equilibrium in which unskilled households face a lower interest rate than under autarky, while skilled household face a higher one. Since both b^s and b^u are decreasing in r at the autarky point, this equilibrium will have unskilled households borrowing and skilled ones lending. Under results previously established, given a decline in their implicit interest rate and the fact they become borrowers, unskilled households will choose a higher educational level once the credit market opens. 2

Intuitively, opening up a credit market allows poor families to borrow in order to relax income constraints in the first period. This enables them to rely less on child labour for generating first-period income and leads to substitution towards child schooling.

[13] The wording of the proposition should not be construed as implying that non-existence or, at the other extreme, multiplicity of equilibrium is likely to be a generic problem in this economy. Such possibilities are not the subject of interest in this paper and could be easily ruled out by imposing further restrictions.

The amount of child labour amongst skilled households could rise, however; it is therefore unclear what happens to child labour overall. Three cases are possible, either (i) e_d^s remains at unity while e_d^u remains below unity, but above its autarky value; (ii) e_d^s remains at unity while e_d^u rises to unity as well; (iii) e_d^s falls below unity while e_d^u rises but remains below unity.[14] In both cases (i) and (ii), the aggregate incidence of child labour falls, while under case (iii) it changes ambiguously.

In the special case of quasi-linear preferences,[15]

$$v^h = (c_1)^{®} + (c_2)^{-} + c_3 + (c_4)^{\circ} + N g(e): \tag{14}$$

with both types of household having identical preferences but di®ering in terms of income and wealth, the educational decisions of the two households equalise once credit markets open. This is because di®erences in educational decisions are, in the present model, in°uenced by two things: the interest factor facing each household and the household's marginal utility of income. A domestic credit market equalises the interest factor. With the above preferences, the marginal utility of income is constant and independent of the level of income. Hence, with quasi-linear preferences, only cases (ii) and (iii) are possible (see appendix A).

Whether or not the outcome under quasi-linear preferences is unrealistic is a moot point. Perhaps it is. However, occasionally one does observe signi¯cant amounts of child labour among non-poor families (see Cain (1997)). Moreover, the above result is of some interest in highlighting a feature of the interaction between education and credit markets. The educational decision is an intertemporal one, given that it involves a sacri¯ce of current consumption. In the absence of credit markets, the marginal returns (taking into account both subjective and pecuniary factors) from investing in education may be di®erent among di®erent households. This creates potential gains from trade. Opening a credit market helps realise these gains as poor households borrow and increase their investment while rich households lend and (possibly, depending

[14] A fourth situation, where $e_d^s < 1$ while $e_d^u = 1$ is not possible since, from equation (7), that would require $E_5^u > E_5^s$ which is not possible given the distribution of income and wealth.

[15] In this speci¯cation of quasi-linear preferences, the entire income e®ect falls on the consumption of good 3, i.e., the good produced by skilled workers in period 2, and the marginal utility of income | the reciprocal of E_5 | is constant.

on whether they are at a corner or not) decrease theirs. Ex post, the marginal returns tend to equalise. In the case of identical quasi-linear preferences, this general tendency asserts itself by leading to an equalisation of the actual educational levels.

Heterogeneity of households is important for a domestic credit market to a®ect the incidence of child labour. If all households consisted of identical parents, opening a domestic credit market would not lead to any actual trade and equilibrium choices would not be a®ected.

4 Trade sanctions and child labour

Having analysed some of the properties of equilibrium, in this section we shall analyse the e®ect of a temporary trade sanction on the incidence of child labour. Since the goods produced by unskilled workers are exported, the impact of a trade sanction in the ¯rst period would entail a reduction in P_2. Thus we shall examine the sign of $de=dP_2$ under the three scenarios in relation to credit markets.

4.1 Perfect international credit markets

We shall assume that the initial endowments of the two groups are such that families with a skilled head do not send any child to work, i.e. $e^s = 1$, and the equilibrium value of e^u is strictly in the interior of the set [0,1] so that (7) is satis¯ed with equality. Moreover, since the interest factor r is exogenously given in this case, the equilibria for the two types of households do not interact. We can therefore concentrate solely on the unskilled family and omit the superscript u from the variables. Throughout the paper we shall also make the assumption of non-increasing marginal utility of income ($E_{55} \leq 0$) and normality of all goods ($E_{5i} > 0;\ i = 1;\cdots;4$).

Totally di®erentiating (6) and (7), we obtain

$$E_5 dv = [f1 + N(1 - e)g - E_2]dP_2; \tag{15}$$

$$\left[E_5 g'' - N(g')^2 E_{55}\right] de = (1 - g' E_{52})dP_2 - g' E_{55} dv: \tag{16}$$

Since, with $e^s = 1$, the skilled families do not produce any of the unskilled good, $1 + N(1 - e)$ is the output of the unskilled good in period 1 per unskilled family, and E_2 is its consumption of that good. The economy is also a net exporter of good 2. All these imply that the coefficient of dP_2 in (15) is positive. That is, a reduction in P_2 reduces the welfare of the unskilled family. This effect is akin to the standard terms-of-trade effect in international trade.

Turning to the effect on e, note that the coefficient of de in (16) is negative.[16] The first and second terms on the right hand side of (16) give, respectively, the price and price-induced income effects. A decrease in the price of the exportable, for a given level of real income, reduces the opportunity cost of education and therefore increases e. An increase in real income has the same effect. That is, the coefficient of dP_2 is positive and that of dv negative.[17] Since from (15) we know that $dv/dP_2 > 0$, the price and income effects work in opposite directions. Clearly, if the marginal utility of income is constant $E_{55} = 0$, and a decrease in P_2 unambiguously increases e and reduces the incidence of child labour. However, if E_{55} is very large, a trade sanction will increase the incidence of child labour.

The above discussion implies that whether or not trade sanctions reduce child labour depends crucially on the nature of preferences. If the preferences are quasi-linear as given by equation (14) in section 3, marginal utility of income is constant and therefore trade sanctions will decrease child labour. Let us now consider another form of preferences where the outcome of trade sanctions is likely to be the opposite. If the preferences are given by the following constant relative risk aversion utility function[18]

$$v = \frac{(c_1^{\mu} c_2^{1-\mu})^{1-R}}{1-R} + \frac{(c_3^{\mu} c_4^{1-\mu})^{1-R}}{1-R} + Ng(e); \quad R \geq 0; \tag{17}$$

[16] The negativity of this term also implies that the second order condition for the optimality of e is satisfied.

[17] Using (7), we can write

$$1 - g'E_{52} = (1 - P_2E_{52}/E_5) + E_{52}(P_3 - P_4)/(E_5 r).$$

Noting that P_2E_{52}/E_5 is the marginal propensity to consume good 2 and is less than unity, it is easy to see from the above equation that $1 - g'E_{52} > 0$.

[18] Without loss of generality, we assume the rate of time preference to be zero.

it can be shown that E_{55} is given by (Detailed derivation is given in appendix B)

$$E_{55} = \frac{E_5}{(1 - R)(v - Ng(e))} - \frac{E}{(1 - R)(v - Ng(e))^2}: \tag{18}$$

We now consider the special case where $R > 1$.[19] Noting that $(1 - R)(v - Ng(e))$ always takes positive values, it is evident from (18) that E_{55} is a very large positive number when $v - Ng(e) \simeq 0$. In other words, if the preferences of the unskilled families are represented by (17) with $R > 1$ and if the unskilled family is extremely poor, trade sanctions will increase the incidence of child labour. In appendix C we present a numerical simulation and show that this result is indeed possible. These results are stated formally as Proposition 3.

Proposition 3: Suppose all the families have unrestricted access to international credit markets. If the preferences of unskilled families are quasi-linear ((14)), trade sanctions will reduce the incidence of child labour. However, if the preferences are of the constant relative risk aversion type ((17)) with $R > 1$ and the unskilled families are very poor, trade sanctions will increase the incidence of child labour.

We conclude this subsection by writing explicitly, for future reference, the expression for de/dP_2. Substituting (15) into (16) we get

$$-\alpha_1 de = \alpha_2 dP_2; \tag{19}$$

where

$$\alpha_1 = -E_5 g'' + N(g')^2 E_{55} > 0;$$

$$\alpha_2 = (1 - g' E_{52}) - \frac{g' E_{55}[1 + N(1 - e)g - E_2]}{E_5}:$$

4.2 Financial autarky

In this section we shall assume that neither of the two groups can borrow or lend so that the interest factor r is endogenous and equals each group's autarky interest factor

[19] As reported in Djajić (1987), in this case the two goods are Edgeworth complements in the sense that an increase in consumption of one good increases the marginal utility of the other.

r_a^h, $(h = s; u)$. However, we shall continue to assume that the initial endowments are such that the skilled families send all their children to school and focus our attention on the unskilled families.

Totally differentiating (6), (7) and (10) we obtain

$$E_5 dv = [f1 + N(1 - e)g - E_2]dP_2; \tag{20}$$

$$-\Phi_1 de = \Phi_2 dP_2 + \Phi_3 dr; \tag{21}$$

$$-\bar{}_1 dr = -\bar{}_2 de + \bar{}_3 dP_2; \tag{22}$$

where Φ_1 and Φ_2 are defined in (19) and

$$\begin{aligned}
r^2\Phi_3 &= g'P_3E_{53} + g'P_4E_{54} + P_3 - P_4 > 0;\\
r^2\bar{}_1 &= -(P_3)^2E_{33} - 2P_3P_4E_{34} - (P_4)^2E_{44} > 0;\\
\bar{}_2 &= N(P_3 - P_4 + P_3g'E_{35} + P_4g'E_{45}) > 0;\\
\bar{}_3 &= P_3E_{32} + P_4E_{42} + \left(\frac{P_3E_{35}}{E_5} + \frac{P_4E_{45}}{E_5}\right)[f1 + N(1 - e)g - E_2] > 0:
\end{aligned}$$

Comparing (20) with (15), we note that the welfare effects are exactly the same as in the case of perfect international borrowing and lending. This is because the intertemporal terms of trade effect | i.e., the effect via a change in r | is zero as the level of intertemporal trade (borrowing/lending) is absent. Compared to (19), there is an extra term in (21) which captures changes via those in r. As derived in Section 3, an increase in r reduces e. A decrease in P_2 increases demand for consumption in period 1 relative to period 2 (assuming goods to be intertemporal substitutes) and also reduces the income of unskilled families at t = 1. This shifts outwards the demand for loan schedule and raises the autarky interest rate. Similarly an increase in the level of schooling increases future income and therefore the demand for loans, raising the autarky interest rate.

Substituting (22) into (21) we get

$$-\left(\Phi_1 + \frac{\Phi_3\bar{}_2}{\bar{}_1}\right)de = \left(\Phi_2 - \frac{\Phi_3\bar{}_3}{\bar{}_1}\right)dP_2: \tag{23}$$

Comparing (23) with (19) it is evident that trade sanctions are more likely to raise the incidence of child labour when there are no credit opportunities than when the international credit market is perfect. In other words, if $de=dP_2$ is positive in the presence of perfect international credit markets, it will also be positive in the absence any credit markets.[20] Formally,

Proposition 4: If trade sanctions increase the incidence of child labour in the presence of perfect international credit markets, such sanctions will also increase the incidence of child labour when there are no credit markets.

It follows from the above proposition and our analysis in subsection 4.1 that trade sanctions will increase child labour if the preferences are given by equation (17) (with $R > 1$) and the unskilled families have very low level of utilities. In appendix D we show with the help of a numerical simulation that this can in fact occur.

In the case of quasi-linear preferences ((14)), using the fact that $b = 0$ equation (23) reduces to[21]

$$\left(\alpha_1 + \frac{\alpha_3 - 2}{-1}\right)\frac{de}{dP_2} = \frac{P_3P_1E_{31} + P_4P_1E_{41} - rP_1E_1 + rA^u}{r - 1}: \qquad (24)$$

and it can be shown that $de=dP_2 > 0$, i.e., trade sanctions reduce child labour.[22] The above results are summarised in the following proposition.

Proposition 5: Suppose there are no credit markets. If the preferences of the unskilled families are quasi-linear ((14)), trade sanctions will reduce the incidence of child labour. However, if the preferences are of the constant relative risk aversion type ((17)) with $R > 1$ and the unskilled families are very poor, trade sanctions will increase the incidence of child labour.

[20] Strictly speaking, our argument requires that the values for the interest rate are the same in the two initial equilibria.

[21] Note that in this case $E_{5i} = 0$; $(i = 1; 2; 4;$ and $5)$ and $E_{53}P_3=(rE_5) = 1$.

[22] With quasi-linear preferences, for trade sanctions to increase child labour it is necessary that education and skilled intensive goods are complements. In appendix E, we show, with a numerical simulation, that under such preferences trade sanctions can indeed increase child labour.

Finally we turn to the case where unskilled families can freely borrow from the skilled ones.

4.3 Perfect domestic credit markets

In this subsection we shall examine the effect of trade sanctions on the incidence of child labour when the international credit market in inaccessible, but the domestic credit market operates perfectly. That is, in equilibrium, borrowing by the unskilled families is equal to lending by the skilled ones. As before, we shall assume that the skilled families send all their children to school, i.e, $e^s = 1$. Moreover, in order to compare the comparative static results with the case of autarky, we shall assume that there is no actual borrowing at the initial equilibrium.[23] By setting the initial conditions to be the same, we are able to focus on the comparative static effects of a reduction of P_2 under different scenarios relating to credit markets.

From equation (9) and using we obtain

$$rdb^u = -\bar{\lambda}_1 dr + \bar{\lambda}_2 de^u - \bar{\lambda}_3 dP_2; \tag{25}$$

$$rd(-b^s) = \phi_1 dr + \phi_2 dP_2; \tag{26}$$

where the $\bar{\lambda}_i$'s are defined after equation (22) and

$$r^2\phi_1 = -(P_3)^2 E^s_{33} - 2E^s_{34}P_3P_4 - (P_4)^2 E^s_{44} > 0;$$
$$\phi_2 = rE^s_2\left(\frac{P_3E^s_{32}}{rE^s_2} - \frac{P_3E^s_{35}}{rE^s_5}\right) + rE^s_2\left(\frac{P_4E^s_{42}}{rE^s_2} - \frac{P_4E^s_{45}}{rE^s_5}\right):$$

Equation (25) has been explained before. The properties of the supply function of loans are given in (26). The positivity of ϕ_1 signifies the fact the supply function is upward sloping. The sign of ϕ_2 can be either positive or negative. A decrease in P_2 increases the real income of the skilled families as they do not take part in the production of good 2. This income effect would increase the demand for goods 3 and 4. But a reduction in P_2 also has substitution effects which reduce the demand for

[23] In this case, different values of e^h, $h = (s; u)$, may be reconciled with identical values, $b^u = b^s = 0$, by assuming that the two types of households have different intertemporal preferences. This is the only case in which such differences in preference are invoked in this paper.

goods 3 and 4. A decrease in P_2 will, therefore, increase the supply of loan if the income effect is bigger than the substitution effects. It can be worked out that

$$\phi_2 \gtrless 0 \quad \text{according as} \quad \varepsilon_3^2 + \varepsilon_4^2 \gtrless c_y^3 + c_y^4;$$

where ε_i^2 is the cross price elasticity of demand of good 2 with respect to the price of good i and c_y^i is the value of the marginal propensity to consume good i $(i = 3; 4)$. This ambiguity in the effect of a change in P_2 on the supply function of credit will be the source of ambiguity in the comparative effects on the incidence of child labour.[24]

Differentiating the market clearing condition $M^s b^s + M^u b^u = 0$ and substituting equations (25) and (26) into that equation we get

$$\frac{dr}{dP_2} = -\frac{M^s \phi_2 \theta_1 + M^u(\theta_1 \bar{\varepsilon}_3 + \bar{\varepsilon}_2 \theta_2)}{M^s \theta_1 \phi_1 + M^u(\theta_1 \bar{\varepsilon}_1 + \bar{\varepsilon}_2 \theta_3)}. \tag{27}$$

Finally, substituting (27) into (21) we obtain

$$\left.\frac{de^u}{dP_2}\right|_d = -\frac{M^s(\theta_2 \phi_1 - \theta_2 \phi_2) + M^u(\theta_2 \bar{\varepsilon}_1 - \theta_3 \bar{\varepsilon}_3)}{M^s \theta_1 \phi_1 + M^u(\theta_1 \bar{\varepsilon}_1 + \bar{\varepsilon}_2 \theta_3)}. \tag{28}$$

Rewriting the analogous expression in the case of financial autarky, equation (23), as

$$\left.\frac{de^u}{dP_2}\right|_a = -\frac{\theta_2 \bar{\varepsilon}_1 - \theta_3 \bar{\varepsilon}_3}{\theta_1 \bar{\varepsilon}_1 + \bar{\varepsilon}_2 \theta_3}; \tag{29}$$

we are able to compare the comparative statics under the two scenarios. Suppose that under autarky a trade sanction reduces child labour, i.e., the right hand side of (29) is negative. In this case it is necessary that $\theta_2 > 0$, i.e., the trade sanction also reduces child labour under perfect international credit markets. It then follows from (28) that a trade sanction will reduce child labour under perfect domestic credit markets if $\phi_2 < 0$. Formally,

Proposition 6: If a trade sanction decreases the incidence of child labour in the absence of any credit markets, it will also decrease the incidence of child labour when there is a domestic credit market if $\varepsilon_3^2 + \varepsilon_4^2 < c_y^3 + c_y^4$.

[24] As has been shown at the end of appendix B, for preferences given by (17), $\phi_2 > 0$ if and only if $R < 1$.

An equivalent statement to Proposition 6 would be: under the sufficient condition, if a perverse effect were to take place under both a domestic credit market and autarky, it would have a bigger magnitude in the latter case than in the former.

Propositions 4 and 6 can be interpreted as follows. The overall effect of a change in P_2 upon e can be decomposed into two effects:

$$\frac{de}{dP_2} = \frac{\partial e}{\partial P_2} + \frac{\partial e}{\partial r} \cdot \frac{dr}{dP_2}$$

The first term is the effect of P_2 on e at given interest rates. In the case of perfect international credit markets, this constitutes the overall effect. As stated in Proposition 3, this can be negative (the normal case) or positive (the perverse case), depending on household preferences and income.

The second effect comes through changes in the interest rate, which take place in the cases of financial autarky and domestic credit. At an initial equilibrium with no borrowing or lending, $\partial e/\partial r$ is negative. The second effect then depends on the sign of dr/dP_2. Under financial autarky, a decrease in P_2 unambiguously raises the household's autarky discount factor, essentially by increasing consumption demand but reducing income at t = 1. Hence, $dr/dP_2 < 0$ under autarky and the second term contributes a perverse effect, even when the first term contributes a normal one. This is the logic underlying Proposition 4.

When the interest rate is determined by borrowing and lending between the two classes, a decrease in P_2 could (i) lower r, (ii) raise it but less than by the increase in the unskilled household's autarky discount factor or (iii) raise it by more than the increase in the unskilled household's autarky discount factor.

In the first two cases, dr_d/dP_2 is either negative or less positive than dr_a^u/dP_2. In either case, it contributes a smaller tendency towards a perverse effect from trade sanctions to education. The condition $\Delta < 0$ ensures that the supply of savings from rich families increases as P_2 falls.[25] This restricts outcomes to the first two cases.

[25] This means that the positive income effect at t = 1 outweighs the substitution effect (if any) of reduced demand for goods 3 and 4 as P_2 falls.

In the third case, the chances of a perverse effect are greater under domestic borrowing and lending than under financial autarky. This happens if the supply of savings by rich families decreases by more than the demand curve curve for borrowing by poor families. This appears implausible, as it implies that in the new equilibrium rich families will be borrowers and poor families lenders. Note that $\phi_2 < 0$ is sufficient, but not necessary, to rule out case (iii). If it fails, case (iii) still need not hold. Indeed, consider a benchmark case where, in the original equilibrium, $P_1 = P_2$, $P_3 = P_4$ and the non-human assets of both skilled and unskilled parents are the same. In this case, skilled and unskilled households are economically equal and given identical preferences will make identical consumption and educational choices. Now, if a tariff on good 2 drives down P_2, unskilled households will become poorer at $t = 1$ and under the income effect alone will increase their demand for borrowing, while skilled households will be richer and under the income effect alone will increase the supply of their savings. The substitution effect between future consumption and good 2 will increase both type of household's demand for borrowing, but this will have the same magnitude for both households. In this case, the new equilibrium must involve borrowing by unskilled households and lending by rich ones, so case (iii) is definitely ruled out.

Note that, with preferences as specified in (17), with $R > 1$, $z_3^2 + z_4^2 < c_y^3 + c_y^4$. In this case, while there can be a perverse effect from sanctions if international credit markets are available, such an effect is more likely to happen in the absence of any credit market. What Proposition 6 says is that, compared to financial autarky, a perverse effect is less likely to happen with any credit market, even one with only domestic borrowing and lending.

Finally, what happens if $\phi_2 > 0$? In this case, the supply of savings by rich families falls as P_2 falls. As a result, the interest factor will unambiguously increase in a domestic credit market. Even if θ_2 is positive, i.e. there is no perverse effect under a perfect international credit market, a perverse effect can arise under a domestic credit market. But if θ_2 is negative, i.e. there is already a perverse effect under a perfect international credit market, a perverse effect must also arise (and have a

greater magnitude) under a domestic credit market. This outcome is captured in the following proposition.

Proposition 7: If trade sanctions increase the incidence of child labour in the presence of perfect international credit markets, such sanctions will also increase the incidence of child labour when there is a domestic credit market if $z_3^2 + z_3^2 > c_y^3 + c_y^4$.

Note that if $°_2 < 0$, this does not necessarily invalidate Proposition 7. That would require that the interest factor in a domestic credit market falls as P_2 goes down. This in turn requires that as P_2 falls, the supply of savings by rich families increases by more than the demand for borrowing by poor ones does. This appears to be not very likely, given that a decrease in P_2 increases the demand for consumption of good 2 for both types of families. This con°icts with the income e®ect on rich families' savings but reinforces the income e®ect on poor families' borrowings. To conclude this section, what appears most likely is that the interest factor rises more strongly under ¯nancial autarky for poor families, and also rises, but less strongly, under a domestic credit market. This suggests that a perverse e®ect from trade sanctions to child labour in poor households becomes progressively less likely as the availability of credit increases.

5 Conclusion

In this paper, we have studied child labour in the context of intertemporal decision making by families which are subject to various scenarios concerning the credit market. We have shown that under fairly general and plausible circumstances, more developed credit markets are likely to induce poor households to reduce child labour and allocate more of their children's time to education. However, fully functional credits markets, on their own, may not eliminate child labour altogether.

We have also shown that trade sanctions that reduce the wage of working children may, given the pressure they place on already low parental incomes, induce

very poor families to increase the amount of children's time spent in labour and reduce that spent in education. While this e®ect is always possible, we have shown that it is less likely to occur when households can borrow or lend freely on an international credit market than when they have no access to credit. Even when international credit is not available, we have shown that the presence of a richer class of households who can lend to the poor ones might be enough to reduce the possibility that trade sanctions have unintended e®ects.

We would like to emphasise that it has not been an intention of the paper to make a case for or against trade instruments for solving the problem of child labour. We assume that the presence of child labour has, rightly or wrongly, led to the use of trade sanctions against many of the countries where children work in large numbers. One of the purposes of this paper has been to examine how this policy interacts with the functioning of the credit markets.

To summarise, it is very important that the poor households have access to credit markets at reasonable rates of interest if we want a serious reduction in the incidence of child labour. However, credit on its own is unlikely to eliminate child labour. One also needs to improve the economic conditions of the poor households and to provide their children with better quality primary education. Moreover, properly functional credits markets are also importaat for the e®ectiveness of other policies to reduce child labour. For example, the impact of trade sanctions on child labour is likely to be more favourable when the poor families have better access to credit. Trade sanctions can in fact be counter-productive if credit markets are completely absent.

APPENDICES[26]

Appendix A: Equalisation of child participation rate:

Suppose both families have quasi-linear preferences:

$$v^h = (c_1^h)^{\alpha} + (c_2^h)^{\beta} + \gamma c_3^h + (c_4^h)^{\delta} + N \pm g(e^h)$$

where α, β, δ, g are all parameters between zero and one, and $\gamma > 0$.

Under financial autarky, it maximises the above function subject to a budget constraint with respect to each period's income. The first-order condition with respect to e^h, assuming a positive choice, is:

$$\pm g(e^h)^{(g-1)} - \lambda_1^h P_2 + \lambda_2^h (P_3 - P_4) \geq 0$$

where λ_t denotes the marginal utility of income at time t, t = 1; 2. It is easy to show that $\lambda_2^h = \gamma / P_3$ and therefore is equal for both types of households. λ_1^h, however, can differ across the two types. Hence, in this case, households with lower λ_1 will choose higher e.

With a domestic credit market, however, each household faces a single intertemporal budget constraint. The shadow price of income for each household, λ^h, does not depend on the time-pattern of income. The analogous first-order condition for e^h is:

$$\pm g(e^h)^{(g-1)} - \lambda^h \dot{P}_2 - \frac{(P_3 - P_4)\dot{}}{r} \geq 0$$

In this case, it is easy to show that $\lambda^h = r\gamma / P_3$, which does not depend on household characteristics such as parental income or wealth. Hence, each household will choose the same value of e.

Appendix B: Derivation of equation (18) and cross price elasticities:

[26] The numerical simulations presented in the various appendices have been carried out using the fsolve2 subroutine of the software MATLAB.

Consider the following optimisation problem.

Minimise $P_1c_1 + P_2c_2 + P_3c_3=r + P\ ¡\ 4c_4=r$

subject to

$$v = \frac{(c_1^{\mu}c_2^{1¡\mu})^{1¡R}}{1\ ¡\ R} + \frac{(c_3^{\mu}c_4^{1¡\mu})^{1¡R}}{1\ ¡\ R} + Ng(e): \tag{B.1}$$

It is known that the value of this optimisation problem gives us the expenditure function $E(P_1; P_2; P_3=r; P_4=r; v\ ¡\ Ng(e))$.

Writing the lagrangean function,

$$L = P_1c_1 + P_2c_2 + \frac{P_3}{r}c_3 + \frac{P_4}{r}c_4 + ¸\ \Big[v\ ¡\ Ng(e)\ ¡\ \Big\{\frac{(c_1^{\mu}c_2^{1¡\mu})^{1¡R}}{1\ ¡\ R} + \frac{(c_3^{\mu}c_4^{1¡\mu})^{1¡R}}{1\ ¡\ R}\Big\}^{1}{}_{¡R}\Big];$$

where $¸$ is the lagrangean multiplier, we get the ¯rst order conditions as

$$P_1 = ¸\mu c_1^{(\mu¡1)}c_2^{(1¡\mu)}\ \big[c_1^{\mu}c_2^{1¡\mu}\big]^{¡R} \tag{B.2}$$

$$P_2 = ¸(1\ ¡\ \mu)c_1^{\mu}c_2^{¡\mu}\ \big[c_1^{\mu}c_2^{1¡\mu}\big]^{¡R} \tag{B.3}$$

$$\frac{P_3}{r} = ¸\mu c_3^{(\mu¡1)}c_4^{(1¡\mu)}\ \big[c_3^{\mu}c_4^{1¡\mu}\big]^{¡R} \tag{B.4}$$

$$\frac{P_4}{r} = ¸(1\ ¡\ \mu)c_3^{\mu}c_4^{¡\mu}\ \big[c_3^{\mu}c_4^{1¡\mu}\big]^{¡R}: \tag{B.5}$$

$$\tag{B.6}$$

From (B.2)-(B.5) and (B.1), we get

$$\begin{aligned} P_1c_1 + P_2c_2 + \frac{P_3}{r}c_3 + \frac{P_4}{r}c_4 &= ¸\ \big[(c_1^{\mu}c_2^{1¡\mu})^{1¡R} + (c_3^{\mu}c_4^{1¡\mu})^{1¡R}\big] \\ &= ¸(1\ ¡\ R)(v\ ¡\ Ng(e)): \end{aligned} \tag{B.7}$$

Since the Lagrangean multiplier is the shadow price of utility, we have

$$¸ = E_5; \tag{B.8}$$

and therefore from (B.7) and the de¯nition of the expenditure function E that

$$E_5 = \frac{E}{(1\ ¡\ R)(v\ ¡\ Ng(e))}: \tag{B.9}$$

Di®erentiating (B.9) with respect to the ¯fth argument $(v - Ng(e))$, we obtain

$$E_{55} = \frac{E_5}{(1 - R)(v - Ng(e))} - \frac{E}{(1 - R)(v - Ng(e))^2};$$

which is equation (18).

From (B.2) and (B.3) we get

$$P_1 c_1 = P_2 c_2 \frac{\mu}{1 - \mu}: \tag{B.10}$$

Substituting (B.10) and (B.8) into (B.3) and then di®erentiating with respect to $P_3=r$ we get

$$\varepsilon_3^2 = \frac{dc_2}{d(P_3=r)} \frac{P_3=r}{c_2} = \frac{c_y^3}{R} = \frac{1}{R} \frac{E_{53}(P_3=r)}{E_5}; \tag{B.11}$$

and similarly

$$\varepsilon_4^2 = \frac{dc_2}{d(P_4=r)} \frac{P_4=r}{c_2} = \frac{c_y^4}{R} = \frac{1}{R} \frac{E_{54}(P_4=r)}{E_5}: \tag{B.12}$$

From (B.11) and (B.12) it follows that

$$\varepsilon_3^2 + \varepsilon_4^2 > c_y^3 + c_y^4 \qquad ( ) \qquad R < 1:$$

Appendix C: Perverse outcome under perfect international credit markets

Suppose the preferences of the unskilled families are given by

$$v = \frac{(c_1^{0:7} c_2^{0:3})^{-10}}{-10} + \frac{(c_3^{0:7} c_4^{0:3})^{-10}}{-10} + 0:01N e^{0:01}; \tag{C.1}$$

and that $N = 5$, $A^u = B^u = 0$, $P_1 = P_3 = 1:5$, $r_w = 1:2$, and $P_2 = P_4 = 1:01$.

For the above situation, the equilibrium values of our model are:

$c_1^u = 2:2621$, $c_2^u = 1:4399$, $c_3^u = 2:2981$, $c_4^u = 1:4621$, $v^u = 0:0496$, and $e^u = 0:7176$.

From the above equilibrium, a 1% decrease in P_2 leads to the following percentage changes:

$c_1^u : -0:1153$, $c_2^u : -0:0716$, $c_3^u : -0:0542$, $c_4^u : -0:0574$, $v^u : -0:0055$, and $e^u : -0:1186$.

Appendix D: Financial autarky

Suppose the preferences of the unskilled families are given by

$$v = \frac{(c_1^{0:5}c_2^{0:5})^{\,i\,0:5}}{¡\,0:5} + \frac{(c_3^{0:5}c_4^{0:5})^{\,i\,0:5}}{¡\,0:5} + 0{:}1Ne^{0:5}; \qquad (D.1)$$

and that $N = 5$, $A^u = B^u = 0$, $P_1 = P_3 = 2{:}0$, and $P_2 = P_4 = 1{:}01$.

For the above situation, the equilibrium values of our model are:

$c_1^u = 1{:}1457$, $c_2^u = 2{:}2687$, $c_3^u = 1{:}8770$, $c_4^u = 3{:}7169$, $v^u = ¡\,2{:}5353$, and $e^u = 0{:}2925$.

From the above equilibrium, a 1% decrease in P_2 leads to the following percentage changes:

$c_1^u : ¡\,0{:}9003$, $c_2^u : 0{:}0906$, $c_3^u : ¡\,0{:}0542$, $c_4^u : ¡\,0{:}0542$, $v^u : ¡\,0{:}1547$, and $e^u : ¡\,0{:}2811$.

Appendix E: Complementarity between education and consumption:

Suppose the preferences of the unskilled families are given by:

$$v^u = 1{:}5\, c_1^{0:9}(Ne)^{0:1} + c_2^{0:8} + c_3 + c_4^{0:7}; \qquad (E.1)$$

and assume that $A^u = B^u = 0$, $N = 5$, $P_1 = P_3 = 2{:}0$ and $P_2 = P_4 = 1{:}01$.

For the above situation, the equilibrium values of our model are:

$c_1^u = 1{:}2668$, $c_2^u = 2{:}4249$, $c_3^u = 2{:}0583$, $c_4^u = 2{:}9696$, $v^u = 8{:}0997$, and $e^u = 0{:}2133$.

From the above equilibrium, a 1% decrease in P_2 leads to the following percentage changes:

$c_1^u : ¡\,3{:}9444$, $c_2^u : 3{:}5391$, $c_3^u : ¡\,0{:}2619$, $c_4^u : ¡\,0{:}0024$, $v^u : ¡\,0{:}2027$, and $e^u : ¡\,1{:}0280$.

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