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LABOUR MARKET REFORM AND INCIDENCE OF CHILD LABOUR IN A DEVELOPING ECONOMY

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Abstract: The paper is purported to examine the consequences of possible labour market reform in the developing economies on the incidence of child labour and economic well-being of the child labour supplying families. A two-sector, full-employment general equilibrium structure with child labour and imperfection in the market for adult labour has been used for the analytical purpose. Although this policy is likely to lower the incidence of child labour the welfare of the families supplying child labour worsens. The paper, therefore, questions the desirability of a policy designed at mitigating the child labour problem especially when it makes the poor families worse off.

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1. Introduction

The incidence of child labour is a slur on the fair face of the globalized world. According to ILO (2002) one in every six children aged between 5 and 17 - or 246 million children are involved in child labour.¹ Out of 246 million about 170 million child workers were found in different hazardous works. However, after economic liberalization the problem of child labour has decreased satisfactorily in most of the developing economies. ILO (2006) has reported that the number of economically active children in the 5-14 age group declined by 11 per cent in 2004 from the 2000 figure. Advocates of liberalized policies believed that economic reforms would take the developing countries into higher growth orbits, the benefits of which would definitely percolate down to the bottom of the society, thereby leading to reduction of poverty and poverty-driven child labour incidence.

The developing countries have chosen free trade as their development strategy and been vigorously implementing liberalized trade and investment policies for the last two decades or so. Although the pace of economic reforms has been different across countries, radical measures for reducing tariff barriers and completely doing away with non-tariff barriers to ensure freer global trade have already been undertaken in manufacturing commodities. Foreign direct investment (FDI) norms have been liberalized considerably. Several sectors, hitherto protected, have now been opened up to foreign capitalists so that inflows of foreign capital take place in abundance in order to facilitate economic growth. After satisfactory progress in trade and investment reforms many of the developing countries including India are now seriously thinking in terms of implementing reforms in the labour market which has been a crucial aspect in the reform agenda. It is argued that rigid labour laws are serious impediments to the profitability of the capitalists. If wages are high and investors are unable to retrench redundant workers, close down unviable

¹ If the "invisible" workers who perform unpaid and household jobs are included, it is likely that the estimate would shoot up significantly further.

units and relocate their businesses within the economy, they would not be able to compete effectively with other countries where labour laws are relatively flexible. Consequently, they would be forced to pull their shutters down which will lead to widespread open unemployment. According to this line of argument labour market reforms should get top priority even for the betterment of the working class as a whole given the grave unemployment situations in the developing countries.

It is needless to point out that liberalization of labour laws is a very much politically sensitive issue. It is apprehended by the trade unions that any relaxation of labour laws will lead to general wage reductions of the poorer groups of the working population engaged in different sectors of the economy and accentuate wage inequality and the unemployment problem. Consequently, such a move is also expected to increase poverty and affect the child labour problem adversely. As labour markets take a longer time to adjust vis-à-vis the capital markets, the working class has to face substantial adjustment costs, especially at the early stages of labour market reforms.

Empirical studies e.g. Cigno et al. (2002), Edmonds and Pavcnik (2005) and Neumayer and Soysa (2005) have reported that trade and investment reforms have produced a favorable impact on child labour. However, as the labour market reforms are yet to be phased in one cannot judge empirically the consequences of such liberalization on the labour market and the incidence of child labour in the developing countries.

Under the circumstances, it would be an interesting theoretical exercise to analyze the effects of labour market reform on the incidence of child labour and economic well-being of the child labour supplying families. A two-sector full-employment general equilibrium structure has been used for the analytical purpose. Sector 1 is agriculture that produces its output by means of adult labour, child labour and capital. On the other hand, sector 2 uses adult labour and capital to produce a manufacturing commodity. There is imperfection in the market for adult labour which is a salient feature of the developing countries. The adult workers in sector 2 are organized and receive a high unionized wage while their counterparts in sector 1 receive the competitive wage. Using such a framework we shall show that labour market reform indeed leads to a general wage

reduction. Not only the adult wages but also the child wage decrease. As the informal wage decreases but the formal sector expands the number of poor people declines although the conditions of the poor workers who still remain in the informal sector deteriorate. Although this policy is likely to lower the incidence of child labour the welfare of the families supplying child labour worsens. The paper, thus, finds that there might exist a trade-off between the economy's twin objectives of lowering the incidence of child labour and improving the welfare of the poor working families.

2. The Model

We consider a small open economy with two sectors: informal and formal. There are three factors of production, adult labour (L), child labour (L_C) and capital (K). All the three inputs are fully employed. The informal sector (sector 1) uses both adult labour and child labour apart from capital to produce an agricultural commodity, X_1 . The formal sector, on the other hand, produces a manufacturing commodity, X_2 , by means of capital and adult labour. Child labour is a specific input in sector 1. Adult labour is imperfectly mobile while capital is completely mobile between the two sectors of the economy. There are imperfections in the market for adult labour. Adult workers in sector 2 are organized and they receive a high unionized wage, W^* , while their counterparts in sector 1 earn only a competitive wage, W with $W^* > W$. Sector 2 uses capital more intensively with respect to adult labour vis-à-vis sector 1. Production functions exhibit constant returns to scale with positive and diminishing marginal productivity to each factor. Markets, except the formal unskilled labour market, are perfectly competitive. Owing to our small open economy assumption both the commodity prices are given internationally. Finally, we assume that any two factors are substitutes to each other in the different sectors. This means that any cross partials of the factor coefficients are positive.

2.1 Derivation of Supply Function of Child Labour

In this section, we derive the supply function of child labour from the utility maximizing behaviour of the representative altruistic poor household. There are L numbers of homogeneous working families, which are classified into two groups with respect to the earnings of their adult members. The adult workers who work in the higher paid formal manufacturing sector comprise the richer section of the working population. On the contrary, labourers who are engaged in the informal sector constitute the poorer section. There is now considerable evidence and theoretical reason for believing that, in developing countries, parents send their children to work out of sheer poverty.² A distinctive paper in this regard is that of Basu and Van (1998). Following their ‘*Luxury Axiom*’ we assume that there exists a critical level of family (or adult labour) income, \bar{W} , from non-child labour sources, such that the parents will send their children out to work if and only if the actual adult wage rate is less than this critical level. We assume that each worker in the formal manufacturing sector earns a wage income, W^* , sufficiently greater than this critical level. So, the workers belonging to this group do not send their children to work. On the other hand, adult workers employed in the informal sector earn W amount of wage income, which is less than \bar{W} and, therefore, send many of their children to the job market to supplement low family income.

The supply function of child labour by each poor working family is determined from the utility maximizing behaviour of the representative altruistic household. We assume that each working family consists of one adult member and ‘ n ’ number of children. The altruistic adult member of the family (guardian) decides the number of children to be sent to the work place. The utility function of the household is given by

$$V = V(C_1, C_2, (n - l_c)) \quad (1)$$

² A good deal of research has focussed on the inextricable connection between poverty and child labour. See, for instance, Basu (1999), Basu and Tzannatos (2003), Edmonds (2001), Admassie (2002), Nagaraj (2002), Cartwright and Patrinos (1999), Wahba (2002), Cartwright (1999) and Grootaert and Patrinos (1999, 2002). They held poverty as the primary reason behind the child labour problem in the developing countries.

The household derives utility from the consumption of the final goods and from the children's leisure. For analytical simplicity let us consider the following Cobb-Douglas type of the utility function.

$$V = A(C_1)^\alpha (C_2)^\beta (n - l_C)^\gamma \quad (2)$$

with $A > 0$, $1 > \alpha, \beta, \gamma > 0$; and, $(\alpha + \beta + \gamma) = 1$.

It satisfies all the standard properties and it is homogeneous of degree 1.

The household maximizes its utility subject to the following budget constraint.

$$P_1 C_1 + P_2 C_2 = (W_C l_C + W) \quad (3)$$

where, W is the income of the adult worker and $W_C l_C$ measures the income from child labour.

Maximization of the utility function subject to the above budget constraint gives us the following labour supply function.³

$$l_C = \{(\alpha + \beta)n - \gamma(W / W_C)\} \quad (4)$$

This is the supply function of child labour by each poor family. We now analyze its properties. First, l_C varies negatively with the adult wage rate, W . A rise in W produces a positive income effect so that the adult worker chooses more leisure for his children and therefore decides to send a lower number of children to the workplace. An increase in W_C , on the other hand, produces a negative price effect, which increases the supply of child labour from the family.⁴

There are $L_I (= a_{L1} X_1)$ number of adult workers engaged in the informal sector (sector 1) and each of them sends l_C number of children to the workplace. Thus, the aggregate supply function of child labour in the economy is given by

$$L_C = [(\alpha + \beta)n - \gamma \frac{W}{W_C}] a_{L1} X_1 \quad (5)$$

³ See appendix I for mathematical derivation.

⁴ It may be checked that the results of this paper hold for any utility function generating supply function of child labour satisfying these two properties.

2.2 The General Equilibrium Analysis

The general equilibrium of the system is represented by the following set of equations:

$$W a_{L1} + W_C a_{C1} + R a_{K1} = P_1 \quad (6)$$

$$W^* a_{L2} + R a_{K2} = P_2 \quad (7)$$

where a_{ji} s are input-output ratios. W_C is the child wage rate while R is the return to capital.

$$a_{L1} X_1 + a_{L2} X_2 = L \quad (8)$$

$$a_{K1} X_1 + a_{K2} X_2 = K \quad (9)$$

$$a_{C1} X_1 = [(\alpha + \beta)n - \gamma \frac{W}{W_C}] a_{L1} X_1 \quad (10)$$

Equations (6) and (7) are the two competitive industry equilibrium conditions in the two sectors. On the other hand, equations (8) – (10) are the full-employment conditions for adult labour, capital and child labour, respectively.

The firms in the manufacturing sector have well-organized trade unions. One of the most important roles of the labour unions is to bargain with their respective employers in respect of the betterment of the working conditions. Through offer of negotiation, threat of strike, actual strike etc. the trade unions exert pressure on the employers (firms) in order to secure higher wages, reduced hours of work, share in profits and other benefits. Organized workers in large firms leave no stones unturned so as to reap wages higher than their reservation wage i.e. the informal sector adult wage⁵. The relationship for the unionized wage rate is specified as⁶:

$$W^* = W^*(W, U) \quad (11)$$

This function satisfies the following properties.

$$W^* = W \text{ for } U = 0, W^* > W \text{ for } U > 0; (\partial W^* / \partial W), (\partial W^* / \partial U) > 0.$$

⁵ See Bhalotra (2002) in this context.

⁶ Assuming that each formal sector firm has a separate trade union, the unionized wage function may be derived as a solution to the Nash bargaining game between the representative firm and the representative union in the low-skill manufacturing sector. For detailed derivation see Chaudhuri and Mukhopadhyay (2009).

Equation (7) states that in the absence of any bargaining power of the trade unions i.e. when $U = 0$, the formal and informal sector wage rates are equal. However, the formal sector wage rate, W^* , exceeds the competitive informal sector wage rate, W , when there is at least some power to the trade unions. The unionized wage is scaled upward as the informal wage rate rises. Also with an increase in the bargaining power, the unions bargain for a higher wage. The union power, denoted by U , is amenable to policy measures. If the government undertakes measures e.g. partial or complete ban on resorting to strikes by the trade unions, reformation of employment security laws to curb union power, U takes a lower value.

Using (11) equation (7) can be rewritten as follows.

$$W^*(W, U)a_{L2} + Ra_{K2} = P_2 \quad (7.1)$$

We rewrite equation (10) as follows:

$$\text{or, } \left(\frac{a_{C1}}{a_{L1}} \right) = \left[(\alpha + \beta)n - \gamma \frac{W}{W_C} \right] \quad (10.1)$$

3. Comparative Statics

The general equilibrium structure consists of six equations, namely equations (5), (6), (7.1), (8), (9) and (10.1) and the same number of variables: W, W_C, R, X_1, X_2 and L_C . This is an indecomposable system. So factor prices depend on both commodity prices and factor endowments. Given the child wage rate, sectors 1 and 2 together effectively form a miniature Heckscher-Ohlin system as they use both adult unskilled labour and capital. It is sensible to assume that sector 1 is more adult labour-intensive than sector 2 with respect to capital. Totally differentiating equations (6), (7.1) and (10.1) and solving by Cramer's rule the following proposition can be established⁷.

Proposition 1: A policy of labour market reform leads to (i) an increase in the return to capital; (ii) a decrease in the child wage if $S_{LK}^1 \geq S_{CK}^1$; (iii) a decrease in the informal adult wage

⁷ These results have been proved in appendices II and III.

if $S_{LK}^1 \leq S_{CK}^1$; and, (iv) a contraction of the informal sector both in terms of output and employment of adult labour. The policy raises (leaves unchanged) the (W/W_C) ratio if and only if $S_{LK}^1 > (=) S_{CK}^1$.

We explain proposition 1 as follows. A policy of labour market reform lowers the bargaining strength of the trade unions, U . This lowers the unionized wage W^* . Consequently the return to capital, R , must rise to satisfy the zero-profit condition in sector 2 (equation (7.1)). Producers in both the sectors would be using less capital-intensive techniques than before. The capital-output ratios in the two sectors, a_{K1} and a_{K2} decrease. Given the product-mix there would occur an excess supply of capital that produces a Rybczynski-type effect. Consequently, sector 2 (sector 1) expands (contracts) as sector 2 is capital-intensive.

As X_1 falls and R rises there would be two opposite effects on the demand for each type of labour in sector 1. First, owing to contraction of this sector the demand for each type of labour falls which exerts downward pressures on the two wages. Secondly, as R rises producers in sector 1 would be substituting capital by both adult and child labour although the degrees of substitutability of capital by the two types of labour differ. This raises the two labour-output ratios, a_{L1} and a_{C1} which in turn leads to increases in the demand for each type of labour given the output level. As a result of these two opposite effects the net outcome on the two wages, W and W_C , would be ambiguous. In the case of child labour the first effect outweighs the second effect and the child wage declines if $S_{LK}^1 \geq S_{CK}^1$ while the adult wage falls if $S_{LK}^1 \leq S_{CK}^1$. However, if the partial elasticity of substitution between adult labour and capital, S_{LK}^1 , is greater than (equal to) that between child labour and capital, S_{CK}^1 , the proportionate fall in W will be less than (equal to) that in W_C . Consequently, the (W/W_C) ratio rises (remains unchanged) and the supply of child labour by each family, I_C , falls (does not change) if and only if $S_{LK}^1 > (=) S_{CK}^1$.

To examine the implication of labour market reform on the incidence of child labour in the economy we use the aggregate child labour supply function, which is given by equation (5). We

should note that the policy affects the supply of child labour in two ways: (i) through a change in the size of the informal sector adult labour force, ($L_I = a_{L1}X_1$), as these families are considered to be the suppliers of child labour (we call this the *adult labour reallocation effect*); and, (ii) through a change in l_C (the number of child workers supplied by each poor family), which results from a change in the (W / W_C) ratio (this may be called the *relative wage effect*).

Differentiating equation (5) one can establish the following proposition.⁸

Proposition 2: The labour market reform lowers the incidence of child labour in the economy if $S_{LK}^1 \geq S_{CK}^1$.

Proposition 2 can be intuitively explained as follows. From proposition 1 we find that sector 1 contracts both in terms of output and employment due to labour market reform. As the number of child labour supplying families falls the adult labour reallocation effect works favourably and causes the supply of child labour in the society to fall. On the other hand, the (W / W_C) ratio rises (remains unchanged) and the supply of child labour by each family, l_C , falls (does not change) if and only if $S_{LK}^1 > (=) S_{CK}^1$. So when $S_{LK}^1 > S_{CK}^1$ both the relative wage effect and the adult labour reallocation effect work in the same direction and cause the child labour problem in the society to ameliorate. On the other hand, if $S_{LK}^1 (=) S_{CK}^1$, the relative wage effect is zero. Consequently, the family supply of child labour does not change although the aggregate supply of child labour in the economy falls due to the favourable adult labour reallocation effect.

Finally, for examining the consequence of the labour market reform on the welfare (indirect utility) of the child labour supplying families we consider the utility function of the family given by equation (2). The family derives utility from its consumption of three commodities - children's leisure, commodity 1 and commodity 2. Solving the first-order conditions of utility maximization and the budget constraint of the family the optimum consumption levels of the three commodities are obtained. Substitution of these values into the utility function gives the

⁸ See appendix IV for the mathematical proof.

optimum or indirectly utility of each child labour supplying family. Differentiating this indirect utility function one can easily prove the following proposition.⁹

Proposition 3: The welfare (optimum utility) of the families that supply child labour worsens owing to labour market reform if $S_{LK}^1 \geq S_{CK}^1$.

Proposition 3 is explained in the following fashion. Rewriting the budget constraint of each poor family we find that the family allocates its potential aggregate income, $(nW_c + W)$, among the consumption of three commodities including children's leisure. This income falls following labour market reform thereby lowering the consumption of commodities, 1 and 2 through negative income effects under the sufficient condition that $S_{LK}^1 \geq S_{CK}^1$. However, the change in the consumption of children's leisure $((n - l_c))$ is not so obvious. As the potential income falls, $(n - l_c)$ falls due to negative income effect. But, it rises following a substitution effect as the relative price of this commodity, W_c falls. The net result, therefore, depends on the relative strengths of the two effects. It is easy to show that the children's leisure enjoyed by the family increases (remains unchanged) if and only if $S_{LK}^1 \geq S_{CK}^1$. What happens to the optimum utility of the family is somewhat inconclusive. However, it can be mathematically shown that the negative effects on utility of the decreases in the consumption of the first two commodities dominate over the positive effect of a possible increase in $((n - l_c))$ under the sufficient condition that $S_{LK}^1 \geq S_{CK}^1$. Therefore, the policy of labour market reform is welfare-deteriorating to the poor child labour supplying families if $S_{LK}^1 \geq S_{CK}^1$.

4. Concluding Remarks:

This paper has examined the possible outcomes of labour market reform on the incidence of child labour and the welfare of the child labour supplying families in a developing economy. A two-sector full employment general equilibrium structure with child labour and imperfection in the market for adult labour has been deployed for the analytical purpose. A policy of labour

⁹ This has been proved in appendix V.

market reform lowers the extent of imperfection in the adult labour market and lowers the unionized wage that the adult workers receive in the organized sector that does not use child labour. The paper has found that liberalization in the labour market is indeed successful in lowering the incidence of child labour in the society although it affects the welfare of the child labour supplying families adversely. The analysis, therefore, questions the desirability of a policy that mitigates the child labour problem especially when it makes the poor families worse off.

APPENDIX I: Derivation of family supply function of child labour

Maximizing equation (2) with respect to C_1, C_2 and l_C and subject to the budget constraint (3) the following first-order conditions are obtained.

$$((\alpha U) / (P_1 C_1)) = ((\beta U) / (P_2 C_2)) = ((\gamma U) / (n - l_C) W_C) \quad (\text{A.1})$$

From (A.1) we get the following expressions.

$$C_1 = \{\alpha(n - l_C) W_C / (\gamma P_1)\} \quad (\text{A.2})$$

$$C_2 = \{\beta(n - l_C) W_C / (\gamma P_2)\} \quad (\text{A.3})$$

Substitution of the values of C_1 and C_2 into the budget constraint and further simplifications give us the following child labour supply function of each poor working household.

$$l_C = \{(\alpha + \beta)n - \gamma(W / W_C)\} \quad (4)$$

APPENDIX II: Effects of labour market reform on W , W_C and R

Totally differentiating equations (6), (7.1) and (10.1) the following expressions are obtained.

$$\theta_{L1} \hat{W} + \theta_{C1} \hat{W}_C + \theta_{K1} \hat{R} = 0 \quad (\text{A.4})$$

$$\theta_{L2} E_W \hat{W} + \theta_{K2} \hat{R} = -\theta_{L2} E_U \hat{U} \quad (\text{A.5})$$

$$A\hat{W} + B\hat{W}_C + C\hat{R} = 0 \quad (\text{A.6})$$

where:

$$\left. \begin{aligned} E_W &= ((\partial W^* / \partial W)(W / W^*)) > 0; E_U = ((\partial W^* / \partial U)(U / W^*)) > 0 \\ A &= (S_{CL}^1 - S_{LL}^1 + \frac{\gamma W}{W_C L_C}) > 0; B = (S_{CC}^1 - S_{LC}^1 - \frac{\gamma W}{W_C L_C}) < 0; \text{ and,} \\ C &= (S_{CK}^1 - S_{LK}^1) \end{aligned} \right\} \quad (\text{A.7})$$

Here θ_{ji} = distributive share of the j th input in the i th sector; and, ' \wedge '=proportional change.

S_{ji}^k = the degree of substitution between factors j and i in the k th sector, $j, i = L, L_C, K$; and, $k = 1, 2$. $S_{ji}^k > 0$ for $j \neq i$; and, $S_{ji}^k < 0$.

Writing equations (A.4) – (A.6) in a matrix notation we get

$$\begin{bmatrix} \theta_{L1} & \theta_{C1} & \theta_{K1} \\ \theta_{L2} E_W & 0 & \theta_{K2} \\ A & B & C \end{bmatrix} \begin{bmatrix} \hat{W} \\ \hat{W}_C \\ \hat{R} \end{bmatrix} = \begin{bmatrix} 0 \\ -\theta_{L2} E_U \hat{U} \\ 0 \end{bmatrix} \quad (\text{A.8})$$

From (A.8) the determinant of the coefficient-matrix is obtained as

$$\Delta = B(\theta_{K1} \theta_{L2} E_W - \theta_{L1} \theta_{K2}) + \theta_{C1} \theta_{K2} A - \theta_{C1} \theta_{L2} E_W C \quad (\text{A.9})$$

(-) (-) (+)

(Note that $(\theta_{K1} \theta_{L2} E_W - \theta_{L1} \theta_{K2}) < 0$ as $1 \geq E_W > 0$ and sector 2 is more capital-intensive than sector 1 with respect to adult unskilled labour).

From (A.9) it follows that

$$\Delta > 0 \text{ if } C \leq 0 \text{ i.e. if } S_{LK}^1 \geq S_{CK}^1 \quad (\text{A.10})$$

Solving (A.8) by Cramer's rule the following expressions are obtained.

$$\left. \begin{aligned}
\hat{W} &= \left(\frac{\theta_{L2} E_U \hat{U}}{\Delta} \right) [\theta_{C1} C - \theta_{K1} B]; \\
\hat{W}_C &= \left(\frac{\theta_{L2} E_U \hat{U}}{\Delta} \right) [\theta_{K1} A - \theta_{L1} C]; \\
\hat{R} &= \left(\frac{\theta_{L2} E_U \hat{U}}{\Delta} \right) [\theta_{L1} B - \theta_{C1} A]; \\
(\hat{W} - \hat{W}_C) &= \left(\frac{\theta_{L2} E_U C \hat{U}}{\Delta} \right) \\
(\hat{W} - \hat{R}) &= - \left(\frac{B \theta_{L2} E_U \hat{U}}{\Delta} \right)
\end{aligned} \right\} \quad (\text{A.11})$$

Note that $(S_{LL}^1 + S_{LC}^1 + S_{LK}^1) = (S_{CL}^1 + S_{CC}^1 + S_{CK}^1) = 0$.

APPENDIX III: Effects of labour market reform on X_1 and $a_{L1} X_1$

Differentiating equations (8) and (9), simplifying and writing in a matrix notation one obtains

$$\begin{bmatrix} \lambda_{L1} & \lambda_{L2} \\ \lambda_{K1} & \lambda_{K2} \end{bmatrix} \begin{bmatrix} \hat{X}_1 \\ \hat{X}_2 \end{bmatrix} = \begin{bmatrix} - \left(\frac{E_U D}{\Delta} \right) \hat{U} \\ - \left(\frac{E_U E}{\Delta} \right) \hat{U} \end{bmatrix} \quad (\text{A.12})$$

where: λ_{ji} = proportion of the j th input employed in the i th sector;

$$\left. \begin{aligned}
D &= [\lambda_{L2} S_{LL}^2 \theta_{K2} (\theta_{C1} A - \theta_{L1} B) + \lambda_{L1} \theta_{L2} (S_{LK}^1 B - S_{LC}^1 C)] < 0; \text{ and,} \\
&\quad \quad \quad (-) \quad \quad \quad (+) \quad \quad \quad (-) \\
E &= [\lambda_{K2} S_{KL}^2 (\theta_{C1} A - \theta_{L1} B) + \lambda_{K1} \theta_{L2} (S_{KC}^1 A - S_{KL}^1 B)] > 0 \\
&\quad \quad \quad (+) \quad \quad \quad (+)
\end{aligned} \right\} \quad (\text{A.13})$$

Solving (A.12) we get

$$\hat{X}_1 = \left(\frac{E_U \hat{U}}{|\lambda| \Delta} \right) [E \lambda_{L2} - D \lambda_{K2}] \quad (\text{A.14})$$

(+), (+), (-)

$$\text{where: } |\lambda| = (\lambda_{L1}\lambda_{K2} - \lambda_{L2}\lambda_{K1}) > 0 \quad (\text{A.15})$$

(Note that sector 2 is more capital-intensive than sector 1 with respect to adult labour.)

From (A.14) we find that

$$\hat{X}_1 < 0 \text{ when } \hat{U} < 0 \text{ if } S_{LK}^1 \geq S_{CK}^1. \quad (\text{A.16})$$

The number of poor families employed in the informal sector (sector 1) and supplying child labour, denoted as L_I , is given by

$$L_I = a_{L1}X_1 \quad (\text{A.17})$$

Differentiating (A.17) we get

$$\begin{aligned} \hat{L}_I &= \hat{a}_{L1} + \hat{X}_1 = (S_{LL}^1\hat{W} + S_{LC}^1\hat{W}_C + S_{LK}^1\hat{R}) + \hat{X}_1 \\ &= S_{LC}^1(\hat{W}_C - \hat{W}) + S_{LK}^1(\hat{R} - \hat{W}) + \hat{X}_1 \end{aligned}$$

Using (A.11) and after simplification the above expression becomes

$$\begin{aligned} \hat{L}_I &= \left(\frac{\theta_{L2}E_U\hat{U}}{\Delta}\right) \left[S_{LK}^1 \left(S_{CC}^1 - \frac{\gamma W}{W_C l_C} \right) - S_{LC}^1 S_{CK}^1 \right] + \hat{X}_1 \quad (\text{A.18}) \\ &\quad (+) \quad (+) \quad (-) \quad (-) \end{aligned}$$

Substituting the expression for \hat{X}_1 from (A.14) into (A.18), using (A.13) and (A.15) and after simplification one gets

$$\begin{aligned} \left(\frac{\hat{L}_I}{\hat{U}}\right) &= \left(\frac{\theta_{L2}\lambda_{L2}}{\Delta|\lambda|}\right) \left[\lambda_{K2} \frac{(\theta_{C1}A - \theta_{L1}B)}{\theta_{L2}} (S_{KL}^2 + S_{LK}^2) + \lambda_{K1} (S_{KC}^1 A - S_{KL}^1 B) \right. \\ &\quad (+)(+) \quad (+) \quad (+) \quad (+) \quad (-) \\ &\quad \left. - \lambda_{K1} \left\{ S_{LK}^1 \left(S_{CC}^1 - \frac{\gamma W}{W_C l_C} \right) - S_{LC}^1 S_{CK}^1 \right\} \right] \quad (\text{A.19}) \\ &\quad (-) \quad (+) \end{aligned}$$

From (A.19) it follows that L_I falls when U falls. So the informal sector contracts both in terms of output and employment of adult labour following labour market reform.

APPENDIX IV: Effect of labour market reform on L_C

Differentiating (5) we obtain

$$dL_C = -(\gamma a_{L1} X_1 \frac{W}{W_C})(\hat{W} - \hat{W}_C) + l_C a_{L1} X_1 (\hat{a}_{L1} + \hat{X}_1)$$

Using (A.11) it is rewritten as

$$\hat{L}_C = -(\frac{\gamma W \theta_{L2} E_U C}{l_C W_C \Delta}) \hat{U} + [S_{LL}^1 \hat{W} + S_{LC}^1 \hat{W}_C + S_{LK}^1 \hat{R} + \hat{X}_1]$$

$$\text{or, } \hat{L}_C = -(\frac{\gamma W \theta_{L2} E_U C}{l_C W_C \Delta}) \hat{U} + [-S_{LK}^1 (\hat{W} - \hat{R}) - S_{LC}^1 (\hat{W} - \hat{W}_C) + \hat{X}_1]$$

Using (A.7), (A.11), (A.13) and (A.14) and simplifying we obtain

$$\begin{aligned} \hat{L}_C = & (\frac{E_U \hat{U}}{|\lambda| \Delta}) [\lambda_{L2} \{ \lambda_{K2} (\theta_{C1} A - \theta_{L1} B) (S_{KL}^2 - \theta_{K2} S_{LL}^2) + \lambda_{K1} \theta_{L2} (S_{KC}^1 A - S_{KL}^1 B) \}] \\ & (+) \quad (+) \quad (-) \quad (-) \quad (+) \quad (-) \\ & + \theta_{L2} \lambda_{L2} \lambda_{K1} (S_{LC}^1 S_{CK}^1 - S_{LK}^1 S_{CC}^1) + (\frac{\theta_{L2} \gamma W}{W_C l_C}) \{ \lambda_{L2} \lambda_{K1} S_{CK}^1 + \lambda_{K2} \lambda_{L1} (S_{LK}^1 - S_{CK}^1) \} \end{aligned} \quad (\text{A.20})$$

(-)

From (A.20) we find that

$$\hat{L}_C < 0 \text{ when } \hat{U} < 0 \text{ if } S_{LK}^1 \geq S_{CK}^1.$$

APPENDIX V: Effect of labour market reform on welfare of the poor families

The budget equation of each child labour supplying family, given by (3), can be rewritten as follows.

$$P_1 C_1 + P_2 C_2 + W_C (n - l_C) = (n W_C + W) \quad (3.1)$$

where $(n W_C + W)$ is the potential aggregate income of each family.

From (4) one obtains

$$(n - l_C) = [\frac{\gamma (n W_C + W)}{W_C}] \quad (\text{A.21})$$

Using (A.18) equations (A.2) and (A.3) can respectively be rewritten as

$$C_1 = \left[\frac{\alpha(nW_C + W)}{P_1} \right] \quad (\text{A.2.1})$$

$$C_2 = \left[\frac{\beta(nW_C + W)}{P_2} \right] \quad (\text{A.3.1})$$

(A.21), (A.2.1) and (A.3.1) show how the potential aggregate income of the family is distributed among the consumption of three commodities - children's leisure, commodity 1 and commodity 2, respectively.

Let the potential aggregate income of each child labour supplying family be Z and is given by

$$Z = (nW_C + W) \quad (\text{A.22})$$

Differentiation of (A.22) with respect to U gives

$$\left(\frac{dZ}{dU} \right) = \left[\frac{dW}{dU} + n \frac{dW_C}{dU} \right] \quad (\text{A.23})$$

Using (A.7) and (A.11) and after simplification from (A.23) the following expression can be derived.

$$\left(\frac{dZ}{dU} \right) = \left[\frac{\theta_{L2} E_U}{U \Delta} \right] \left[(\gamma W_C \theta_{L1}) \left(n + \frac{W}{W_C} \right) (S_{LK}^1 - S_{CK}^1) + \theta_{K1} (nW_C A - WB) \right] \quad (\text{A.24})$$

(+)

(+)

(-)

From (A.24) it follows that

$$\left(\frac{dZ}{dU} \right) > 0 \text{ if } S_{LK}^1 \geq S_{CK}^1 \quad (\text{A.25})$$

From (A.2.1) and (A.3.1) it then follows that

$$\left(\frac{dC_1}{dU} \right) > 0; \text{ and, } \left(\frac{dC_2}{dU} \right) > 0 \text{ if } S_{LK}^1 \geq S_{CK}^1 \quad (\text{A.26})$$

From (A.25) and (A.26) we find that the potential aggregate income of each family, Z , and the consumption of the two commodities, C_1 and C_2 , fall following a policy of labour market reform under the sufficient condition that $S_{LK}^1 \geq S_{CK}^1$.

Differentiating (A.21), using (A.11) and simplifying we find that

$$\left(\frac{d(n-l_c)}{dU}\right) = \left(\frac{\gamma\theta_{L2}E_U W}{\Delta U W_C}\right)[S_{CK}^1 - S_{LK}^1] \quad (\text{A.27})$$

So, the children's leisure enjoyed by the family, $(n-l_c)$, increases (remains unchanged) following labour market reform if and only if $S_{LK}^1 > (=) S_{CK}^1$.

Now consider equation (2). The poor household's indirectly utility falls as C_1 and C_2 fall if $S_{LK}^1 \geq S_{CK}^1$. On the contrary, it rises (does not change) as $(n-l_c)$, increases (remains unchanged) if and only if $S_{LK}^1 > (=) S_{CK}^1$. The net result is thus inconclusive. However, it can be mathematically proved that the optimum utility (welfare) of the families that supply child labour deteriorates owing to labour market reform under the sufficient condition that $S_{LK}^1 \geq S_{CK}^1$. This is shown as follows.

Substitutions from (A.2.1), (A.3.1) and (A.21) into (2) and simplification gives the optimum (indirect) utility of each child labour families as

$$V^* = [A(\alpha / P_1)^\alpha (\beta / P_2)^\beta (\gamma)^\gamma] \left[\frac{(nW_c + W)}{(W_c)^\gamma} \right] \quad (\text{A.28})$$

Differentiating (A.28) with respect to U one gets

$$\begin{aligned} \left(\frac{dV^*}{dU}\right) &= \left[\frac{A(\alpha / P_1)^\alpha (\beta / P_2)^\beta (\gamma)^\gamma}{(W_c)^\gamma} \right] \left[n \frac{dW_c}{dU} + \frac{dW}{dU} - \gamma \left(n + \frac{W}{W_c} \right) \frac{dW_c}{dU} \right] \\ &= [A(\alpha / P_1)^\alpha (\beta / P_2)^\beta (\gamma / W_c)^\gamma] \left[\frac{dW_c}{dU} \left\{ n(1-\gamma) - \gamma \frac{W}{W_c} \right\} + \frac{dW}{dU} \right] \\ &= [A(\alpha / P_1)^\alpha (\beta / P_2)^\beta (\gamma / W_c)^\gamma] \left[l_c \frac{dW_c}{dU} + \frac{dW}{dU} \right] \end{aligned}$$

Substitution of the expressions for $\frac{dW_c}{dU}$ and $\frac{dW}{dU}$ from (A.11) into the above equation yields

$$\left(\frac{dV^*}{dU}\right) = [A(\alpha/P_1)^\alpha (\beta/P_2)^\beta (\gamma/W_c)^\gamma] \left(\frac{\theta_{L2} E_U}{U\Delta}\right) [l_c W_c (\theta_{K1} A - \theta_{L1} C) + W(\theta_{C1} C - \theta_{K1} B)]$$

Using (A.7) and after simplification one obtains

$$\begin{aligned} \left(\frac{dV^*}{dU}\right) = & [A(\alpha/P_1)^\alpha (\beta/P_2)^\beta (\gamma/W_c)^\gamma] \left(\frac{\theta_{L2} E_U}{U\Delta}\right) [\theta_{K1} \{l_c W_c (S_{CL}^1 - S_{LL}^1 + \frac{\gamma W}{W_c l_c}) \\ & + W(S_{LC}^1 - S_{CC}^1 + \frac{\gamma W}{W_c l_c})\} + \left(\frac{W W_c}{P_1}\right) (S_{LK}^1 - S_{CK}^1) (l_c a_{L1} - a_{C1})] \end{aligned}$$

$$\text{or, } \left(\frac{dV^*}{dU}\right) = [A(\alpha/P_1)^\alpha (\beta/P_2)^\beta (\gamma/W_c)^\gamma] \left(\frac{\theta_{L2} E_U}{U\Delta}\right) [\theta_{K1} \{l_c W_c (S_{CL}^1 - S_{LL}^1 + \frac{\gamma W}{W_c l_c})$$

(+)

(+)

$$+ W(S_{LC}^1 - S_{CC}^1 + \frac{\gamma W}{W_c l_c})\} \quad (\text{A.29})$$

(+)

[Note that $(l_c a_{L1} - a_{C1}) = 0$. See equations (4) and (10.1).]

From (A.29) it follows that

$$\left(\frac{dV^*}{dU}\right) > 0 \text{ if } S_{LK}^1 \geq S_{CK}^1 \quad (\text{A.30})$$

[This is because $[(S_{LK}^1 \geq S_{CK}^1) \Rightarrow C \leq 0 \Rightarrow \Delta > 0 \Rightarrow (\frac{dV^*}{dU}) > 0]$.]

From (A.30) it follows that V^* falls when U falls. Therefore, the optimum utility (welfare) of the families that supply child labour deteriorates owing to labour market reform under the sufficient condition that $S_{LK}^1 \geq S_{CK}^1$. It may be noted that there can be several other sufficient conditions under which V^* falls when U falls.

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