The Determinants of Child Labour: The Role of Primary Product Specialization

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Abstract. The paper tests predictions of a traditional intra-household bargaining model which, under reasonable assumptions, shows that lack of bargaining power in the value chain significantly reduces the capacity for obtaining benefits from increased product demand arising from trade liberalization and therefore is positively associated with child labour. Cross-sectional and panel negative binomial estimates in a sample of emerging countries support this hypothesis. They show that proxies of domestic workers' bargaining power in the international division of labour (such as the share of primary product exports) are significantly related to child labour, net of the effect of traditional controls such as parental income, quality of education, international aid, and trade liberalization. The positive impact of the share of primary product exports on child labour outlines a potential paradox. The paradox suggests that trade liberalization does not always have straightforward positive effects on social indicators and that its short-run effects on income distribution and distribution of skills and market power across countries need to be carefully evaluated.

1. Introduction

The recent literature on global integration, trade openness, poverty, and growth generally focuses on two crucial issues: the verification of the presumed significant and positive effects of trade openness on growth and, in the eventuality of a positive response to the first issue, an analysis of whether and how these effects trickle down to the lowest income classes, thereby reducing poverty and improving social indicators. The majority of authors (with some qualified exceptions) generally responded affirmatively to the first issue.[1] The crucial issue therefore seems to involve the analysis of

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barriers which keep benefits from trade openness from accruing to the lowest income classes and being translated into improvements in social and poverty indicators.

From a methodological point of view, the literature on trade, social indicators, and growth usually polarize around two extremes. The first consists of aggregate growth estimates which test the positive impact of trade openness on growth (Dollar, 1992; Edwards, 1998; Frankel and Romer, 1999; Sachs and Warner, 1995). These estimates have the advantage of drawing quite general results against the disadvantage of poor or non-existent inspection of the distributional consequences of trade openness and of the heterogeneous impact of it on different income classes.

The second extreme is represented by empirical papers using microdata or by case studies which have the benefit of inspecting in-depth short- and medium-term consequences of trade liberalization on individuals and different income or skill classes, but the disadvantage of a lack of generality in their conclusions (Feliciano, 2001; Revenga, 1997; Seddon and Wacziarg, 2001). By illustrating that the position in the value chain is a fundamental requirement if one is to reap benefits from trade openness, this paper intends to show that, even using aggregate data, it is possible to find quite general results on the presence of a trade-off relative to the impact of trade liberalization on social indicators.

We pursue this goal by testing predictions from a modified intra-household bargaining model of child labour on a panel of emerging countries.[2] Beyond the classical investigation on the relationship between child labour, parental income and quality of education, our contribution to the literature is an explicit focus on the effects of relative export specialization in primary products on child labour. This paper documents, theoretically and empirically, that low-skill workers may benefit from the increased labour demand generated by trade liberalization only if the labour market is competitive and if they have sufficient bargaining power to climb up the value chain. For this reason, permanence in the low added value part of the export market is very likely to have negative effects on their income and on child labour, thereby offsetting the benefits of liberalization.

The paper is divided into four sections, including the introduction and conclusions. In the second section we summarize the main testable hypotheses in the child labour literature by focusing, in particular, on the relationship of the dependent variable with the share of exports in primary goods, parental income and education, and the quality of child education. In the third section we describe our

methodological approach, with a discussion of the choice of dependent variable and the decision to limit the sample to less-developed countries (LDCs). Lastly, in the fourth section, we present our empirical findings.

2. Testable hypotheses from the child labour literature

According to ILO data, in 1995 120 million children under the age of 14 worked in paid jobs. Child labour has been a characteristic of almost all economic systems at some stage of their existence. In this perspective, what occurred in Europe during the industrial revolution is roughly similar to what is currently happening in LDCs.

Despite these historical considerations, the dynamics of child labour is far from being deterministic, and is thought to be significantly related to several factors, clearly identified by the economic literature. Some of them (GDP, parental education) are standard, and their effects on child labour have been thoroughly explored. Others (trade liberalization and share of export in primary products) have been considered only in part and need further attention. In our empirical estimates, we will use the first group of variables as control regressors to verify the effect of the second group and, following that, we will present succinct theoretical rationales for why they are expected to affect child labour.

2.1 Trade openness, trade specialization, and child labour

The Stolper–Samuelson (SS) theorem in the framework of standard neoclassical trade models establishes that trade openness raises wages of low-skill workers in countries where this factor is abundant. An easy prediction is therefore that trade liberalization should increase household income in poor families, thereby reducing child labour if the latter is related to household income.

Indeed, the SS theorem holds only in the case of perfect competition and does not apply if purchasers of intermediate products from the North have excess market power. In imperfect labour markets such as those of the primary product industry (above all agricultural commodities and textiles) unskilled workers find it difficult to step up the 'skill ladder' because low bargaining power, subsistence wage levels, and tariff and non-tariff barriers[3] imposed by developed countries prevent them from accumulating resources that could be invested in human capital to increase their productivity.[4]

The recent process of delocalization and global integration of labour and product markets,[5] in which a combination of trade and technological progress effects is increasing wage–skill differentials (Deardorff, 2000; Feenstra and Hanson, 2001), does not necessarily create the framework for improving the conditions of unskilled workers.[6] This is because 'superstars' (and high-skill workers) take advantage of the extension of demand and are not harmed by the increased competition, while untalented workers (or raw material producers) pay the cost of the increased competition with unskilled workers (producers) from different countries and may gain no benefit from the enlargement of product markets if their bargaining power with employers (subcontractors) is too low.

It is then clear that the effect of international trade on child labour operates not only through economic growth but also through changes in the skill premium.

If the luxury axiom holds and parents cannot send children to school because they are below a given income threshold, a reduction in the skill premium obtained through an increase of unskilled wages, typical of the SS effect of trade openness, may reduce child labour when, as is highly likely, parents are unskilled workers. On the other side, for a given level of unskilled wages, the effect of an increase in the skill premia is likely to be positive in models in which parents maximize welfare of children, since it increases the expected value of human capital investment. Unfortunately, it is impossible to acquire data on skill premia for all countries and years considered in our estimate and we therefore cannot distinguish between these two channels (economic growth and changes in the skill premium) through which trade openness is likely to affect child labour.

Some examples of how these perverse effects may occur are provided by Bardhan (2003) and Scheve and Slaughter (2001) showing that in more open economies increased competition may lead to an increased elasticity in the demand for labour, thereby reducing workers' bargaining power and weakening unions.

Recent empirical evidence documents the existence of this non-virtuous relationship. Attanasio *et al*. (2002) have found that an increase in the size of the informal sector related to increased foreign competition, while Deaton (1999) shows that terms of trade have been persistently flat, despite repeated forecasts on their future improvement by development institutions. His interpretation is that they depend not only on the combined effect of low-demand elasticities and technological progress[7] but also on the presence of an unlimited supply of unskilled labour.

Our hypothesis is that unskilled workers or raw material producers (particularly in the agricultural sector) have, by definition, low bargaining power and therefore do not benefit from the increased demand, unless they exit the 'low skill trap'. This hypothesis will be tested in the empirical section after controlling for traditional factors affecting child labour for the reasons briefly described in the next section.

2.2 Other traditional determinants of child labour (GDP, parental education, rural life, and quality of education)

The first control in an estimate of the determinants of child labour obviously has to be a proxy of parental income. In this respect, a well-defined negative relationship between per capita GDP and participation rates of children aged 10–14 seems to emerge when we inspect cross-sectional country evidence. To quote an example of two non-OECD countries, China passed from around 40 per cent in 1970 to 15 per cent in 1990 and 7 per cent in 2000, while the same participation rate in Ethiopia declined from 43 per cent in 1990 to only 38 per cent in 2000. A cursory look at these data seems to suggest that a rise in per capita income is, by far, the strongest antidote against child labour.

Several theoretical explanations support and illustrate this intuition. A well-known principle in the literature, the *luxury axiom*, postulates that children enter the job market if household income fails to rise above a given subsistence threshold (Basu, 1999; Basu and Van, 1998). Baland and Robinson (2000) explain the child labour–GDP per capita relationship by combining incomplete markets, parental altruism, and chronic poverty. Ranjan (1999) and Grote *et al*. (1998) present models in which child labour arises as the result of imperfect credit markets.

While definitely beneficial in the medium run, GDP growth may have negative effects on the reduction of child labour in the short run. Cigno and Rosati (2002) have found a highly non-linear relationship between child labour and per capita income in household surveys in Vietnam and Morocco. Swinnerton and Rogers (1999) explain these findings by showing that economic growth with distributional costs may generate a temporary slowdown in the reduction of child labour, or even an increase to the extent that GDP rises.[8]

A second variable which crucially affects child labour is parental education. The relationship between the two variables has been shown by Marshall (1920).[9] More recent theoretical and empirical literature

(Haddad and Hoddinott, 1994; Hoddinott and Haddad, 1995; Manser and Brown, 1980) stresses the role of mothers' educational and working status, emphasizing that female empowerment may benefit children (*the women's agency hypothesis*). The poor educational status of women may generate self-reinforcing mechanisms as well. Mothers with poor human capital and low wages may confirm the expectation that women's human capital has low returns (Cigno, 1991).

Other authors suggest that mothers' education has a strong positive effect because mothers spend more time than fathers caring for children (Eswaran, 2002; Folbre, 1986). Alternative points of view cannot be excluded in principle (see note 9).

Among other indicators, the share of the population working in the agricultural sector may be positively associated with child labour not only because the variable is generally considered as an indicator of poor human capital but also because of certain characteristics of rural life.

Children belonging to farm households with more land are more likely to work, because their services are more valuable. Cigno *et al.* (2000) and Rosenzweig and Everson (1977) have found a positive relationship between farm size and child work. The higher the probability that a child will work, the higher the probability of an additional birth (Cigno *et al.*, 2000).

Finally, several authors have also shown that the decision to send children to primary school is positively affected by the quality of education and, specifically, by the presence of secondary schools (Cigno *et al.*, 2000; Lavy, 1996). Evidence on the links between school quality and child labour is provided by Schultz (1997) and by Dreze and Kingdom (2000).

3. The empirical analysis on the determinants of child labour

3.1 The methodological approach: the dependent variable

The empirical section tests predictions stemming from traditional simple intra-household bargaining models in which low market power in the value chain prevents workers from reaping the benefits of trade liberalization.[10] The test is performed on a panel of emerging countries using World Bank data combined with data on political and institutional development taken from various sources (i.e. *Economic Freedom of the World: 2000 Annual Report* — Fraser Institute, 2000).

Examples of empirical papers based on the World Bank database are Shelburne (2001) and Cigno *et al*. (2002). Shelburne (2001), with cross-sectional estimates, identifies a negative relationship of child labour with country size, per capita GDP, and a country's openness. Cigno *et al*. (2002) also propose a static estimate and identify a significant negative impact of country trade openness on child labour.

In the light of what is described above, our contribution aims to test the potential limits of the trade openness rationale, checking whether proxies of poor bargaining power in the value chain of agricultural products do in fact limit gains from trade liberalization. Furthermore, we want to propose a dynamic estimate in which the significance of this factor against other potential regressors identified by the literature may be tested.

The dependent variable adopted for the empirical analysis is the same as in the empirical papers mentioned above: participation rates of children aged 10–14 years. This variable, measured by the ILO, has several limitations in that it does not consider the participation of children younger than 10, household child labour, and children neither working nor studying.[11]

Moreover, the 10–14 age group participation rates assimilate the work-and-study status to the work-only status. Theoretical and empirical findings have shown that the former is not as bad as the latter, since part-time work may improve children's nutritional status (Cigno *et al*., 2000) and finance their school attendance.

For these reasons, primary school enrolment is an alternative variable generally used for measuring child labour. The problem with this variable, though, is that net enrolment ratios are difficult to come by. The solution of using gross enrolment ratios is highly questionable since the share of individuals older than 14 still attending primary school in child labour countries is quite high. This 'noisy element' prevents, for instance, from considering the difference between child labour rates, and the difference between 1 and the primary school enrolment ratios, as the share of children that both work and study. By using gross enrolment rates, this difference always becomes negative and, even when positive, seriously underestimates the share of part-time workers.

Given these considerations, we work on participation rates of children aged 10–14 years only.

We also choose to limit our empirical analysis to all those countries having non-zero child participation rates.[12] This is because the presence of wealthy countries which, at least officially, have suc-

cessfully moved in the past to zero child labour rates would grossly overstate the impact of common characteristics of LDCs on our dependent variable. This choice is also consistent with our purpose of identifying those variables that positively affect the reduction of child labour within the group of countries that still show this phenomenon.

The World Bank database reports child labour rates for a reasonably large number of countries in 1980, 1990, 1995 and 1997, but many of the variables considered as regressors in the estimates that follow were recorded only in 1980 and 1990. Our static analysis is therefore necessarily confined to the first 2 years, while in the panel we also use information from 1995 and 1997.

3.2 Selection of variables and descriptive empirical findings

Our brief survey of the literature, summarized in the previous sections, shows that the child labour–GDP per capita relationship is well established. The challenge is to discover whether other factors are relevant.

Our a priori hypotheses from the literature and theoretical predictions from the simple example of the intra-household bargaining model provided in Appendix A are that at least six other factors (transfers, trade openness, parental education, quality of child education, rural life, and labour market conditions) should matter. To verify this we consider the descriptive and econometric impact of the following factors:

(i) an indicator of trade openness (*EFW6*);
(ii) the share of agricultural raw material exports on total export (*AGROWEX*);

using as additional controls:

(iii) aid per capita (*AIDCAPIT*) as a proxy of transfers integrating household per capita income;
(iv) proxies of the educational level of adult males and females (including *ILLETFEM*: the illiteracy rate of adult females);
(v) the number of pupils per teacher in primary schools (*PUPTEACH*) as a measure of the quality of child education;
(vi) the share of females working in the agricultural sector as a combined proxy of the lack of urbanization and parental education (*AGRFEM*).

In general, the second variable may be considered as a proxy of the inverse of a country's capacity to climb the value chain in internationally traded goods. We therefore believe that this last variable identifies how much a country's exports depend upon a sector in which the labour market is more likely to be non-competitive and low-skill workers are likely to make up a large proportion of the manpower.

When we inspect partial correlation matrices for the selected variables (see Tables 1a and 1b) we find that child labour is positively and significantly related to the share of females working in the agricultural sector, the pupil–teacher ratio in primary school, the share of agricultural raw material exports on total exports, and the share of illiterate females. The same variable is negatively and significantly related to the institutional indicator of trade liberalization (*EFW6*) in 1980 and 1990. A similar (inverted) relationship holds between the considered regressors and male and female enrolment rates in primary schools.

We also observe that the partial correlations among three of the explanatory variables mentioned above (*AGRFEM*, *ILLETFEM*, *PUPTEACH*) are quite high (above 0.5 per cent) in all of the three periods, while they are much lower with the variable proxying the lack of competitiveness of the unskilled labour market (*AGROWEX*). The correlation of this variable with child labour was much higher in 1990 than in 1980.

By comparing descriptive evidence on these variables in child and non-child labour countries we find that average distributions of the first subgroup stochastically dominate those of the second subgroup in almost all cases (see Tables 2a–2c and 3a–3c).

These tables show the depth of the differences concerning factors assumed to be potential determinants of child labour between child and non-child labour countries. As an example, the share of females working in the agricultural sector (*AGRFEM*) of the lowest decile of child labour countries in 1980 and 1990 (7.94 and 7.18, respectively) is higher than the median level of the same variable in non-child labour countries (based on the real per capita GDP in PPP). The same occurs for the number of pupils per teacher in primary schools (above 20 in the lowest decile child labour countries), while the illiteracy rate of adult females of the lowest decile child labour countries is just slightly above the median level in non-child labour countries.

This means that parental education, quality of child education, rural life, and labour market conditions have significantly different values in child labour countries than in the rest of the world at any observed level of the variables' distribution.

Table 1a. Correlation matrix of variables used in empirical estimates (1980)

	MALENR	*FEMENR*	*AGRFEM*	*PUPTEAC*	*AGROWEX*	*ILLETFEM*	*CHILD*	*AIDcapit*	*GDPcapit*	*EFW1*	*EFW2*	*EFW3*	*EFW4*	*EFW5*	*EFW6*	*EFW7*
MALENR	1															
FEMENR	0.883	1														
AGRFEM	–0.309	–0.578	1													
PUPTEAC	–0.298	–0.477	0.571	1												
AGROWEX	–0.375	–0.272	0.118	–0.307	1											
ILLETFEM	–0.554	–0.840	0.812	0.543	0.147	1										
CHILD	–0.382	–0.524	0.761	0.549	0.089	0.633	1									
AIDcapit	–0.009	–0.129	0.284	0.274	–0.344	0.246	0.041	1								
GDPcapit	0.343	0.560	–0.818	–0.575	–0.102	–0.746	–0.626	–0.389	1							
EFW1	–0.335	–0.381	0.064	0.069	0.295	0.311	0.254	–0.625	–0.083	1						
EFW2	–0.049	0.225	–0.614	–0.331	0.295	–0.463	–0.213	–0.310	0.384	0.126	1					
EFW3	–0.155	–0.221	0.183	0.483	–0.072	0.250	0.209	0.296	–0.309	–0.106	0.082	1				
EFW4	0.259	0.400	–0.513	–0.524	0.348	–0.450	–0.406	–0.505	0.515	0.074	0.607	0.076	1			
EFW5	0.402	0.500	–0.206	–0.204	–0.029	–0.451	–0.289	–0.298	0.506	–0.431	–0.046	–0.116	0.296	1		
EFW6	0.274	0.419	–0.228	–0.111	–0.136	–0.451	–0.332	0.364	0.188	–0.691	0.063	0.306	0.277	0.333	1	
EFW7	0.018	0.232	–0.567	–0.339	0.209	–0.486	–0.242	–0.220	0.611	–0.079	0.691	0.301	0.624	0.274	0.295	1

Notes: Variables: *MALENR*: gross primary school enrolment ratio — males; *FEMENR*: gross primary school enrolment ratio — females; *CHILD*: participation rate of the population aged 10–14; *ILLETFEM*: illiteracy rate of adult females; *PUPTEAC*: number of pupils per teacher in primary schools; *AGRFEM*: share of females working in the agricultural sector; *AGROWEX*: the share of agricultural raw material exports on total export; *GDPcapit*: real per capita GDP in PPP. *EFW(1)*: *Size of Government*: Consumption, Transfers, and Subsidies [11.0 per cent], (i) General Government Consumption Expenditures as a Percentage of Total Consumption (50 per cent); (ii) Transfers and Subsidies as a Percentage of GDP (50 per cent). *EFW(II)*: *Structure of the Economy and Use of Markets* (*Production and allocation via governmental* [14.2 per cent] *and political mandates rather than private enterprises and markets*), (i) Government Enterprises and Investment as a Share of the Economy (32.7 per cent); (ii) Price Controls: Extent to which Businesses Are Free to Set Their Own Prices (33.5 per cent); (iii) Top Marginal Tax Rate (*and income threshold at which it applies*) (25.0 per cent); (iv) The Use of Conscription to Obtain Military Personnel (8.8 per cent). *EFW(III)*: *Monetary Policy and Price Stability* (*Protection of money as a store of value and medium of exchange*) [9.2 per cent], (i) Average Annual Growth Rate of the Money Supply during the Last 5 Years (34.9 per cent) minus the Growth Rate of Real GDP during the Last 10 Years; (ii) Standard Deviation of the Annual Inflation Rate during the Last 5 Years (32.6 per cent); (iii) Annual Inflation Rate during the Most Recent Year (32.5 per cent). *EFW(IV)*: *Freedom to Use Alternative Currencies* (*Freedom of access to alternative currencies*) [14.6 per cent], (i) Freedom of Citizens to Own Foreign Currency Bank Accounts Domestically and Abroad (50 per cent); (ii) Difference between the Official Exchange Rate and the Black Market Rate (50 per cent). *EFW(V)*: *Legal Structure and Property Rights* (*Security of property rights and viability of contracts*) [16.6 per cent], (i) Legal Security of Private Ownership Rights (*Risk of confiscation*) (34.5 per cent); (ii) Viability of Contracts (*Risk of contract repudiation by the government*) (33.9 per cent); (iii) Rule of Law: Legal Institutions Supportive of the Principles of Rule of Law (31.7 per cent) and Access to a Non-discriminatory Judiciary. *EFW(VI)*: *International Exchange: Freedom to Trade with Foreigners* [17.1 per cent], (i) Taxes on International Trade; (ia) Revenue from Taxes on International Trade as a Percentage of Exports plus Imports (23.3 per cent); (ib) Mean Tariff Rate (24.6 per cent); (ic) Standard Deviation of Tariff Rates (23.6 per cent); (iia) Non-tariff Regulatory Trade Barriers; (iib) Percentage of International Trade Covered by Non-tariff Trade Restraints (19.4 per cent); (iic) Actual Size of Trade Sector Compared to the Expected Size (9.1 per cent). *EFW(VII)*: *Freedom of Exchange in Capital and Financial Markets* [17.2 per cent], (i) Ownership of Banks: Percentage of Deposits Held in Privately Owned Banks (27.1 per cent); (ii) Extension of Credit: Percentage of Credit Extended to Private Sector (21.2 per cent); (iii) Interest Rate Controls and Regulations that Lead to Negative Interest Rates (24.7 per cent); (iv) Restrictions on the Freedom of Citizens to Engage in Capital Transactions with Foreigners (27.1 per cent).

Table 1b. Correlation matrix of variables used in empirical estimates (1990)

	CHILD	*MALENR*	*FEMENR*	*AGRFEM*	*PUPTEAC*	*AGROWEX*	*ILLETFEM*	*AIDcapit*	*GDPcapit*	*EFW1*	*EFW2*	*EFW3*	*EFW4*	*EFW5*	*EFW6*	*EFW7*
CHILD	1.000															
MALENR	–0.436	1.000														
FEMENR	–0.566	0.897	1.000													
AGRFEM	0.792	–0.193	–0.408	1.000												
PUPTEAC	0.623	–0.130	–0.385	0.518	1.000											
AGROWEX	0.444	–0.293	–0.361	0.089	0.206	1.000										
ILLETFEM	0.566	–0.466	–0.744	0.628	0.561	0.186	1.000									
AIDcapit	0.245	–0.205	–0.278	0.069	0.520	0.042	0.347	1.000								
GDPcapit	–0.716	0.211	0.366	–0.717	–0.516	–0.293	–0.499	–0.358	1.000							
EFW1	0.347	–0.137	–0.167	0.243	0.186	0.251	0.079	0.023	–0.337	1.000						
EFW2	–0.279	–0.005	0.188	–0.462	–0.273	–0.033	–0.372	0.051	0.406	0.268	1.000					
EFW3	0.287	–0.152	–0.331	0.468	0.245	0.085	0.404	0.111	–0.376	0.032	–0.152	1.000				
EFW4	–0.160	0.036	0.133	–0.393	–0.134	0.087	–0.242	–0.138	0.431	0.234	0.668	–0.389	1.000			
EFW5	–0.492	0.450	0.548	–0.474	–0.264	–0.159	–0.635	–0.387	0.621	–0.184	0.255	–0.073	0.327	1.000		
EFW6	–0.413	0.075	0.149	–0.530	–0.123	0.125	–0.313	–0.063	0.337	–0.139	0.269	–0.133	0.521	0.394	1.000	
EFW7	–0.038	–0.039	–0.008	–0.288	0.062	0.167	–0.137	0.284	0.283	0.285	0.751	–0.019	0.673	0.280	0.336	1.000

Note: For a description of the variables see Table 1a footnote.

Table 2a. Percentiles of non-discrete variables used in empirical estimates (1980) — child labour countries

Percentiles	*CHILD*	*AGRFEM*	*PUPTEAC*	*AGROWEX*	*ILLETFEM*	*GDPcapit*	*MALENR*	*FEMENR*
10	0.58	7.94	20.39	0.25	7.20	490.00	60.80	42.04
20	3.88	15.76	24.23	1.01	15.32	770.00	81.66	50.84
30	5.61	25.09	27.56	2.12	20.32	1,060.00	92.38	73.64
40	9.59	38.02	30.77	2.46	26.72	1,480.00	97.96	88.60
50	16.66	57.55	33.80	3.26	40.35	1,980.00	101.10	95.35
60	20.77	72.92	36.86	5.82	51.70	2,310.00	105.36	99.94
70	28.28	81.01	38.87	9.21	67.25	2,870.00	108.46	103.09
80	34.61	87.98	44.66	15.67	75.18	3,710.00	115.06	106.10
90	42.91	92.61	53.15	27.76	86.91	5,200.00	120.28	111.89
100	61.19	98.00	64.58	80.69	97.30	8,790.00	148.10	134.50

Note: For a description of the variables see Table 1a footnote.

Table 2b. Percentiles of non-discrete variables used in empirical estimates (1980) — no child labour countries

Percentiles	*CHILD*	*AGRFEM*	*PUPTEAC*	*AGROWEX*	*ILLETFEM*	*GDPcapit*	*MALENR*	*FEMENR*
10	0	0.20	13.79	0.05	1.44	5,210.00	66.07	50.66
20	0	1.68	14.42	0.94	2.54	6,834.00	89.84	84.82
30	0	2.97	14.91	1.23	5.68	8,458.00	95.81	94.10
40	0	4.98	18.30	1.62	6.34	8,900.00	98.34	95.64
50	0	7.30	18.80	2.49	7.60	9,250.00	99.45	98.05
60	0	10.24	22.43	3.37	10.78	9,534.00	1.40	99.26
70	0	12.65	24.19	5.22	32.04	10,116.00	104.51	101.09
80	0	13.42	26.28	9.63	40.58	10,568.00	109.00	104.00
90	0	24.17	35.03	15.08	40.87	12,773.00	113.60	111.04
100	0	31.90	45.18	26.39	40.90	24,610.00	131.30	129.00

Note: For a description of the variables see Table 1a footnote.

Table 2c. Percentage difference between child labour and no child labour countries (no child labour country basis value) — 1980

Percentiles	*CHILD*	*AGRFEM*	*PUPTEAC*	*AGROWEX*	*ILLETFEM*	*GDPcapit*	*MALENR*	*FEMENR*
10	0	–97.48	–32.37	–80.00	–80.00	963.27	–5.27	–48.91
20	0	–89.34	–40.49	–6.93	–83.42	787.53	–8.18	–33.98
30	0	–88.16	–45.90	–41.98	–72.05	697.92	–91.95	–20.46
40	0	–86.90	–40.53	–34.15	–76.27	501.35	–0.38	–7.04
50	0	–87.32	–44.38	–23.62	–81.16	367.17	–95.23	–94.07
60	0	–85.96	–39.15	–42.10	–79.15	312.73	–96.00	0.68
70	0	–84.38	–37.77	–43.32	–52.36	252.47	–99.98	–96.79
80	0	–84.75	–41.16	–38.54	–46.02	184.85	–104.20	–99.58
90	0	–73.90	–34.09	–45.68	–52.97	145.63	–108.58	0.85
100	0	–67.45	–30.04	–67.29	–57.97	179.98	–125.13	–123.38

Note: For a description of the variables see Table 1a footnote.

Table 3a. Percentiles of non-discrete variables used in empirical estimates (1990) — child labour countries

Percentiles	*CHILD*	*AGRFEM*	*PUPTEAC*	*AGROWEX*	*ILLETFEM*	*GDPcapit*
10	1.9	7.18	20.82	0.22	7.28	70.31
20	3.98	14.06	22.26	0.45	13.32	78.02
30	7.9	24.46	24.70	1.36	20.32	81.16
40	13.21	46.86	27.59	2.60	28.04	92.32
50	17.22	59.35	30.38	3.03	34	100.05
60	21.53	71.4	31.80	3.77	46.76	103.1
70	27.71	80.64	36.71	4.81	61.04	108.37
80	33.77	86.42	41.75	8.56	70.26	112.8
90	42.07	91.07	61.83	14.23	80.46	122.68
100	57.92	98	77.02	62.27	94.9	140.9

Note: For a description of the variables see Table 1a footnote.

Table 3b. Percentiles of non-discrete variables used in empirical estimates (1990) — no child labour countries

Percentiles	*CHILD*	*AGRFEM*	*PUPTEAC*	*AGROWEX*	*ILLETFEM*	*GDPcapit*
10	0	0.91	15.362	0.124	0.74	4,384
20	0	1.64	17.555	0.542	2.98	5,668
30	0	3.03	18.355	1.057	4.26	7,208
40	0	4.02	20.223	1.406	5.6	9,604
50	0	5.35	20.730	1.970	6.7	12,340
60	0	8.14	22.461	2.556	9.4	15,810
70	0	9.76	25.923	3.880	14.64	16,796
80	0	13.28	27.070	4.419	19.16	17,842
90	0	22.04	31.902	9.210	27.92	19,484
100	0	42	35.589	18.480	53.6	22,660

Note: For a description of the variables see Table 1a footnote.

Table 3c. Percentage difference between child labour and no child labour countries (no child labour country basis value) — 1990

Percentiles	*CHILD*	*AGRFEM*	*PUPTEAC*	*AGROWEX*	*ILLETFEM*	*GDPcapit*
10	0	–87.33	–26.22	–43.64	–89.84	6,135.24
20	0	–88.34	–21.14	–20.44	–77.63	7,164.80
30	0	–87.61	–25.69	–22.28	–79.04	8,781.22
40	0	–91.42	–26.70	–45.92	–80.03	10,302.95
50	0	–90.99	–31.76	–34.98	–80.29	12,233.83
60	0	–88.60	–29.37	–32.20	–79.90	15,234.63
70	0	–87.90	–29.38	–19.33	–76.02	15,398.75
80	0	–84.63	–35.16	–48.38	–72.73	15,717.38
90	0	–75.80	–48.40	–35.28	–65.30	15,781.97
100	0	–57.14	–53.79	–70.32	–43.52	15,982.33

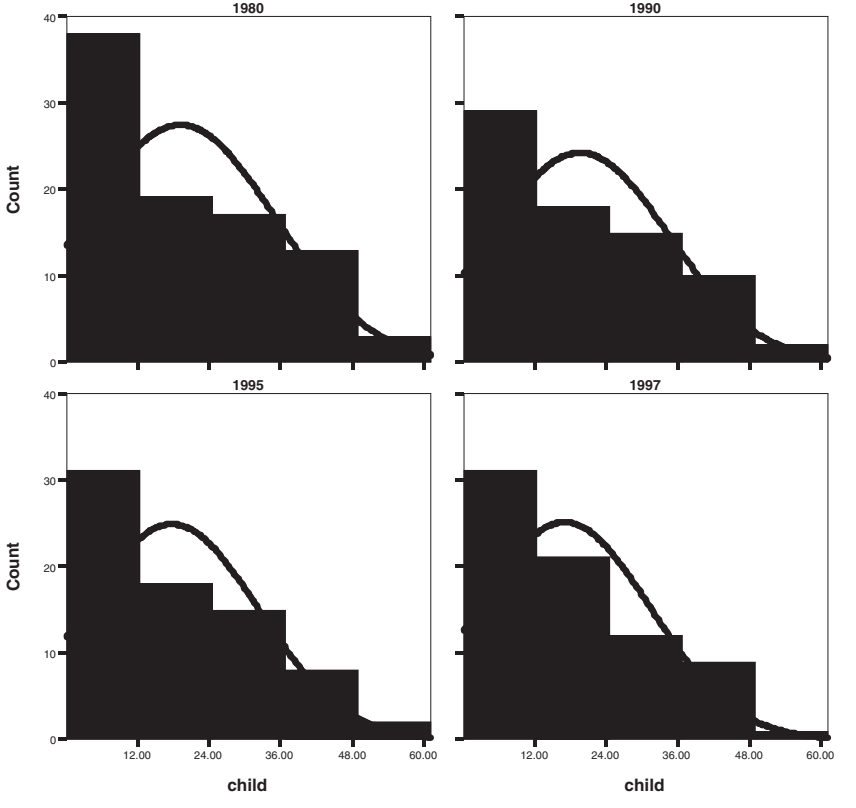
Note: For a description of the variables see Table 1a footnote.

3.3 Results from static and dynamic econometric estimates

The dependent variable is represented by participation rates of children aged 10–14 years. This variable is non-negative by definition and can be modelled as a realization of a process governed by some specific rate of occurrence, i.e. participation in the labour market for an individual aged 10–14 in a given country. In Figure 1 we report its distribution in 1980, 1990, 1995 and 1997.

The variable can be estimated following a Poisson model, assuming a specific term as offset. Another problem in our database is

Figure 1. Distribution of child labour by country and by years. Child labour: participation rate of the population aged 10–14. The curve over the histogram is the truncated normal distribution



that the dependent variable is measured at irregular time intervals. A likely consequence is that the variance is higher than the mean, i.e. the estimate exhibits over-dispersion. The standard methodology to be applied in this case is the negative binomial regression model (Cameron and Trivedi, 1986, 1998). Further details on

Notes: **1980**, *0–12 per cent*: Albania, Algeria, Argentina, Belize, Colombia, Costa Rica, Ecuador, Hungary, Italy, Jamaica, Jordan, Malaysia, Mauritius, Mexico, Oman, Panama, Peru, Portugal, Romania, Sri Lanka, Uruguay, Venezuela; *12–24 per cent*: Bolivia, Brazil, Egypt (Arab Rep.), El Salvador, Ghana, Guatemala, Honduras, India, Indonesia, Iran (Islamic Rep.), Morocco, Nicaragua, Pakistan, Paraguay, Philippines, Sierra Leone, Syrian Arab Republic, Turkey, Zambia; *24–36 per cent*: Bangladesh, Benin, Botswana, Cameroon, China, Congo (Dem. Rep.), Congo (Rep.), Cote d'Ivoire, Dominican Republic, Gabon, Haiti, Myanmar, Namibia, Nigeria, Papua New Guinea, Thailand, Togo, Zimbabwe; *36–48 per cent*: Chad, Guinea-Bissau, Kenya, Madagascar, Malawi, Niger, Rwanda, Senegal, Somalia, Tanzania, Uganda; *>48 per cent*: Burundi, Mali, Nepal. **1990**, *0–12 per cent*: Albania, Algeria, Argentina, Belize, Colombia, Costa Rica, Ecuador, Honduras, Hungary, Indonesia, Iran, Italy, Jamaica, Jordan, Malaysia, Mauritius, Mexico, Morocco, Oman, Panama, Paraguay, Peru, Philippines, Portugal, Romania, Sri Lanka, Syrian Arab Republic, Uruguay, Venezuela; *12–24 per cent*: Bolivia, Botswana, Brazil, China, Cote d'Ivoire, Dominican Republic, Egypt (Arab Rep.), El Salvador, Gabon, Ghana, Guatemala, India, Nicaragua, Pakistan, Papua New Guinea, Sierra Leone, Thailand, Zambia; *24–36 per cent*: Bangladesh, Benin, Cameroon, Central African Republic Congo (Dem. Rep.), Congo (Rep.), Haiti, Myanmar, Namibia, Nigeria, Senegal, Somalia, Togo, Turkey, Zimbabwe; *36–48 per cent*: Burundi, Chad, Guinea-Bissau, Kenya, Madagascar, Malawi, Nepal, Niger, Rwanda, Tanzania, Uganda; *>48 per cent*: Mali. **1995**, *0–12 per cent*: Albania, Algeria, Argentina, Belize, China, Colombia, Costa Rica, Ecuador, Egypt (Arab Rep.), Honduras, Hungary, Indonesia, Iran (Islamic Rep.), Italy, Jamaica, Jordan, Malaysia, Mauritius, Mexico, Morocco, Oman, Panama, Paraguay, Peru, Philippines, Portugal, Romania, Sri Lanka, Syrian Arab Republic, Uruguay, Venezuela; *12–24 per cent*: Bolivia, Botswana, Brazil, Cote d'Ivoire, Dominican Republic, El Salvador, Gabon, Ghana, Guatemala, India, Namibia, Nicaragua, Pakistan, Papua New Guinea, Sierra Leone, Thailand, Turkey, Zambia; *24–36 per cent*: Bangladesh, Benin, Cameroon, Central African Republic Congo (Dem. Rep.), Congo (Rep.), Haiti, Madagascar, Malawi, Myanmar, Nigeria, Senegal, Somalia, Togo, Zimbabwe; *36–48 per cent*: Burundi, Chad, Guinea-Bissau, Kenya, Nepal, Niger, Rwanda, Tanzania, Uganda; *>48 per cent*: Mali. **1997**, *0–12 per cent*: Albania, Algeria, Argentina, Belize, China, Colombia, Costa Rica, Ecuador, Egypt (Arab Rep.), Ghana, Honduras, Hungary, Indonesia (Islamic Rep.), Italy, Jamaica, Jordan, Malaysia, Mauritius, Mexico, Morocco, Oman, Panama, Paraguay, Peru, Philippines, Portugal, Romania, Sri Lanka, Syrian Arab Republic, Uruguay, Venezuela; *12–24 per cent*: Bolivia, Botswana, Brazil, Cameroon, Cote d'Ivoire, Dominican Republic, El Salvador, Gabon, Guatemala, Haiti, India, Myanmar, Namibia, Nicaragua, Pakistan, Papua New Guinea, Sierra Leone, Thailand, Turkey, Zambia; *24–36 per cent*: Bolivia, Botswana, Brazil, Cameroon, Cote d'Ivoire, Dominican Republic, El Salvador, Gabon, Guatemala, Haiti, India, Myanmar, Namibia, Nicaragua, Pakistan, Papua New Guinea, Sierra Leone, Thailand, Turkey, Zambia; *36–48 per cent*: Burundi, Chad, Guinea-Bissau, Kenya, Nepal, Niger, Rwanda, Tanzania, Uganda; *>48 per cent*: Mali.

Source: World Bank data set (1997).

the estimation approach followed are provided in Appendix B. However, based on the negative binomial model, we estimate the following base equation:

$$\begin{aligned} Childlab = \exp(&\alpha_0 + \alpha_1 GDPcapit + \alpha_2 AGROWEX \\ &+ \alpha_3 AGRFEM + \alpha_4 AIDCAPIT \\ &+ \alpha_5 ILLETFEM + \alpha_6 PUPTEAC \\ &+ \sum_k b_k EFW_k + Offset + \varepsilon_1), \end{aligned} \quad [1]$$

where the omitted variable ε, which is the source of the heterogeneity, follows a gamma distribution with parameter α and *Offset* is the distance from the first year of the sample period measured in years.[13] *GDPcapit* is real per capita GDP corrected for purchasing power parities, EFW_k is the kth indicator of institutional freedom,[14] *AGROWEX* is the share of agricultural raw material exports over total export, *AGRFEM* is the share of females working in the agricultural sector, *AIDCAPIT* is aid per capita and is used as a proxy for transfers to poor domestic households; *ILLETFEM* is the illiteracy rate among adult females, and *PUPTEACH* is the pupil/teacher ratio in primary schools as a measure of the quality of child education (see Tables 4a and 4b).

When passing to a dynamic regression model we start from the following base equation:

$$\begin{aligned} Childlab_t = \exp(&\alpha_0 + \alpha_1 Childlab_{t-1} + \alpha_2 GDPgrwt_t \\ &+ \alpha_3 GDPcapit_t + \alpha_4 AGROWEX_t \\ &+ \alpha_5 AGRFEM_t + \alpha_6 AIDCAPIT_t \\ &+ \alpha_7 ILLETFEM_t + \alpha_8 PUPTEAC \\ &+ \sum_k EFW_{kt} + offset + \varepsilon_2), \end{aligned} \quad [2]$$

where the difference from the previous equation in the set of regressors is given by the presence of the lagged dependent variable and the rate of GDP growth (see Table 4b).[15]

A first general point is that all estimation diagnostics confirm the existence of over-dispersion with α significantly different from zero, thereby rejecting the simple Poisson model and confirming the validity of the choice of the binomial regression model.

A second general result is that the existence of additional factors different from per capita GDP affecting child labour is confirmed.

Table 4a. The determinants of child labour (1980 and 1990) — dependent variable, participation rates of children aged 10–14 years

	1980			1990			
	Base equation			**Base equation**			
GDPcapit	–0.0004	–0.0002	–0.0003	–0.0003	–0.0002	–0.0002	–0.0002
	(–7.25)	(–1.83)	(–3.25)	(–7.58)	(–2.82)	(–2.94)	(–3.08)
AGRFEM		0.011	0.011		0.014	0.014	0.015
		(3.05)	(4.17)		(2.47)	(2.58)	(3.13)
PUPTEAC		0.014			0.013	0.014	0.015
		(1.75)			(1.23)	(1.56)	(1.63)
AGROWEX		0.008	0.007		0.013	0.014	0.012
		(2.04)	(1.74)		(1.81)	(2.03)	(1.69)
ILLETFEM		0.001			0.002		–0.0003
		(0.3)			(0.25)		(–0.06)
EFW1					0.138	0.128	
					(1.17)	(1.2)	
EFW2					0.039	0.039	
					(0.51)	(0.57)	
EFW3		–0.020	–0.009		–0.137	–0.131	–0.128
		(–0.55)	(–0.3)		(–2.93)	(–3.13)	(–3.43)
EFW4					0.022	0.025	
					(0.38)	(0.47)	

Table 4a. Continued

	1980			1990			
	Base equation			**Base equation**			
EFW5					0.089	0.078	
					(0.98)	(1.05)	
EFW6		–0.059	–0.070		–0.223	–0.223	–0.082
		(–1.67)	(–2.04)		(–2.00)	(–2.12)	(–1.05)
EFW7					0.010	0.008	
					(0.13)	(0.11)	
AIDcapit		–0.002	–0.002				–0.004
		(–2.03)	(–2.42)				(–1.81)
Constant	3.589	2.315	3.123	3.643	2.287	2.414	3.431
	25.12	(4.53)	(8.59)	(26.62)	(2.04)	(2.32)	(4.96)
α	0.58	0.07	0.12	0.43	0.13	0.11	0.14
$\chi^2\ \alpha = 0$	316.87	29.12	43.26	227.01	16.43	11.70	18.76
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
LR (χ^2 (11))	36.18	62.95	64.81	42.28	50.84	53.97	43.15
R^2	0.05	0.16	0.14	0.07	0.20	0.21	0.17
Countries	79	47	56	70	33	34	32

Notes: For a description of the variables see Table 1a footnote. *Z* values are shown in parentheses.

Table 4b. The determinants of child labour (negative binomial regression panel estimates) — dependent variable, participation rates of children aged 10–14 years

	Base equation				
Childlab (–1)		0.002	0.002	0.003	0.003
		(0.29)	(0.33)	(0.68)	(0.56)
GDPcapit	–0.0003	–0.0002	–0.0002	–0.0003	–0.0002
	(–12.9)	(–5.02)	(–4.77)	(–8.64)	(–2.25)
PUPTEAC					0.016
					(2.12)
GDPgrwthca		–0.061	–0.060		–0.092
		(–1.72)	(–1.61)		(–2.15)
GDPgrwth			0.026	0.027	–0.001
			(1.3)	(1.37)	(–0.03)
ILLETFEM		0.010			
		(2.36)			
AGRFEM					0.015
					(3.69)
AGROWEX		0.016	0.018	0.017	0.012
		(1.81)	(1.88)	(1.92)	(2.01)
EFW1			0.0002		
			(0.03)		
EFW2			0.037		
			(0.58)		
EFW3		–0.058	–0.024	–0.050	–0.104
		(–1.95)	(–0.74)	(–1.8)	(–3.13)
EFW4			0.022		
			(0.55)		
EFW5			–0.159		
			(–2.74)		
EFW6		–0.064	–0.078	–0.060	–0.056
		(–1.21)	(–1.28)	(–1.23)	(–0.77)
EFW7			–0.022		
			(–0.34)		
AIDcapit		–0.004	–0.004	–0.005	–0.004
		(–1.69)	(–1.69)	(–2.31)	(–2.06)
Constant	0.995	1.265	1.999	1.656	0.642
	(11.74)	(2.75)	(2.22)	(4.47)	(1.07)
α	0.53	0.42	0.44	0.49	0.08
χ^2 $\alpha = 0$	832.08	259.4	253.44	356.81	7.7
	(0.00)	(0.00)	(0.00)	(0.00)	(0.003)
LR (χ^2 $(n - k)$)	120.54	82.02	79.27	83.22	53.52
R^2	0.07	0.10	0.10	0.10	0.21
Countries	206	104	104	121	33

Notes: *GDPgrwthca*: one period rate of growth of real per capita GDP; *GDPgrwth*: one period rate of growth of real GDP. For a description of the other variables see Table 1a footnote. *Z* values are shown in parentheses.

In both tables (4a and 4b) the base estimate including only per capita GDP is significantly improved by the introduction of additional regressors, at the expense of a significant reduction in sample size. In the 1980 estimate (Table 4a) the best estimate has an R^2 that is three times higher and an over-dispersion that is almost five times lower.[16] In the 1990 estimate (see Table 4a) the R^2 is three times higher and over-dispersion is three times lower. In the dynamic estimate (see Table 4b), the R^2 is more than twice as high and over-dispersion is more than three times lower.

Empirical findings from static binomial regression estimates document the significance of the positive impact of the dependence of exports on agricultural raw materials and of the negative impact of trade openness on child labour (only in some estimates). Remember, in fact, that *EFW6*, negative and significant in the static estimates, is an indicator of 'freedom to trade with foreigners' or an average of measurements of mean tariff rates, shares of international trade covered by non-tariff trade barriers, and taxes on international trade.

These findings confirm that benefits from globalization on social indicators may be mitigated if poor skills and trade or non-trade barriers prevent emerging countries from climbing up the value chain of tradable goods. The interesting result that emerges from our paper is that the trade-off may emerge even from the aggregate evidence before looking at microdata or case studies, as a large part of the literature on trade, growth and poverty does (Bardhan, 2003; Quibria, 2002).

Our findings have several parallels in the relationship between specialization in primary product exports and growth. Young (1991) argues that a trade-off exists between static and dynamic comparative advantages. This is because learning by doing in technologically intensive production is an important source of human capital development and growth, and LDCs that specialize in exporting primary goods lack it as a factor. Bleaney and Greenaway (2001) have found that high variance in primary product prices has negative effects on investment and growth for fourteen sub-Saharan countries between 1980 and 1995.

When looking at other significant factors in static estimates, the variable with the strongest and most stable significant influence on child labour (after per capita GDP) proves to be the share of females working in the agricultural sector (*AGRFEM*). If we consider this variable as a proxy of skills and women's wage capacity, we find that it supports the theoretical predictions based on the

model presented in Appendix A. The estimates show something more, however, given that the share of males working in agriculture and the share of illiterate women do not have the same effects. A plausible interpretation is that the *AGRFEM* variable probably summarizes more than one factor affecting child labour (parental education, relative weight of agricultural sector, family division of labour, etc.) as described in the short survey of the literature presented in Section 2.

It is significant to note that we tested several other proxies of parental education, but none of them were significant.[17] It seems, therefore, that the share of adult females working in the agricultural sector captures all the parental education effect or that this effect is not relevant *per se*, being absorbed by the impact of the other regressors.

Regression diagnostics in panel results (see Table 4b) reveal a degree of over-dispersion significantly different from zero and larger than in the cross-sectional estimate, confirming that the autoregressive model with irregular time spacing has an additional source of heterogeneity.

Empirical findings show that the significance of some variables (*AGRFEM*, *AGROWEX*, *GDPcapit*) is robust and confirmed in dynamic estimates, while others lose significance (*EFW3*, *EFW6*).

4. Conclusions and policy suggestions

Theoretical models of endogenous growth and empirical findings of conditional convergence are an important contribution of the economic literature to the current discussion on the capacity of economic systems to reduce existing inequalities. These findings often suggest that both extremely optimistic and pessimistic 'deterministic' approaches to the problem are not correct and that LDCs may catch up if they bridge their gap with industrialized countries in terms of those factors to which growth is conditioned (i.e. human capital, institutions, etc.). But what is the relationship between per capita GDP (an average indicator) and social variables (such as child labour, among others) which are highly sensitive to the distributional implications of growth and to the capacity of the latter to reduce some of the pathological effects of poverty?

In this paper we find that, beyond the expected negative relationship between GDP growth and child labour, and beyond the

effect of other expected regressors (such as parental education, quality of child education, international aid), the social indicator is significantly affected by a country's permanence in the lowest part of the agricultural goods value chain.

These findings suggest that 'socially responsible' consumption and, in particular, private 'minimum wage' transfers from consumers of end products in the North to agricultural raw producers in the South — i.e. workers or subcontractors in non-competitive markets — through consumption may be a successful policy measure to reduce child labour.

The advantage of these solutions is that while government redistribution policies are costly and not very effective—increases of 10–20 per cent of household income through redistribution transfers have been shown not to modify child labour significantly (Cigno, Rosati, 2002) — these transfers are targeted directly at poor rural households, are entirely privately financed, and correspond to threefold/fourfold increases in workers' market wages.[18]

The difference with respect to domestic government minimum wage transfers in terms of marginal cost of the donor is therefore enormous since fair trade allows consumers in the North to buy products almost at market prices and exploits large differences in purchasing power. When the fair trade transfer to low-skill workers in the South is oriented to education it may have powerful direct and indirect effects on child labour by accompanying a large increase in poor household income with a subsidy for education.

Appendix A: The model

To work out simple relationships between child labour and some of the variables considered above, separated from any specification of the utility function, let us consider the following simple intra-household bargaining model which closely follows Basu (1999). In the model, $e \in (0, 1)$ is the work done by the child (and $1 - e$ is child leisure), a is the weight attached to parental utility, w_1 and w_2 are parental and child wages, respectively, while x_1 and x_2, respectively, represent the amount consumed by both parents and by the child. Assume that wages reflect the value of the marginal product in proportion to the degree of competitiveness of the labour market $w_1 = pMP(h)/(1 + 1/\eta)$, where $\eta = \infty$ is the special case of perfect

competition[19] and h is human capital affecting worker productivity. The maximand is:

$$\text{Max } au(x_1, x_2, e) + (1-a)u_2(x_1, x_2, e)$$

$$\text{s.t. } x_1 + x_2 = w_1(.) + w_2 e.$$

By using the Lagrangean and maximizing with respect to parent and child consumption and to child labour, we have the following four first-order conditions:

$$au_1'(x_1) + (1-a)u_2'(x_1) + \lambda = 0 \qquad [A1]$$

$$au_1'(x_2) + (1-a)u_2'(x_2) + \lambda = 0 \qquad [A2]$$

$$au_1'(e) + (1-a)u_2'(e) - \lambda w_2 = 0 \qquad [A3]$$

$$x_1 + x_2 = w_1(.) + w_2 e. \qquad [A4]$$

By replacing x_2 from [A4] in [A2], and, by replacing λ from [A3] in [A1] and [A2], we get:

$$au_1'(x_1) + (1-a)u_2'(x_1) + (au_1'(e) + (1-a)u_2'(e))/w_2 = 0 \qquad [A1']$$

and

$$au_1'(w_1(.) + w_2 e - x_1) + (1-a)u_2'(w_1(.) + w_2 e - x_1) + (au_1'(e) + (1-a)u_2'(e))/w_2 = 0. \qquad [A2']$$

By equating and taking the total differential we have:

$$(-a(\partial^2 u_i/\partial x_1 \partial w_1) - (1-a)\partial^2 u_2/\partial x_1 \partial w_1)\,\mathrm{d}w_1 = (w_2(a\partial^2 u_1/\partial x_2 \partial e + (1-a)\partial^2 u_2/\partial x_2 \partial e)\,\mathrm{d}e. \qquad [A5]$$

Under the reasonable assumption that all cross-derivatives have the same sign,[20] the negative sign of $\mathrm{d}e/\mathrm{d}w_1$ confirms, as expected, that a higher parental wage reduces child labour. This prediction is consistent with the luxury axiom which suggests that parents send children to work only if household income is below a given threshold.

Now consider the potential effect of trade liberalization by assuming that it generates delocalization and an increased demand

for products intensive in the factor which is relatively abundant in the country (i.e. the low-skilled factor in emerging countries). The increased product demand generates a positive shock on the price p. The transmission of the shock to wages depends on the relative competitiveness of the labour market and therefore on η. The consequence is that countries in which the labour market is not competitive will have reduced gains from trade liberalization.

To evaluate the impact of educational quality on child labour, consider a simple two-period extension of the model in which wages and consumption have two subscripts (the first indicating individuals and the second time). In the second period children become adults. The maximand becomes:

$$\begin{aligned}&\text{Max } a(w_{11}, w_{12}, w_{21}, w_{22})u_1(x_{11}, x_{12}, x_{21}, x_{22}, e)\\&\quad+(1-a(w_{11}, w_{12}, w_{21}, w_{22}))u_2(x_{11}, x_{12}, x_{21}, x_{22}, e)\end{aligned}$$

$$\text{Sub } x_{11}+x_{12}+x_{21}+x_{22}=w_{11}+w_{12}+w_{21}e+w_{22}(e, q_E).$$

By reasonably assuming that the second-period child wage is increasing in the quantity and quality of education received in the first period, where the former is negatively related to child labour, $w'_{22}(e) < 0$, $w'_{22}(q_E) > 0$, $\partial^2 w_{22}/\partial e \partial q_E < 0$, we easily show that child labour is decreasing in the quality of education.

Appendix B: The econometric approach followed for our estimates

The negative binomial approach is mostly adopted when the data match a Poisson distribution, but there is unobserved individual heterogeneity that follows a gamma distribution given that the true mean cannot be correctly observed. The gamma distribution is usually adopted in these cases since it represents the only exponential-form conjugate distribution of the Poisson distribution: hence the marginal likelihood is still tractable (Greenwood and Yule, 1920). In these cases the unobserved individual heterogeneity typically determines the phenomenon of over-dispersion; that is, the standard model cannot capture the heterogeneity by adopting only the covariates in the conditional mean function (Kingman, 1993).

Another motivation for the adoption of a negative binomial regression is that we are handling panel data in which the conditional independence assumption is known to fail. Panel estimates

are generally designed to tackle heterogeneity by considering fixed or random effects (see Lancaster, 1990, for a good survey on the consequences of misspecified heterogeneity). But in our case the existing over-dispersion suggests that it is advisable to use the negative binomial together with the longitudinal design (Cameron and Trivedi, 1998).

On the above-mentioned grounds the negative binomial can be viewed as a gamma mixture of a Poisson kernel (Greenwood and Yule, 1920). In a standard Poisson regression model the heterogeneity is correctly evaluated by the observable covariates; that is, $(y_i|\mathbf{x}_i)$. In a mixture model we represent the heterogeneity as υ_i; that is, the distribution becomes $(y_i|\mathbf{x}_i, \upsilon_i)$. In this way we assume that the individuals differ randomly and that the covariates cannot fully capture this individual heterogeneity. The marginal distribution of $(y_i|\mathbf{x}_i, \upsilon_i)$ can be derived from the average of y_i with respect to υ_i.[21] In this way we have to specify the correct functional link between y_i and $(\mathbf{x}_i, \upsilon_i)$. The standard functional form is the exponential mean with multiplicative error. This form can be modelled by $E(y_i|\mathbf{x}_i, \upsilon_i) = \exp(\mathbf{x}_i^T\beta)\upsilon_i$, in which the stochastic term υ_i is assumed to be independent from the regressors. By this methodology we avoid considering an additive form for the errors and we can assume a distribution for υ_i from which the marginal distribution of y_i can be derived.

We can therefore write the conditional likelihood as:

$$f(y_i|\upsilon_i) = \frac{(\upsilon_i, \mu_i)^{y_i} \exp\left[-(\upsilon_i, \mu_i)^{y_i}\right]}{\Gamma(y_i + 1)},$$

where $\mu_i = \exp(\mathbf{x}_i^T\beta + \text{exposure}_i)$ has the following gamma density:

$$g(\upsilon) = \frac{\upsilon^{(1-\alpha)}/\alpha_e - \upsilon_i/\alpha}{\Gamma(1/\alpha)},$$

with unit mean and variance equal to α. Since the gamma distribution measures heterogeneity, an α significantly different from zero implies that the assumption of mean-variance equality of the Poisson distribution is rejected and that there is over-dispersion (Cameron and Trivedi, 1998).

The marginal likelihood for the ith observation is therefore:

$$f(y_i) = \int_0^\infty f(y_i|\upsilon_i)g(\upsilon)\mathrm{d}\upsilon.$$

Notes

[1] On this point see Bhagwati and Shrinivasan (2003), but also the more critical perspective of Rodríguez and Rodrik (1999).

[2] In this direction we try to follow the advice of Basu (1999) who observes, in his survey on the child labour literature, that there are many empirical papers without any theory and many theoretical insights in purely descriptive papers. He therefore encourages not only further theoretical research but also empirical work which is analytically better founded.

[3] The 2002 Oxfam report, containing a foreword by A. Sen, calculates that tariff and non-tariff barriers cost developing countries around $100bn per year, twice as much as these countries receive in terms of international aid (Oxfam, 2002). The report also highlights the fact that a 1 per cent increase in sub-Saharan countries' share of world trade could bring 120 million people above the poverty line.

[4] The empirical literature confirms that specialization in primary products is harmful to growth (Sachs and Warner, 1997; Sala-i-Martin, 1997). Bleaney and Greenaway (2001) examined the impact on investment and growth of the level and volatility of the terms of trade and the real effective exchange rate for a panel of 14 sub-Saharan African countries over the period 1980–95. They found that growth is negatively affected by terms of trade instability, and investment by real exchange rate instability. Moreover, both growth and investment increase when the terms of trade improve and real exchange rate overvaluation is eliminated.

[5] Feenstra (1998) documents the phenomenon of disintegration in production by showing a significant rise in the ratio of imported to domestic intermediate inputs and in the ratio of merchandize trade to merchandize value added in OECD countries in the last decades. Other authors refer to the phenomenon as delocalization (Leamer, 1998), vertical specialization (Hummels *et al*., 2001) and slicing the value chain (Krugman, 1995).

[6] Katz and Murphy (1992) show that the graduate/undergraduate wage ratio for workers with 1–5 years of work experience rose from 1.4 to 1.9 during the 1980s. David *et al*. (1998) found that *college workers*' wages rose by 25 per cent in the period 1970–95, against an average yearly decline of 0.11 per cent between 1940 and 1970. The trade and wage debate highlights two main concurrent explanations for increasing skill wage differentials within industries: technological innovation and outsourcing within industries of the least skill-intensive processes to developing countries (Rodrik, 1997).

[7] If low demand elasticity is the only rationale it is difficult to explain why agricultural wages have risen in developed countries while not in the LDCs (Deaton, 1999).

[8] Several other authors mention the existence of counterintuitive dynamics and of a potential perverse relationship between economic growth and child labour in the short run. On the empirical side, Ray (2000) shows that the *luxury axiom* is supported in Peru, but not in Pakistan. Basu (1993) finds evidence of a perverse causation which may generate a positive GDP growth/higher child labour effect in the short run. This occurs if the increase in GDP is obtained by raising female wages. In such cases it may generate higher female participation in the labour market and mothers' decision to move children from school to work.

[9] 'The less fully children's faculties are developed, the less will they realise the importance of the faculties of their children, and the less will be their power of doing so. And conversely any change that awards to the workers of one generation

better earnings, together with better opportunities of developing their best qualities, will increase the material and moral advantages which they have the power to offer to their children.'

[10] An example of such models is presented in Appendix A.

[11] A recent household survey in Morocco shows that the group of children doing nothing can be relatively large (20 percent or more of the population cohort), while the NCAER survey in rural India shows that female child labour is seriously underestimated by neglecting household labour (Cigno and Rosati, 2002).

[12] The list of countries is reported in an Appendix available from the author upon request.

[13] The presence of this variable in negative binomial regressions filters the heterogeneity arising from irregular time spacing.

[14] The indicators are taken from the index of economic freedom published in the *Economic Freedom of the World: 2000 Annual Report*. *EFW COMPOSITE* is a weighted average of the seven following composed indicators designed to identify the consistency of institutional arrangements and policies with economic freedom in seven major areas: *EFW(I)*: *Size of Government*: Consumption, Transfers, and Subsidies [11.0 per cent], (i) General Government Consumption Expenditures as a Percentage of Total Consumption (50 per cent); (ii) Transfers and Subsidies as a Percentage of GDP (50 per cent). *EFW(II)*: *Structure of the Economy and Use of Markets* (*Production and allocation via governmental* [14.2 per cent] *and political mandates rather than private enterprises and market*s), (i) Government Enterprises and Investment as a Share of the Economy (32.7 per cent); (ii) Price Controls: Extent to which Businesses Are Free to Set Their Own Prices (33.5 per cent); (iii) Top Marginal Tax Rate (*and income threshold at which it applie*s) (25.0 per cent); (iv) The Use of Conscription to Obtain Military Personnel (8.8 per cent). *EFW(III)*: *Monetary Policy and Price Stability* (*Protection of money as a store of value and medium of exchange*) [9.2 per cent], (i) Average Annual Growth Rate of the Money Supply during the Last Five Years (34.9 per cent) minus the Growth Rate of Real GDP during the Last Ten Years; (ii) Standard Deviation of the Annual Inflation Rate during the Last Five Years (32.6 per cent); (iii) Annual Inflation Rate during the Most Recent Year (32.5 per cent). *EFW(IV)*: *Freedom to Use Alternative Currencies* (*Freedom of access to alternative currencie*s) [14.6 per cent], (i) Freedom of Citizens to Own Foreign Currency Bank Accounts Domestically and Abroad (50 per cent); (ii) Difference between the Official Exchange Rate and the Black Market Rate (50 per cent). *EFW(V)*: *Legal Structure and Property Rights* (*Security of property rights and viability of contract*s) [16.6 per cent], (i) Legal Security of Private Ownership Rights (*Risk of confiscation*) (34.5 per cent); (ii) Viability of Contracts (*Risk of contract repudiation by the governmen*t) (33.9 per cent); (iii) Rule of Law: Legal Institutions Supportive of the Principles of Rule of Law (31.7 per cent) and Access to a Non-discriminatory Judiciary. *EFW(VI)*: *International Exchange: Freedom to Trade with Foreigners* [17.1 per cent], (i) Taxes on International Trade, (ia) Revenue from Taxes on International Trade as a Percentage of Exports plus Imports (23.3 per cent); (ib) Mean Tariff Rate (24.6 per cent); (ic) Standard Deviation of Tariff Rates (23.6 per cent); (iia) Non-tariff Regulatory Trade Barriers; (iib) Percentage of International Trade Covered by Non-tariff Trade Restraints (19.4 per cent); (iic) Actual Size of Trade Sector Compared to the Expected Size (9.1 per cent). *EFW(VII)*: *Freedom of Exchange in Capital and Financial Markets* [17.2 per cent], (i) Ownership of Banks: Percentage of Deposits Held in Privately Owned Banks (27.1 per cent); (ii) Extension of Credit: Percentage

of Credit Extended to Private Sector (21.2 per cent); (iii) Interest Rate Controls and Regulations that Lead to Negative Interest Rates (24.7 per cent); (iv) Restrictions on the Freedom of Citizens to Engage in Capital Transactions with Foreigners (27.1 per cent). *Any of the considered freedom indicators has a value range of 0 to 10. A higher value means a higher level in the item considered by the indicator.*

[15] Our panel estimates are dynamic in the sense that they introduce lagged values of the dependent variable in the specification and exploit all time dimensions of our data set (even though time distances are non-homogeneous). A well-known result in the statistical literature demonstrates that it is possible to take into account non-homogeneous distances in time by using the log of the time exposure as offset. Moreover, when we deal with GLMs (generalized linear models), inequality in time distances does not create distortions in estimates (for details see Cameron and Trivedi, 1998; McCullagh and Nelder, 1989).

[16] We cannot use all indicators of economic freedom as regressors in the static 1980 equation for the problem of missing observations.

[17] Estimates are available from the author upon request.

[18] According to Cigno and Rosati (2002), universal income subsidies are an expensive way of subsidizing parents, while income subsidies targeted at poorer families are more cost effective.

[19] For simplicity, we analyse the case in which parents are workers who can or cannot be in competitive labour markets. The same reasoning applies if they are subcontractors and the wage is replaced by the price of their products sold to an upstream producer with a given degree of market power.

[20] The concavity of $U_i(x_i)$ for any i ($i = 1, 2$) is a sufficient condition for having all cross-derivatives in [A5] with the same sign.

[21] For more details on the negative binomial function see Cameron and Trivedi (1986, 1998).

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