The effect of globalization and credit market imperfections on the incidence of child labour

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Abstract

Purpose – The purpose of this paper is to explore the effect of globalization and credit market imperfections on child labour.

Design/methodology/approach – Analysis is based on cross-country regression framework, incorporating 129 developing countries for the period 1970-2010.

Findings – The findings indicate that countries that are more open to trade and having higher foreign direct investment inflow have lower incidence of child labour. As child labour in export-related industries is hard to find, trade sanctions may not have a significant effect on child labour. Further study concludes that income of the bottom quartile of the population is the best representation of the income of the poor when studying child labour.

Research limitations/implications – The study uses the data compiled by International Labour Organization (ILO). Though much of the variation in the data is because of the adjustments made by ILO, this is the only comparable cross-country estimates available. Hence in the absence of the cross-country comparable estimates, many empirical studies have used this data set (e.g. Cigno *et al.*, 2002; Dehejia and Gatti, 2002; Rogers and Swinnerton, 2001). This study acknowledges this limitation but again in the absence of any comparable estimates, the assessment is also based on this data set.

Originality/value – Study contributes in the literature by comparing the effect of export and trade and by exploring the effect of an alternate measure of the income, estimated by using Gini coefficient, on child labour. Further studies exploring the effect of globalization did not explore the presence of imperfect credit market, however, this study has explored the effect of credit market imperfections as well.

Keywords Development, Globalization, Income distribution, Trade, Child labour, FDI and credit market

Paper type Research paper

1. Introduction

The purpose of this paper is to investigate the link between globalization, defined as an increase in trade openness and penetration of foreign direct investment (FDI), and the incidence of child labour while taking into account the role of credit market imperfections. The empirical assessment is based on the panel data comprising of 129 developing countries for four decades from 1970 to 2010. The basic proposition is that trade sanctions may reduce the demand for unskilled workers and minimize their wages; poor families when unable to borrow may have no alternative but to send their children to work. The paper contributes to the existing literature of globalization and child labour not only by exploring the role of credit market imperfections but also by highlighting the changes in exports, incorporating the Jafarey and Lahiri (2002) model of trade sanction and credit market imperfections. It further critically examines Edmonds's (2009) argument that the channel through which trade could affect child labour is income because the proportion of child labour in the exporting sector is negligible.

There already exists an extensive amount of literature on the factors explaining incidence of child labour but it primarily focusses on modelling the demand and supply of child labour and determining its welfare implications. Very few studies have empirically tested the effect of globalization and credit market imperfection on the incidence of child labour. According to Edmonds and Pavcnik (2006), the interaction of trade and child labour has received considerable theoretical attention but empirical evidence on the topic is very scarce.

JEL Classification — F16, J21, O15, O16

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On the theoretical sides Maskus (1997) showed that opening up to trade raises the output of the exportable sector and thus increases the demand for child labour and child wages. Working on two-sector general equilibrium model Chaudhuri and Gupta (2004) pointed out that the effect of trade on incidence of child labour crucially depends on the relative factor intensities within the sectors. Jafarey and Lahiri (2002) presented a two-period two-good model to demonstrate that trade can increase child labour among poor households; a possibility that decreases as their access to credit improves. More recently Dwibedi and Chaudhuri (2010) using three-sector general equilibrium model, demonstrate that an inflow of foreign capital leads to an increase in both adult unskilled wages and skilled wages; and a decrease in child wage rate and a fall in the return to capital.

On the empirical sides, Cigno *et al.* (2002) found out that trade openness[1] is negatively associated with the child labour force participation rate, but not with the primary school non-attendance rate. Edmonds and Pavcnik (2002) found that greater market integration is associated with less child labour. Considering the possible endogeneity in trade, Edmonds and Pavcnik (2006) analyse the effect of trade on child labour. Their result shows that openness is negatively associated with child labour if income is excluded from the regression model, concluding that trade lowered child labour, but via its positive effect on per capita income.

After rejecting the presence of possible endogeneity in their model, Neumayer and Soysa (2005) examined the relationship between trade openness, FDI and child labour. From their findings it is quite evident that countries more open to trade and having a higher stock of FDI have a lower incidence of child labour. Davies and Voy (2009) exploring the role of financial development (FDI) and trade, after correcting the endogeneity in both trade and FDI, concluded that FDI and trade openness results in reducing the incidence of child labour by increasing the income.

The extent that child labour is caused by capital market imperfections is studied in great detail by Ranjan (2001) and Beegle *et al.* (2005, 2006). According to these studies, capital market imperfections interfere with the parents' ability to make inter-temporal trade-offs. Child labour can arise due to credit constraints such as the absence of well-functioning capital markets. Ranjan (2001) presents a positive relationship among the inequality in income distribution, capital market imperfections and the incidence of child labour. Beegle *et al.* (2006) observe how a transitory income shock leads to an increase in child labour and how household access to credit moderates the effects.

The above-mentioned studies can easily be sub-divided into two broad groups: first incorporates the effect of trade (a few also include FDI as well) on child labour, while the second investigates the effect of income inequality and credit market imperfections on child labour. The end result is that studies have either looked into the effect of trade only, or the effect of credit only. For example, the three most recent studies on globalization which addressed the issue of endogeneity first time, i.e. Edmonds and Pavcnik (2006), Neumayer and Soysa (2005) and Davies and Voy (2009) do not take into account the role of credit market. Although Jafarey and Lahiri (2002) theoretically demonstrate that countries more open to trade are more likely to have lower interest rates and a developed credit market which lowers the opportunity cost of schooling and thereby reduces child labour. Further to this, another neglected issue is the presence of possible endogeneity in the credit variable, and although the issue is not explicitly raised in any of the studies, Dehejia and Gatti (2005) split the countries in their sample into low and high credit groups to control for the presence of endogeneity.

Moreover, all of the above-cited studies have either explored the role of international trade, FDI or credit market imperfections on the incidence of child labour, overlooking the effect of changes in export due to trade sanctions. The effect was first discussed by Maskus (1997) and is taken up more recently by Jafarey and Lahiri (2002). According to

these two studies, overall incidence of child labour may decline due to income effect of the trade but in export-related industries child labour incidence could increase due to the result of an increase in demand for cheap labour.

Keeping all these arguments into consideration this paper evaluates the effects of international trade, FDI and credit market imperfections on the incidence of child labour. It also tests empirically the model presented by Jafarey and Lahiri (2002) by taking into account the effect of changes in export on child labour. Particularly, the study addresses the following three sets of questions:

(1) After controlling for endogeneity does income remains a significant determinant of the child labour participation rate – is the effect sensitive to different measures of income? What role does inequality in income play?

(2) Do credit markets or financial development matter for the child labour incidence rate with particular reference to trade sanctions? Does the endogeneity in credit market matter?

(3) What role does globalization (captured via trade volume and penetration of FDI in the economy) play? Does it lead to more child employment? – Is the effect channelled through income? Does the effect of trade differ from the effect of exports?

The rest of the paper is organized into following sub-sections: Section 2 discusses theoretical foundation for the study, Section 3 sheds light on the estimation technique, Section 4 describe the data employed, Section 5 discusses the results and final section concludes.

2. Theoretical foundation

Empirical analysis of this paper is based on the theoretical model which was proposed by Jafarey and Lahiri (2002) and on arguments put forth by Edmonds (2009). Jafarey and Lahiri (2002) considered a case of small open economy, net exporter of unskilled goods, having two periods and producing two goods per period. Assuming the normality in all goods, Jafarey and Lahiri evaluated the household education decision as a function of price and a given interest rate. They came up with the conclusion that with the increase in interest rate, the welfare of the lender rises while that of the borrower falls, this induces a lower choice of schooling decision. Jafarey and Lahiri precede their analysis by considering three scenarios in credit market.

In scenario I, all the households can borrow and lend freely in a perfectly competitive credit market that links to the international market. In this case the interest rate is exogenously given and is equal to world interest rate. Under scenario II, Jafarey and Lahiri assume that borrowing is subject to a quantitative constraint. In scenario III, households borrow from the domestic credit market. In this case rich and poor household exchange loan and discount rate for each household is equal to the equilibrium interest rate. Jafarey and Lahiri use the condition that education for rich household is equal to 1. Therefore, rich households can increase their savings only through lending in the credit market.

After analysing the equilibrium in the credit market, Jafarey and Lahiri introduce the effect of trade sanction on the incidence of child labour. As a country is a net exporter of unskilled goods, trade sanctions will result in a fall in the price of unskilled goods in period 1. A reduction in price reduces the welfare of the unskilled families. Jafarey and Lahiri have shown that a decrease in the price of the exportable, for a given level of real income, would reduce the opportunity cost of education (a substitution effect) and therefore might result in an increase in education. On the other hand a decrease in the price would also decrease real income thus discourage education (the income effect). Hence, the two effects are opposite while changes in education outcome via interest rate means an increase in interest rate reduces education outcome.

Overall, Jafarey and Lahiri suggest that a decrease in the price of unskilled goods has the potential to decrease education (increase child labour) if the income effect dominates the substitution effect. Their results hold even for the internationally perfect credit market as well. Similarly, any increase in the level of schooling will also raise future income and therefore the demand for loans will also arise. This indirectly raises the interest rate. Jafarey and Lahiri demonstrate that a decrease in the price increases the supply of loans. According to them, a decrease in the price of the unskilled labour-intensive products will result in a rise in the income of the rich household as they do not participate in the production of unskilled goods. This will increase the supply of loan because education cannot be increased. Further, Jafarey and Lahiri also compare the effects of a trade sanction using two different approaches. In the first approach, the borrowing constraint is assumed to be preventing loans from adjustment. In the second approach, market freely adjusts to a new equilibrium. According to Jafarey and Lahiri, the trade sanction is less likely to lead to perverse effects on child labour if the supply of loans can adjust in a competitive domestic credit market than if it cannot.

However, Edmonds (2009) is of the view that trade affects children in developing countries by changing relative prices and altering living standards. Edmonds supports his proposition on the basis of two reasons. First, for the poor, the standard of living is the single most important determinants of child labour. Second, children are rarely engaged in work that is connected to trade. In poor developing countries, agriculture is the largest sector employing children. Within manufacturing sectors, firms that trade usually hire skilled labour. Hence, the direct effects of trade on child labour through wages paid in the trade sector will be minimal. According to Edmonds (2009), trade raises the income and in turn reduces child labour while opponents of globalization are mostly concerned about the fact that trade increases the product demand and thus increases child labour. According to him, this is unlikely to happen as proportion of children employed in trade sectors are negligible.

Furthermore, there is again ambiguity in determining the effect of FDI on child labour. Neumayer and Soysa (2005) have presented two types of arguments. First, they explain that developing countries usually have low labour standards, low wages and an abundant supply of unskilled labour, including child labourers, and therefore are regarded as being a heaven for foreign investors. A higher extent of child labour could cut the cost of production which results in a competitive advantage. Hence, increases in FDI raises the relative wage of unskilled workers, including children, leading to an increase in child labour supply by increasing the opportunity cost of schooling. Second, they argue that the above case may not necessarily be realized, as foreign investors might not be enthusiastic in exploiting cheap labour than is assumed. Other factors such as market size, economic growth, political stability, infrastructure and abundance of skilled labourers are often as important as low wages (Neumayer and Soysa, 2005).

Finally, as child labour is a poverty-driven phenomenon, any increase in income beyond the subsistence level of living will reduce child labour. Trade may increase the income of the poor families, this may help parents to reduce the work load of the children and send them to schools. Therefore, there may exist a straight-forward negative relationship between income and child labour. However, Edmonds and Pavcnik (2006) and Dagdemir and Acaroglu (2010) rejected the linearity in the effect. Both authors found a U-shaped relationship between income and child labour supply. This paper also assumes the same.

3. Methodology

Child labour has always been considered as a phenomenon which is poverty driven but as mentioned earlier this study specifically explores the link between globalization,

income and credit with child labour. In order to do so the following simple model is estimated:

$$Cl_{it} = \beta_0 + \beta_1 Trd_{it} + \beta_2 FDI_{it} + \beta_3 Crdt_{it} + \beta_4 Incm_{it} + \beta_5 Incm_{it}^2 + \beta_6 X_{it} + \mu_i + \varepsilon_{it} \quad i = 1, \ldots, N \text{ and } t = 1 \text{ to } T \tag{1}$$

where Cl_{it} is the percentage of economically active children in the age group of 10-14; Trd_{it} is a measure of trade openness which in the later case was replaced by export (% GDP); FDI_{it} is the inflow of FDI; $Incm_{it}$ and $Incm_{it}^2$ are the real GDP per capita and its square representing income which again in later stages replaced by the income of the bottom quartile population (see Section 3.2 for detail); $Crdt_{it}$ is the domestic credit provided by the banking sector as a percentage of GDP. All the variables of interest are in the log form. The log independent variables are used after checking Akaike information criterion (AIC) and Bayesian information criterion (BIC) statistics and after running the Davidson and Mackinnon (1985) test for model specification. X_{it} is a set of control variables as in order to determine the strength of the relation one must control for other potentially important variables. The existing literature provides extensive guidance in this regard. This study includes share of agriculture sector in GDP (AGR_{it}), share of mining and manufacturing sector in GDP ($MANF_{it}$), average year of adult schooling ($YRSCH_{it}$), pupil teacher ratio (primary) ($PUPTECH_{it}$), female labour force participation rate ($FLFPR_{it}$) and aid (% GNI) as control variables in the model. μ_i represents country-specific effect, i represents country and t represents time.

Average year of adult schooling and pupil teacher ratio are included in the model in order to predict the effect of schooling on child labour. More explicitly pupil teacher show the effect of quality of schooling, as most of the children drop out before completing the primary schooling. The study hypothesizes the positive effect of this variable on child labour. Second, the reason behind including average year of adult schooling is to evaluate the effect of skill attainment on child labour. Children often drop out from school to get involved into paid work. Hence, countries with low educational attainment will have unskilled labour in abundance, including child labour. Female employment is likely to empower women by enhancing their status and increasing their decision-making power. This will tend to result in the improvement of child condition/welfare. Therefore, any increase in this variable will reduce child labour incidence. However, there could be an opposite effect if the variable captures the labour market effect. For example, there is evidence for the fact that usually women enter the job market when the earnings from their male counter parts decrease from the subsistence level of living. They are usually involved in home-based work or self-employment, where they often involve children in simple work. Hence, for this variable, the study expects that if it captures the effect of gender and development it will have a negative sign while if it captures the effect of labour market it will have a positive sign.

Furthermore, the share of agriculture sector is included in the model as child labour is often considered as a rural phenomenon, hence, share of agriculture sector is assumed to have a positive effect while manufacturing sector may have either positive or negative effects depending upon the requirement of skill composition. For example, it may have a negative effect if the sector requires more skilled labour than unskilled while the effect could be positive if the production process involves unskilled labour in abundance. Finally, the role of aid in reducing child labour is also interesting, something that past studies have ignored. The reason behind inclusion is to evaluate the claim that child-labour laws only worked in countries where the standards of living had risen to a level where it has no longer remained an economic necessity for children to work. Child labour could automatically end with the economic development. Trade sanctions and boycotts are considered as counter-productive because these retard economic growth. Foreign aid is considered as a growth promoting instrument though aid may not be the only solution for long-term development or growth.

3.1 Estimation technique

Simple OLS estimation of Equation (1) relies on the assumption that explanatory variables are not correlated with the error term ε_{it}. If Cl_{it} and any of the variables of interest are simultaneously determined or if the model has omitted variable bias, then this assumption is violated, and OLS estimates will be biased. In this study, Trd_{it}, FDI_{it} and $Incm_{it}$ have simultaneity bias while $Crdt_{it}$ might have omitted variable bias. Income is endogenous as income explains presence of child labour while child labour also affects income. FDI is endogenous as it reduces child labour but it might be the case that child labour affects FDI. For example, countries with high incidence of child labour will also have low skilled labour in abundance and literature suggests that FDI is often attracted to countries where skilled labour is in abundance. Trade openness is endogenous because availability of child labour and labour standards determines trade flows while trade expansion also affects child labour as explained earlier.

Finally, credit is endogenous because in some countries it is easier to have access to credit as compared to others; this is the issue of omitted variables bias – i.e. there are variables that could correlate with credit availability but are unobservable such as a well-developed infrastructure. Menon (2010) points out that credit could be endogenous for two reasons: first, household will borrow only when they consider themselves having experience in managing the funds (Menon, 2010 considers this as an issue of self-selection bias). Second, some areas have easier access to credit as compared to other areas; this might be because of the well-developed infrastructure (Menon considers this issue as having omitted variables bias). Presence of self-selection problem and omitted variables bias results in endogeneity problem. Hence, OLS estimates will be biased. Instrumental variable (IV) regression method is an appropriate solution for the problem. Therefore, for estimating Equation (1) IV approach is followed. As the data are panel data, both time-specific and country-specific test are applied to check if the country and time-specific controls are needed. *F*-statistics indicate that both country and time-specific intercepts are needed.

Furthermore, prior to the estimation, the presence of endogeneity is tested. The study performed the Durbin-Wu-Hausman test in order to see if endogeneity is present in the data. In the entire regressions, Durbin-Wu-Hausman test rejects the null hypothesis that variables are exogenous and thus confirms the presence of endogeneity in all the system of equations (see last rows of Tables I-V). After confirming the endogeneity the next step is to find suitable instrument for the variables and to check whether or not the instrument used passed the over identification tests (OID). The insignificant OID test confirms that instruments are over identified. Another related issue is strength of the instrument used. In order to check, *F*-test is performed on the instrument selected. A probability of *F*-test less than 0.05 shows that the instruments used are not weak.

Finally, to handle the issue of presence of zero in the dependant variable the study applied Tobit model. This is because working on the International Labour Organization (ILO) estimates of economically active population aged 10-14, the study came across samples of countries having zero values. The reason behind this is that in many countries, labour force survey does not collect work-related information on children under age 15. Hence, ILO database reports zero participation rates for children in these countries. On one hand, the zeros could be interpreted as "missing values" and these observations could be discarded. However, this is likely to lead to biased estimates if the zero rates reflect reality in those countries. The vast majority of countries for which zeros are reported are wealthier, more developed ones. The study first excluded the countries that are classified by the World Bank as high or upper-middle income countries; the sample is now left with only low and middle income countries and the zeros left in the remaining sample are treated as censored data. This justifies the estimation of Tobit model using IV. Therefore, in order to control the censored data and to check the robustness of the estimated model, the study re-estimated the Equation (1) using Tobit model as well. However, the Tobit model is not used here as a

Dependent variable	Real GDP per capita
Log FDI (inflow)	0.07 (0.04)**
Log bank credit to private sector (% GDP)	0.13 (0.13)
Log of trade openness	12.11 (0.10)***
Share of agriculture sector in GDP	−0.04 (0.00)*
Share of manufacturing sector in GDP	−0.01 (0.18)
Adult average year of schooling	0.02 (0.50)
Pupil teacher ratio primary	0.00 (0.71)
Female labour force participation rate	0.00 (0.27)
Aid (% GNI)	−0.01 (0.05)**
Region 2	0.34 (0.09)***
3	0.26 (0.16)
4	0.17 (0.51)
6	0.04 (0.87)
7	0.03 (0.88)
Year 1980	0.63 (0.26)
1990	1.15 (0.04)**
2000	0.76 (0.15)
2010	0.92 (0.09)***
Constant	5.94 (0.00)*
F/χ^2 test	23.16
n	276
R^2	0.82

Table I. Determinants of income (country fixed effect)

Notes: Regional Dummies Represents: East Asia and Pacific = 1; Europe and Central Asia = 2; Latin America and Caribbean = 3; Middle East and North Africa = 4; North America = 5; South Asia = 6 and Sub-Saharan Africa = 7. Numbers in parenthesis are p-values. *,**,***Significant at 1, 5 and 10 per cent levels, respectively

main estimation technique because it relies on two assumptions: heteroskedasticity and normality of the error term, and if these assumptions fail the estimates will be inconsistent (see Madala, 1992; Deaton, 1997 for more discussion).

3.2 Measurement issue

So far, theoretical foundations of estimation and characters of data have been examined and highlighted the statistical problems – principally endogeneity. This section highlights the problem related to measuring income of the poor before proceeding to identify the instruments applied. To measure the income of the poor, cross-national studies have often used real GDP per capita but researchers pointed out that GDP per capita could predict misleading effect. For example, Swinnerton and Rogers (1999) and Tanaka (2003) stress that income inequality is more closely related to child labour than simple real GDP per capita. According to the authors, GDP per capita does not represent the economic equality among the population of the country and only a small percentage of the population holds most of the nation's wealth, thus GDP per capita may not describe the situation accurately. Therefore, based on the methodology given by Dollar and Kraay (2000), this study developed another proxy for income of the poor using data of Gini coefficient and bottom quartile income share – Q1, i.e. income accruing to the bottom fifth population as a measure of income of the poor. Dollar and Kraay (2000) define the poor as those in the bottom fifth of the income distribution of a country. Dollar and Kraay (2000) used two approaches for measuring the income of the poor, they first defined the poor as the poorest 20 per cent of the population. Then they obtained the information on the share of income accruing to the poorest quartile. They measured mean income in the poorest quartile directly, as the share of income earned by the poorest quartile times mean income (real GDP per capita), divided by 0.2. For the countries for which they have information on the Gini

Dependent variable: child labour (all)	Fixed effect test			Tobit	
	With RGDP	Without RGDP	Above threshold income sample	With RGDP	Without RGDP
Log RGDP per capita	−76.83 (0.00)*	–	−5.69 (0.24)	−37.74 (0.00)*	–
Square of Log RGDP per capita	4.04 (0.00)*	–	–	1.26 (0.01)*	–
Log FDI (inflow)	−0.39 (0.78)	−2 (0.07)***	0.67 (0.71)	1.75 (0.28)	−3.01 (0.001)*
Log bank credit to private sector (% GDP)	−0.26 (0.94)	4.46 (0.16)	−4.64 (0.70)	−0.15 (0.12)	−0.16 (0.153)
Log of trade openness	−3.09 (0.20)	−5.35 (0.02)**	1.92 (0.72)	−2.04 (0.37)	−7.16 (0.00)*
Share of agriculture sector in GDP	−0.35 (0.21)	0.27 (0.09)***	−0.70 (0.56)	−0.42 (0.006)*	−0.05 (0.666)
Share of manufacturing sector in GDP	−0.10 (0.40)	0.01 (0.90)	−0.28 (0.64)	−0.15 (0.02)*	−0.13 (0.05)*
Adult average year of schooling	−1.91 (0.01)*	−3.07 (0.00)*	0.27 (0.68)	−2.16 (0.00)*	−3.01 (0.00)*
Pupil teacher ratio primary	0.08 (0.38)	0.14 (0.14)	0.01 (0.96)	−0.05 (0.45)	0.01 (0.847)
Female labour force participation rate	0.18 (0.00)*	0.17 (0.01)*	−0.04 (0.84)	0.14 (0.00)*	0.11 (0.002)*
Aid (% GNI)	−0.39 (0.00)*	−0.24 (0.00)*	−0.95 (0.75)	−0.24 (0.00)*	−0.14 (0.00)*
Region 2	5.91 (0.14)	10.38 (0.01)*	−6.11 (0.53)	0.57 (0.87)	−1.9 (0.61)
3	3.12 (0.34)	3.12 (0.35)	−3.16 (0.70)	5.4 (0.071)*	−2.09 (0.41)
4	2.63 (0.55)	4.24 (0.36)	6.10 (0.45)	0.51 (0.85)	−2.66 (0.32)
6	3.23 (0.40)	4.10 (0.31)	–	6.75 (0.05)**	0.7 (0.827)
7	7.36 (0.03)**	10.80 (0.00)*	−6.97 (0.51)	9.08 (0.00)*	6.71 (0.01)*
Year 1980	8.35 (0.43)	−9.12 (0.33)	–	11.15 (0.00)*	−1.29 (0.50)
1990	12.82 (0.22)	−4.52 (0.63)	–	16.57 (0.00)*	1.52 (0.46)
2000	11.11 (0.21)	−2.25 (0.79)	−3.77 (0.61)	14.2 (0.00)*	4.4 (0.12)
2010	11.10 (0.22)	−1.30 (0.87)	–	16.34 (0.00)*	8.6 (0.03)*
Constant	342.7 (0.00)*	−13.7 (0.60)	90.82 (0.42)	186.3 (0.00)*	20.9 (0.27)
F/χ^2 test	24.03	23.02	9.35	68.96	64.89
n	328	328	25	(274 + 54 – Censored)	
R^2	0.83	0.81	0.38	0.242	0.234
OID test	0.39	–	–	–	–
p-value OID test	0.53	–	–	–	–
Endogeneity test $\chi^2(3)$	6.62 (0.08)	–	–	–	–

Notes: Estimation technique used is 2SLS based on countries fixed effect. Income, credit and FDI are instrumented by investment (% GDP), rural population as per cent of total, index of political rights and number of telephone lines while instrument for trade openness is based on gravity model. *,**,***Significant at 1, 5 and 10 per cent levels, respectively

Table II. Determinants of child labour (country fixed effect otherwise mention)

coefficient but not on the first quartile share, they assumed that the distribution of income is lognormal, and thus the share of income accruing to the poorest quartile as the 20th percentile of this distribution was obtained. According to them if the distribution of income is lognormal, i.e. log per capita income follows $N(\mu, \sigma)$ and the Gini coefficient on a scale from 0 to 100 is G, the standard deviation of this lognormal distribution can be obtained by:

$$\sigma = \sqrt{2}.\varnothing^{-1}\left(\frac{1+G/100}{2}\right) \quad (2)$$

where $\varnothing(.)$ denotes the cumulative normal distribution function. According to Dollar and Kraay (2000), by using the properties of the mean of the truncated lognormal distribution, the 20th

Dependent variable: child labour (all)	With RGDP	Without RGDP	With Q1	Without Q1
Log RGDP per capita	−76.83 (0.00)*	–	–	–
Square of Log RGDP per capita	4.04 (0.00)*	–	–	–
Log income of bottom quartile	–	–	−56.27 (0.00)*	–
Square of the log income of bottom quartile	–	–	2.57 (0.00)*	–
Log wages per month	–	–	–	–
Square of log wages per month	–	–	–	–
Log FDI (inflow)	−0.39 (0.78)	−1.98 (0.07)*	−1.80 (0.52)	−3.6 (0.06)***
Log bank credit to private sector (% GDP)	−0.26 (0.94)	4.46 (0.16)	2.72 (0.45)	4.16 (0.26)
Log of trade openness	−3.09 (0.20)	−5.35 (0.02)*	−2.56 (0.64)	−7.35 (0.03)**
Share of agriculture sector in GDP	−0.35 (0.21)	0.27 (0.09)*	0.03 (0.88)	0.13 (0.47)
Share of manufacturing sector in GDP	−0.10 (0.40)	0.01 (0.90)	0.03 (0.82)	0.02 (0.89)
Adult average year of schooling	−1.91 (0.01)*	−3.07 (0.00)*	−3.06 (0.00)*	−3.69 (0.00)*
Pupil teacher ratio primary	0.08 (0.38)	0.14 (0.14)	0.07 (0.50)	0.06 (0.56)
Female labour force participation rate	0.18 (0.00)*	0.17 (0.01)*	0.14 (0.06)***	0.18 (0.02)**
Aid (% GNI)	−0.39 (0.00)*	−0.24 (0.00)*	−0.38 (0.04)**	−0.3 (0.07)***
Region 2	5.91 (0.14)	10.38 (0.01)*	5.70 (0.27)	10.5 (0.05)**
3	3.12 (0.34)	3.12 (0.35)	2.63 (0.53)	1.96 (0.64)
4	2.63 (0.55)	4.24 (0.36)	0.43 (0.94)	−0.45 (0.94)
6	3.23 (0.40)	4.10 (0.31)	3.86 (0.48)	2.06 (0.72)
7	7.36 (0.03)**	10.8 (0.00)*	8.21 (0.05)**	10.1 (0.02)**
Year 1980	8.35 (0.43)	−9.12 (0.33)	−9.84 (0.27)	−13.31 (0.15)
1990	12.82 (0.22)	−4.52 (0.63)	3.24 (0.75)	−2.74 (0.76)
2000	11.11 (0.21)	−2.25 (0.79)	2.25 (0.77)	−2.17 (0.79)
2010	11.10 (0.22)	−1.30 (0.87)	5.79 (0.59)	6.45 (0.57)
Constant	342.7 (0.00)*	−13.7 (0.60)	323.5 (0.00)*	8.7 (0.77)
F/χ^2 test	24.03	23.02	16.09	15.38
n	328	328	196	196
R^2	0.83	0.81	0.78	0.75
OID test	0.39 (0.53)		0.15 (0.69)	
Endogeneity test $\chi^2(3)$	6.62 (0.08)		10.19 (0.02)	

Table III.
Effect of income on child labour (country fixed effect)

Notes: Numbers in parenthesis are p-values. Estimation technique used is 2SLS based on countries effect. Income (based on Q1), Credit and FDI are instrumented by population growth, rural population as per cent of total, index of political rights and number of telephone lines; instrument for trade openness is based on gravity model. *,**,***Significant at 1, 5 and 10 per cent levels, respectively

Model	RGDP per capita	Income of bottom
Number of observation	328	328
ll(null)	−389.35	−389.35
ll(model)	−293.22	−292.37
df	21	21
AIC	628.45	626.75
BIC	708.10	706.40

Table IV.
Comparing the two proxies of income

percentile of this distribution can be given by:

$$\varnothing\left(\varnothing^{-1}(0.2)-\sigma\right) \tag{3}$$

On the basis of the methodology given in Dollar and Kraay (2000), this study also constructed the income of the poor by using the data sources such as UN-WIDER

Dependent variable: child labour (all)	With trade openness		With exports only	
	With RGDP	Without RGDP	With RGDP	Without RGDP
Log RGDP per capita	−76.83 (0.00)*	–	−75.78 (0.00)*	–
Square of log RGDP per capita	4.04 (0.00)*	–	4 (0.00)*	–
Log FDI (inflow)	−0.39 (0.78)	−1.98 (0.07)*	−0.42 (0.75)	−1.92 (0.07)***
Log bank credit to private sector (% GDP)	−0.26 (0.94)	4.46 (0.16)	−0.11 (0.97)	4.49 (0.16)
Log of trade openness	−3.09 (0.20)	−5.35 (0.02)*	–	–
Log export as ratio of GDP	–	–	−3.6 (0.2)	−5.73 (0.02)**
Log import as ratio of GDP	–	–	–	–
Log real interest rate	–	–	–	–
Share of agriculture sector in GDP	−0.35 (0.21)	0.27 (0.09)***	−0.34 (0.23)	0.27 (0.09)***
Share of manufacturing sector in GDP	−0.10 (0.40)	0.01 (0.90)	−0.10 (0.40)	0.01 (0.91)
Adult average year of schooling	−1.91 (0.01)*	−3.07 (0.00)*	−1.96 (0.01)*	−3.11 (0.00)*
Pupil teacher ratio primary	0.08 (0.38)	0.14 (0.14)	0.07 (0.40)	0.13 (0.15)
Female labour force participation rate	0.18 (0.00)*	0.17 (0.01)*	0.18 (0.01)*	0.17 (0.01)*
Aid (% GNI)	−0.39 (0.00)*	−0.24 (0.00)*	−0.39 (0.00)*	−0.24 (0.00)*
Region 2	5.91 (0.14)	10.38 (0.01)*	6.14 (0.13)	10.34 (0.01)*
3	3.12 (0.34)	3.12 (0.35)	3.15 (0.34)	3.23 (0.33)
4	2.63 (0.55)	4.24 (0.36)	2.79 (0.53)	4.22 (0.36)
6	3.23 (0.40)	4.10 (0.31)	3.25 (0.40)	4.05 (0.32)
7	7.36 (0.03)**	10.80 (0.00)*	7.56 (0.02)**	10.85 (0.00)*
Year 1980	8.35 (0.43)	−9.12 (0.33)	8.31 (0.43)	−8.82 (0.35)
1990	12.82 (0.22)	−4.52 (0.63)	13.34 (0.20)	−3.54 (0.71)
2000	11.11 (0.21)	−2.25 (0.79)	11.36 (0.20)	−1.85 (0.82)
2010	11.10 (0.22)	−1.30 (0.87)	11.36 (0.21)	−0.88 (0.91)
Constant	342.7 (0.00)*	−13.7 (0.60)	329.6 (0.00)*	−22.8 (0.42)
F/χ^2 test	24.03	23.02	24.03	23.14
n	328	328	328	328
R^2	0.83	0.81	0.83	0.81
OID test	0.39		0.37	
p-value OID test	0.53		0.55	
Endogeneity test $\chi^2(3)$	6.62		6.68	
p-value	0.08		0.08	

Notes: Numbers in parenthesis are p-values. Estimation technique used is 2SLS based on countries effect. *,**,***Significant at 1, 5 and 10 per cent levels, respectively

Table V.
Effect of trade, exports and imports on child labour (country fixed effect)

(World Income Inequality Database) and Estimated Household Income Inequality (EHII Data Set). UN-WIDER is a substantial extension of the income distribution data set constructed by Deininger and Squire (1996) and Lundberg and Squire (2000). However, incorporating the above measure another problem emerges, i.e. for most of the countries; data for poorest quartile is not available. Using this variable thus means reducing the sample size substantially. For most of the countries, data of Q1 beyond 2000 is also not available. Although, it may best reflect income of the poor but in the absence of sufficient data, this study limited the main analysis by using real GDP per capita as proxy for income. Nevertheless, realizing its importance, a separate analysis is done based on only those countries in the sample that have reported data of Q1 and Gini coefficient.

3.3 Instrument for FDI, credit and income of the poor

The basic strategy in IV estimation is to find an estimator that should be correlated to the endogenous variables but not with the dependent variable (child labour). It is hard to find valid instruments. As far as instrument for income is concerned, the literature includes the following widely used instruments: growth rate in real GDP per capita, initial real GDP per capita,

investment to GDP ratio, government consumption expenditure (measuring size of the government) or lagged values of real GDP per capita. For credit, the literature has identified price of the credit or the costs associated with gaining access to credit, as valid instruments. The price of credit is interest rate on the loan but the data on real interest rate have large number of inconsistencies and missing values. Because of this limitation infrastructure development is used as an instrument. It is hypothesized to correlate with gaining information on borrowing. As far as valid instrument for FDI is concerned, the only study that controls endogeneity in FDI within the child labour framework is done by Davies and Voy (2009)[2]. Hence, finding IV for FDI turns out hard and tricky. Recent literature on FDI and growth indicates that FDI is greatly influenced by host country policies, infrastructure development, political situation, etc.

Thus, after a thorough review of literature available and based on the Wu-Hausman, OID and *F*-test, the following instruments are selected: investment as per cent of GDP, rural population as percentage of total population, index of political rights (index of political right was first used by Davies and Voy (2009) as instrument for FDI) and number of telephone lines (indicator of infrastructure development) when real GDP per capita is in the model. Population growth instead of investment as per cent of GDP is used to instrument income of the bottom quartile population. Inclusion of these variables significantly increases the explanatory power of the estimated coefficients.

3.4 Instrument for trade openness and export

As far as instrument for trade openness and export (% GDP) is concerned, the two most recent studies on the relationship between globalization and child labour have used the gravity model to identify the exogenous component of trade (Edmonds and Pavcnik, 2006; Davies and Voy, 2009). Hence, the study adopted gravity model approach to create the instrument for trade openness and export as well. The equation estimated for the instrument is as follows:

$$Ln\left(Trd_{ijt}/GDP_{it}\right) = \beta_0 + \beta_1 Ln\left(distance_{ij}\right) + \beta_2 Ln\left(pop_{jt}\right) + \beta_3 comnlang_{ijt} + \beta_4 border_{ij} + \beta_5 parea_{ijt} + \beta_6 landlock_{ijt} + \mu_{ijt} \quad (4)$$

where $Ln(Trd_{ijt}/GDP_{it}) = Ln(export_{ijt} + import_{ijt})/GDP_{it}$, $Ln(Trd_{ijt}/GDP_{it})$ is calculated as the natural log of the sum of trade flows between countries i and j divided by country is' GDP; $Ln(distance_{ij})$ is the log of the distance between countries i and j; $Ln(pop_{jt})$ is the country js' population; $parea_{ijt}$ is the product of the area of country i and j in square kilometres; $comnlang_{ijt}$ is a dummy variable equal to 1 if the countries share a common language; $border_{ijt}$ is a dummy variable equal to 1 if the countries share a common border; $landlock_{ijt}$ measures the number of landlocked countries (0, 1 or 2); t is the time period (1970, 1980, 1990, 2000 and 2010).

The same equation was re-estimated after replacing $Ln(Trd_{ijt}/GDP_{it})$ with $Ln(EXPRT_{ijt}/GDP_{it})$ and after assuming that the variables that determine trade between two countries will also determine the export between the two countries. Thus, the instrument for trade openness also represents the instrument for export. We instrumented openness and export based on the geography of country i. The predicted values for the bilateral openness and export from the above equation are then summed for country i across its trading partners. In order to check the endogeneity in trade and exports, the Hausman test approach is applied. Hausman test indicated the presence of endogeneity in the two variables. Therefore, this study uses the predicted value of trade and export in all the analysis.

4. Data sources

The study uses the data on percentage of the population 10-14 year olds that are engaged in work. Data are taken from the ILO database of *Economically Active Population, Estimates and Projections* (*EAPEP* – 4th editions (1996)). The data are available with ten-year intervals. For empirical assessment, the study uses the data of 129 developing countries from 1970 onward. The ILO has computed the activity rates by using the household survey data of individual countries. In order to make the data comparable across countries and time, several adjustments had been made by ILO. The adjustments were made because the individual country survey data vary in terms of definition of economically active population followed, geographical areas covered, type of survey available, age groups considered, etc. Furthermore, survey years also differ for each country. Although *EAPEP* provides comparable information on individual countries across time but the problem with this data is that very few countries have multiple observations available over time. Therefore, much of the variation in child labour data is because of the imputations and adjustments made by ILO. This puts a question mark on the reliability of the estimates as well. However, in the absence of the cross-country comparable estimates with respect to time, many empirical studies have used this data set for the assessment purpose (e.g. Cigno *et al.*, 2002; Dehejia and Gatti, 2002; Rogers and Swinnerton, 2001 and many others). Although this study acknowledges the limitation of this data set but in the absence of any comparable estimates, the empirical assessment is also based on this data set as well.

Domestic credit to private sector (% GDP) is included to serve as a proxy for the degree of financial market imperfections and credit market constraints. The data are taken from the World Bank Development indicator. In order to develop the income of the bottom quartile of the population, the data on Gini coefficients and Q1 (bottom quartile income share) are compiled using different sources. The main source is UN-Wider developed by The World Bank. UN-Wider database includes the database of Deininger and Squire (1996) and Lundberg and Squire (2000). In addition to these, some more information is also taken from EHII Data Set, downloaded from: http://utip.gov.utexas.edu/data.html. To come up with the instrument for trade openness, the bilateral trade data are taken from Direction of Trade Statistics and UN Comtrade database while geographical characteristics are from CEPII database (www.cepii.fr/anglaisgraph/bdd/gravity.htm). Data on real GDP per capita are taken from the Penn World Table 6.3 (adjusted on PPP). Average year of adult schooling is from Barro and Lee's data set. Share of different sectors representing size of different sectors such as agriculture, mining and manufacturing comes from UN-Statistics Division. Data on pupil teacher ratio (primary level) are again compiled by using different sources such as UNESCO and World Bank Education Statistics. Rest of the data, such as data on FDI, import (% GDP), population growth, life expectancy, etc. are from World Bank Development Indicator.

5. Results

This section first highlights some determinants of income, second it discusses the main results and then compares alternative measures of income and finally discusses the role of trade openness and exports.

5.1 Determinants of income – effect of trade and FDI inflow via income

From the discussion, it is evident that variables such as trade and FDI may not only have direct (substitution effect) effect on incidence of child labour but may affect indirectly through income (income effect). This may be true for other variables as well. In this section, we explore the variables having indirect affect via income. Table I presents the results. Both FDI and openness to trade have positive and significant correlation on log real GDP per capita. Positive and significant effect of trade openness and FDI indicate that trade and FDI increase income. Therefore, trade and FDI may affect child labour through income. The phenomenon as

explained earlier may work in following way: expansion in trade and penetration of FDI generates employment opportunities that affect wages and thereby income, which in turn helps poor families to reduce child labour supply. But here one should remember that an increase in employment opportunity may increase child labour incidence as well. The overall effect of trade and FDI inflow hence depends on the magnitude of the effect of the two.

In addition to the trade and FDI inflow, share of the agriculture sector shows a significant effect. The effect of share of the agriculture sector is negative. The negative effect on income means that any increase in the share of the agriculture sector will lead to lower economic development and thereby lower the income of the poor. This may result in an increase in child labour incidence. As far as foreign aid is concerned, the study expects that it will promote economic growth and thus will assist in reducing child labour. Its negative effect on real GDP per capita is puzzling but not surprising. There exist two strands in the literature: one claims that a positive relationship exists between aid and economic growth, while the other literature claims that the relationship is negative between the two. The positive relation is based on the argument that foreign aid supplements domestic resources and encourages savings thereby leading to economic growth. The second view (claiming negative effect) stressed that foreign aid substitutes rather than supplementing domestic resources. The negative relation between foreign aid and economic growth could exist because of the factors such as economic policies, state intervention, business cycles and stability of foreign aid flows in the recipient countries. Furthermore, the results also indicate that average year of adult schooling, female labour force participation rate and credit availability have positive but insignificant effects on real GDP per capita.

5.2 Results based on real GDP per capita

As explained earlier, the study investigates the role of real GDP per capita in reducing if not eliminating child labour. It was found that the role of income in reducing child labour is highly significant. The proposition that child labour is poverty driven seems to be a powerful justification. Explicitly, a 10 percentage point increase in real GDP per capita was found to reduce the incidence of child labour by almost 8 percentage point after controlling for possible endogeneity[3] (while standardized beta coefficients predict that one standard deviation increase in income will reduce child labour incidence by almost 5 per cent). This answers the first part of the first question: income remains a significant determinant even after controlling for endogeneity. In addition to this, non-linearity in income variable is also tested by including the square of the log real GDP per capita. The positive and significant coefficient of the quadratic term shows the non-linear effect of income on child labour. Therefore, it can be concluded from the analysis that the effect of income on the incidence of child labour is non-linear.

Turning to the next question, i.e. whether globalization affects child labour or does the effect channels through income? It is evident from Table II that the effect of trade and FDI is insignificant. However, Edmonds and Pavcnik (2006) argued that the effect of trade is only significant when income is excluded from the model. Hence, as a next step, the study re-estimated the model without income. In the absence of income the effect of trade and FDI now turns significant and negative. This shows that the effect of trade and FDI could channel through income, i.e. the effect of globalization on reducing child labour incidence is indirect and works through income. The phenomenon may work like this: globalization increases the employment opportunities in an economy thereby increasing the income (recall Table I for positive effect of trade and FDI on real GDP per capita) while increase in income reduces child labour incidence (see Table II for negative effect of income on child labour). Using estimates from Equation (1), precisely one standard deviation increase in trade openness was found to be associated with the reduction of almost 0.21 per cent child labour, while one standard deviation increase in FDI inflow was found to be reducing the child labour by almost 0.33 per cent.

After exploring the effect of income and globalization on child labour incidence, the study now turns to investigate the role of credit market. It is assumed that if the poor and unskilled families face the borrowing constraints then whenever trade lowers the wages of poor families, the incidence of child labour will increase. Consequently the study expects a negative association between credit market imperfections and child labour. However, the study does not find strong support for the assumption, as the coefficient of credit variable is negative but insignificant. Hence, overall for credit market, study concludes that it may not have significant effect as both trade and FDI are already considered as important factors in reducing child labour through an increase in the income. Therefore, demand for borrowing to cope up with the income shock does not show significant effect.

After exploring the main variables, we now examine the effects of some important control variables. Among the control variables, average year of adult schooling shows a significant negative effect on the incidence of child labour while the effect of pupil- teacher ratio shows a relatively insignificant effect. Countries with low educational attainment usually have unskilled labour in abundance including child labour. Therefore, any increase in average adult of schooling means higher level of education attainment which may lead to a decline in the incidence rate.

Results also exhibit negative association of aid (% GNI) with child labour. This variable is incorporated to identify the channel through which growth can be promoted. Literature indicates that the aid could affect the growth and may increase the living standard of the people. This study hypothesizes that higher living standards may help in reducing child labour. Role of aid has never been explored under the framework of child labour and our result also predicts a negative effect of aid on GDP per capita, therefore, the study interpreted the negative effect of aid on child labour with caution. The study concludes that foreign aid may be effective in reducing the child labour incidence by promoting the social expenditure but in the absence of any past evidence (literature) no concrete conclusion could be drawn; aid may be effective in reducing child labour.

As far as the effect of agriculture sector on child labour is concerned, agriculture sector was found to be reducing the income (see Table I for reference) and after dropping the income from the model (see Table II) its effect on child labour seems to be positive and significant. The positive effect indicates that child labour is more of a rural phenomenon and any expansion in the agricultural activity may lead to increase in the child labour incidence. Based on the argument that female empowerment leads to the welfare of the house especially children, the study expected that the effect of female labour force participation rate will be negative. But instead it is found to be increasing child labour incidence. One possible explanation might be that in most of the developing countries (especially in Asian countries) females often participate in the labour force when the income from the male earning drops from the subsistence level. If this is the case, these poor households are also more likely to offer their children for child labour, especially girls. Hence, this variable might be capturing the effect of labour market more than the empowerment effect.

Finally, due to the presence of zeros in the dependent variable this study has estimated the main model using the Tobit model. The results of the Tobit estimation is presented in the last columns of Table II. Results are not different to those obtained previously. As Tobit estimates rely on assumptions of heteroskedasticity and normality this study does not consider Tobit as principal estimator. Therefore, in the reminder of the sections country fixed effect is kept as the main model.

5.3 Exploring alternative measures of income

Table III provides the analysis based on the alternative measures of income. Income is represented by real GDP per capita and income share held by bottom quartile of the population (hereafter Q1). The proxies are instrumented before entering the model,

specifically real GDP per capita model includes following instruments: investment as % GDP, rural population as per cent of total, index of political rights and number of telephone lines while in the model where income is represented by poorest quartile income, investment as % GDP is replaced by population growth. In the entire regressions instrument for trade openness is based on gravity model as discussed earlier.

Table III provides the same result for real GDP per capita and income held by bottom quartile of the population on child labour. Precisely, income held by bottom quartile population has significant non-linear effect on child labour as predicted by the real GDP per capita. In total, 10 percentage point increase in the income represented by Q1 found out to be reducing the incidence of child labour by almost 5.6 per cent point (i.e. one standard deviation increase in income of the bottom quartile of the population reduces the incidence of child labour around 4 per cent). The non-linear term further shows that a 10 percentage point increase in the income share held by bottom quartile population is associated with the 0.3 percentage point increase in child labour (i.e. one standard deviation increase in income of the bottom quartile increases the incidence of child labour around 3.6 per cent). Trade openness and FDI again shows the same behaviour. The effect of trade and FDI in reducing the incidence of child is slightly pronounced under the new measure. Specifically, one standard deviation increase in the trade reduces child labour by almost 0.29 per cent (previously 0.21 per cent) while one standard deviation increase in FDI inflow reduces the incidence by almost 0.61 per cent (previously 0.33 per cent). As far as credit availability is concerned the effect is again insignificant.

Although both GDP per capita and income of the bottom population provided the same result; however, the study chooses the best proxy from the two. To do so, the AIC and BIC were used. AIC and BIC values are slightly higher in case of real GDP per capita. Therefore, the study concludes that the income of the bottom quartile population rather than real GDP per capita is the better income proxy to use when analysing child labour incidence. As this alternative measure is computed by using income share of the bottom quartile population and Gini coefficient, hence, this may also show the prevalence of inequality in an economy. The significant effect of this measure, therefore, may also imply that policies to combat child labour incidence should be taken into account the inequalities that exist in an economy (Table IV).

5.4 Exploring an alternate measure of trade

The idea behind including export in place of trade is based on the argument that trade sanctions reduce price of unskilled exportable goods which reduces wages and income, thereby affecting child labour. Therefore, the only channel through which trade could affect child labour is exports rather than trade openness (export plus import as ratio of GDP). However, Edmonds (2009) argues that the dominant effect of an increase in international trade on children in developing economies is through changes in relative prices and living standards. In order to compare the effects of the two to find out if any dissimilarity exists, the study replaces trade openness measure with the exports to GDP ratio.

Result shows (Table V) no significant difference between the effect of trade openness and export. Both trade and exports have significant effect after dropping income from the model. One standard deviation increase in export reduces the child labour around 0.42 per cent which is higher than 0.21 per cent when one considers the effect of trade openness. As export is also significant after dropping income from the model, it shows that exports also increase the income of the poor and increase in income reduces the supply of child labour. Hence, we conclude that income may be the channel through which trade/export and FDI could affect child labour.

Our conclusion may rest on the argument given by Edmonds (2009) that trade sanctions may not have significant effect on the incidence of child labour as proportion of child labour in export-related industries is negligible. The channel though which trade could affect child labour is by increasing the living standard of the poor.

6. Conclusions

The purpose of this paper was to investigate the link between globalization, defined as increase in trade openness and penetration of FDI, and incidence of child labour, while taking into account the role of credit market imperfections. The empirical assessment was based on the cross-sectional analysis of 129 developing countries for four decades, from 1970 to 2010. This study showed that income does affect child labour. The only difference in this study and all the previous studies is that it predicts the negative effect of income using two different measures of income after correcting endogeneity bias. To the best of the author's knowledge, these measures have not been incorporated in earlier studies at the cross-sectional level.

The study first estimated the effect of income on child labour incidence by using real GDP per capita, and then estimated the effect by using an alternative measure of income: income held by bottom quartile of the population. This proxy helps in understanding the income inequality argument. This argument was tested by comparing the estimates of different proxies of income. The two alternative measures, real GDP per capita and income held by bottom quartile of the population showed a significant but non-linear effect. The study also concludes that the income of the bottom quartile of the population rather than real GDP per capita is the better income proxy to use when analysing child labour incidence. As this measure is based on Gini coefficient and income share of bottom quartile population, the study further concludes that an effective policy to reduce child labour incidence should also take into account inequality that exists in an economy.

Evidence also shows that countries more open to trade and having higher FDI inflow have lower incidence of child labour. But the effect of both the variables after correcting for the endogeneity is significant only after dropping the income variable. Therefore, the study concludes that expansion in trade and FDI increases employment opportunities thereby increasing the income of the poor. This increase in income will then reduce child labour incidence.

By comparing the results of exports and trade openness, the study concludes that trade sanctions may not have significant effect on the incidence of child labour as proportion of child labour in export-related industries is negligible. The channel through which trade may affect child labour is by increasing income thereby affecting living standard.

As far as the effect of credit market imperfection is concerned, our analysis does not find any significant effect of credit on child labour. We incorporated credit variable in the model with the hypothesis that in order to overcome the income shock due to trade sanctions, poor people will borrow and thus credit will reduce child labour. Our results show a positive effect of trade and FDI on real GDP per capita while negative effect on child labour. Therefore, study concludes that the effect of credit is insignificant because both trade and FDI are promoting the income and reducing child labour.

Notes

1. Using Sachs and Warner's index of openness.
2. To come up with the instrument they used gravity model approach.
3. The Wu-Hausman test for endogeneity ($\chi^2 = 6.62$ and p-value $= 0.08$) predicts the presence of endogeneity, therefore, study follows instrumental variable approach.

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Appendix. Theoretical model of Jafarey and Lahiri (2002)

The paper is based on the theoretical model provided by Jafarey and Lahiri (2002). They consider a small open economy case of two periods ($t = 1, 2$) producing two goods per period (good labelled $i = 1, 2, \ldots, 4$). They assume that the economy is a net exporter of unskilled goods. Goods 1 and 2 are produced during period 1 while 3 and 4 are produced during period 2. P_i presents the world price of good i. Labour is considered as the only input and could be skilled or unskilled. Jafarey and Lahiri consider that labour cannot be substituted and one unit of each good is produced by using one unit of labour. Assuming that goods 1 and 3 are produced by skilled labour and 2 and 4 are produced by unskilled labour; the wage rate paid to skill worker is thus defined as equal to P_1 in period 1 and P_3 in period 2, whereas for unskilled labour, the wage is defined as P_2 in period 1 and P_4 in period 2 such that $P_1 > P_2$ and $P_3 > P_4$. Households in Jafarey and Lahiri model are headed by the single parents either skilled or unskilled (exogenous in the model). Households headed by skilled parents are considered rich s while households headed by unskilled parents are assumed to be poor u. It is also assumed that there are N identical numbers of children in each household. Each child is born without skill but can acquire skill by taking training in period 1 thus he could earn skilled wages P_3 in period 2. If they do not receive training then they would earn unskilled wages P_2 in period 1 and P_4 in period 2. The training decision is characterized by a function (e) and is assumed to be solely taken by the parents with Ne children receiving training while $N(1-e)$ ending up as child labour. Jafarey and Lahiri household utility function v is based on the consumption (c) of four goods and a measure of educational level:

$$v = w(c_1,\ c_2,\ c_3,\ c_4) + g(Ne) \tag{A1}$$

While the budget constraint is:

$$Y + N(1-e)P_2 + Z/r + NeP_3/r + N(1-e)P_4/r = E\left(P_1,\ P_2,\ P_3/r,\ P_4/r,\ v - g(Ne)\right. \tag{A2}$$

Further, assuming the non-increasing marginal utility of income and normality in all the goods, Jafarey and Lahiri evaluated the household education decision as a function of price and a given interest rate r:

$$Eg'(Ne) + (P_3 - P_4)/r \geqslant P_2 \tag{A3}$$

According to Jafarey and Lahiri, an increase in training decision e means gaining income and it also increases the income of the second period by skill premium (P_3–P_4) which will be discounted back in period 1. This will also result in the loss of first period income. Such a result is interpreted by Jafarey and Lahiri as the interior solution and is basically because of the negative discounted economic returns to education. As training decision and utility function are jointly determined in their model, they study the dependence of training decision and interest rate. They show that with the increase in interest rate, welfare of the lender rises while welfare of the borrowers falls. According to them, an increase in interest rate reduces the economic returns to education. It reduces the marginal benefits of education and induces a lower choice of training decision. But for lenders, the welfare effect is positive and works against the effect of a decline in returns to education. This makes training decision to increase with interest rate for household that lends.

Furthermore, in order to evaluate the dependence of borrowing b on interest rate, Jafarey and Lahiri conclude that an increase in interest rate reduces the training decision and demand for loans by borrowers as training decision has decreased. After establishing the relationship among borrowing, interest rate and training decision, Jafarey and Lahiri precede the analysis by considering three scenarios in credit market.

In scenario I, it was assumed that all the households can borrow and lend freely in the perfectly competitive credit market that link to international market. In this case, interest rate is exogenously given and equal to world interest rate while the decision of rich and poor are entirely independent. Under scenario II, Jafarey and Lahiri assume that borrowing is subject to a quantitative constraint, i.e. interest rate faced by the poor household is influenced by some subjective factors and quantitative

constraint $(b = \overline{b})$. It is again independent of rich household. In scenario III, households borrow from the domestic credit market. According to Jafarey and Lahiri, in this case rich and poor household exchange loan and each household discount rate is equal to the equilibrium interest rate. Jafarey and Lahiri used a combination of different equations to determine training decision, utility function and borrowing decision of poor household and utility function and supply of loan for rich household along with the condition that training decision for rich household is equal to 1. The equilibrium interest rate is, therefore, determined by the interaction of demand and supply of borrowing. This case is viewed by Jafarey and Lahiri as having an interesting policy implication. According to them, rich households increase their savings entirely through lending in the credit market, since the children's education is equal to 1, that is cannot be increased further.

Considering scenario II, Jafarey and Lahiri stress that borrowing constraint is small relative to the unconstrained- or equilibrium-level borrowing. Hence, given that the constraint binds, interest rate will be higher than the equilibrium interest rate. Opening a domestic credit market according to them will result in a fall in the discount rate for poor households which lead to higher educational choice and if there is an international credit market in which all households could participate, it is reasonable to assume that for a developing country equilibrium interest rate will be higher or equal to world interest rate and one shall have world education outcome higher or equal to equilibrium-level education outcome. After analysing the equilibrium in the credit market, Jafarey and Lahiri introduce the effect of trade sanction on the incidence of child labour. Keeping in mind the assumption that the country is a net exporter of unskilled goods now trade sanctions will result in a fall in price of unskilled good in period 1 (i.e. P_2):

$$E_5 dv = \left[\{1+N(1-e)\}-E_2\right]dP_2-(b/r)dr \tag{A4}$$

Because of the assumption that the economy is a net exporter of unskilled good, a reduction in price of unskilled good will reduce the welfare of the unskilled families. Turning to the effect on training decision and borrowing, Jafarey and Lahiri have shown that a decrease in the price of the exportable, for a given level of real income, would reduce the opportunity cost of education (a substitution effect) and therefore might increase training decision. The same will be true for the increase in real income. On the other hand, a decrease in price of unskilled good would also decrease real income and thus encourage a decrease in training (the income effect). Hence, the two effects are opposite while changes in training decision via interest rate means an increase in interest rate reduces training decision.

Overall, Jafarey and Lahiri suggest that a decrease in price of unskilled good has the potential to decrease training decision (increase child labour) if the income effect dominates the substitution effect. Their results hold even for the internationally perfect credit markets as well. On the other hand, a decrease in price increases the demand for consumption in period 1 relative to period 2. But it also reduces the income of unskilled families in period 1. Similarly, any increase in the level of schooling will also increase future income and therefore the demand for loans. This indirectly raises the interest rate. What happens to the supply of loans? Supply comes from the rich households and Jafarey and Lahiri show that a decrease in price of unskilled good increases the supply of loans.

According to them, a decrease in price of unskilled good will increase the income of the rich household as they do not take part in the production of unskilled good. This will increase the supply of loan because education cannot be further increased. Jafarey and Lahiri compare the effects of a trade sanction under two scenarios: in the first case the borrowing constraint is assumed to be preventing loans from adjustment in response of changes in demand or supply of funds; in the second case, Jafarey and Lahiri assumed that market freely adjusts to a new equilibrium. According to Jafarey and Lahiri in the first case, when a decrease in P_2 raises the demand for loans, for a given interest rate, training decision increases. Jafarey and Lahiri have proved that a low value of training decision is associated with a high marginal utility of both income and education. As low initial value of training decision is associated with low parental income in their model, therefore, a trade sanction could cause a decline in children's education at least for households that are poor. Jafarey and Lahiri stress that only those families that suffer large income effects as a result of trade sanctions send a large proportion of children to work. Summarizing the result for case 1, Jafarey and Lahiri conclude that: "In the presence of a borrowing constraint, a trade sanction increases a poor household's discount rate, which negatively affects its children's education".

Turning to the second case where supply of funds adjust in response to changes in demand, new equilibrium will arise where interest rate increases, still having negative effect on child labour. However, a comparison of both cases shows that the trade sanction is less likely to lead to perverse effects on child labour if the supply of loans can adjust in a competitive domestic credit market than if it cannot. To summarize, the analysis of Jafarey and Lahiri suggested that: "The discount rate of poor households rises more strongly under borrowing constraints and rises less strongly or even falls under a domestic credit market. This implies that a perverse effect from trade sanctions to child labour in poor households is less likely if credit is available at the margin".

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