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Abstract: The paper is aimed at providing a theoretical explanation why policies that affect only the supply side of the child labour problem may not be able to mitigate the incidence of child labour in a developing economy in terms of a three-sector general equilibrium model with agricultural dualism and child labour. Although a poverty alleviation program like subsidization of backward agriculture exerts a downward pressure on the child labour incidence through the supply side by raising adult wage income it ultimately worsens the problem by increasing the demand for child labour resulting from an expansion of backward agriculture. The paper finds that a policy of overall economic growth in the form of an FDI (foreign direct investment) is indeed able to put downward pressures on the child labour problem both through the demand and supply sides. Welfare of the child labour-supplying families also improves consequently.

Keywords: Child labour, general equilibrium, agricultural dualism, subsidy policy, poverty alleviation program, capital led growth.

JEL classification: D15, J10, J13, O 12, O17.

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1. Introduction

Abject poverty has been attributed to be the root cause behind the widespread existence of child labour in the developing countries. Therefore, it is a commonly held view that poverty alleviation programs should vigorously be resorted to for mitigating the problem.[1] Empirical studies have revealed that the incidence of child labour has decreased satisfactorily in most of the developing economies[2] although incomes of the poorer section of the population have not changed significantly in absolute terms over the last two decades.[3]

The problem of child labour has two sides: demand and supply. Countries with high incidence of poverty undertake policies which are designed to increase earning opportunities of the poor. Consequently, these policies are expected to produce favourable effect on the incidence of child labour through the supply side. A pertinent question is whether policies which address only the supply side of the problem can indeed be effective in alleviating this problem. This is particularly important because of the empirical findings that the incidence of child labour in the developing nations has decreased satisfactorily although poverty has not changed much during the liberalized economic regime. These evidences suggest that favourable effect on child labour must

[1] See World Development Report (1995), Basu and Van (1998), Basu (2000) and Bonnet (1993) among others.

[2] 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. The decline is sharpest for Latin America and Caribbean, whereas Asia and Pacific and Sub-Saharan Africa registered very small decline in activity rates.

[3] See, for example, Wade (2004), Reddy and Minoiu (2005), Wade and Wolf (2002), Khan (1998) and Tendulkar et al. (1996).

have come from the demand side. This urgently calls for theoretical explanation that might be able to show why policy interventions affecting the supply side alone cannot effectively solve the prevalence of the evil in the system and demand side policies should be given more priorities so as to tackle the child labour situation in the society.

According to ILO (2002) the concentration of child labour is the highest in the rural sector of a developing economy and child labour is used intensively directly or indirectly in the agricultural sector[4]. Besides, agricultural dualism is a common symptom of the developing countries. The distinction between advanced and backward agriculture can be made on the basis of inputs used, economies of scale, efficiency and elasticity of substitution between different factors of production. In backward agriculture, the production techniques are primitive, use of capital is very low and child labour can almost do whatever adult labour does. Farming in backward agriculture is mostly done by using bullocks and ploughs and the cattle-feeding is entirely done by child labour.[5] Besides, at the time of sowing of seeds and harvest children are often used in the family farms for helping adult members of the family. The advanced agricultural sector, on the other hand, uses mechanised techniques of production and uses agricultural machineries like tractors, seeders/planters, sprayers and harvesters etc. and therefore does not require child labour in its production process.

Agriculture in many countries is supported by government's subsidy policies in the form of price support, export subsidy, credit support etc. In a developing country like India, farmers in backward agriculture are given price support with a view to protect themselves from sharp fall in their product prices during the times of over supply in the market. government's Minimum Support Price (or Producers Support Price) mechanism is a very common form of government subsidy policy directed towards backward agriculture.[6]

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[4] According to the ILO (2002) report (figure 4, pp. 36), more than 70 per cent of economically active children in the developing countries are engaged in agriculture and allied sectors.

[5] See Gupta (2000) in this context.

[6] See footnote 9 for details.

These types of subsidy scheme are designed to benefit the poorer section of the working population who are the potential suppliers of child labour. It is therefore natural to expect that these fiscal measures will raise the earning opportunities of the poor households which in turn will lower the supply of child labour by these families through positive income effect. However, the matter is not as straightforward as it appears to be at the first sight. This is because apart from their impact on adult wages, these policies affect the output composition of different sectors and the demand for child labour and therefore earning opportunities by children as well. An expansion of backward agriculture resulting from an increase in Producers Support Price , for example, will result in a higher demand for child labour and raise the use of child labour in the economy. Even if there is a positive income effect due to increase in adult wages, the net effect on child labour may be perverse. Any policy effect on the child labour incidence should, therefore, be carried out in a multi-sector general equilibrium framework so as to capture various *demand and supply* linkages that may exist in the system.

The existing theoretical literature on child labour[7], however, has not so far paid sufficient attention to identify both the demand and supply side effects of the poverty alleviation programs on the problem of child labour in a developing economy with agricultural dualism. The focus of the present paper is to examine how different policies which are primarily designed to eradicate poverty affect the incidence of child labour in the society. We also analyze how these policies impinge on the welfare of the child labour-supplying families. A three-sector full-employment general equilibrium model with child labour and agricultural dualism has been considered for the analytical purpose. The economy is divided into two agricultural and one manufacturing sectors. One of the two agricultural sectors is backward agriculture (sector 2) that uses child labour. In this set-up we have examined the consequence of a price subsidy policy (in the form of increasing the Minimum Support Price) designed to benefit backward agriculture and the poorer section

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7 See Basu an Van (1998), Basu (1999), Gupta (2000, 2002), Jaferey and Lahiri (2002), Ranjan (1999, 2001), Baland and Robinson (2000), Chaudhuri (2010), Chaudhuri and Dwibedi (2006, 2007), Dwibedi and Chaudhuri (2010) among others. In the literature the supply of child labour has been attributed to factors such as abject poverty, lack of educational facilities and poor quality of schooling, capital market imperfection, parental attitudes including the objectives to maximize present income etc.

of the working population on the aggregate supply of child labour in the economy. Our analysis finds that a price subsidy to backward agriculture is most likely to produce a perverse effect on the child labour incidence even though it raises the non-child labour income and welfare of the child labour-supplying families. On the other hand a policy of directly subsidizing advanced agriculture will be effective in lessening the child labour incidence but at the cost of lowering adult income and family welfare. We advocate in favour of policies which are favourable from the supply side as well as the demand side of the child labour problem. For example, a policy of growth with foreign capital will raise the income of the poorer section of the society and at the same time encourages technologies which lower child labour demand. A strategy like this will, therefore, be effective in lessening the gravity of the child labour problem and at the same time welfare-improving.

2. The model

We consider a small open economy with three sectors: two agricultural and one manufacturing. The two agricultural sectors produce two different commodities. Sector 1 is the advanced agricultural sector that produces its output, X_1, by means of adult labour (L), land (N) and capital (K). Capital used in this sector includes both physical capital like tractors and harvesters and working capital required for purchasing material inputs like fertilizers, pesticides, weedicides etc. The other agricultural sector, we call it backward agriculture (sector 2), produces its output, X_2, using adult labour, child labour (L_C) and land. As the backward agriculture uses primitive production techniques, we assume that Sector 2 does not require capital in its production. The land-output ratios in sectors 1, and 2 (a_{N1} and a_{N2}) are assumed to be technologically given. This assumption not only simplifies the algebra but also can be defended as follows. In one hectare of land the number of saplings that can be sown is given. There should be a minimum gap between two saplings and land cannot be substituted by other factors of production.

It is sensible to assume that the backward agricultural sector is more adult labour-intensive vis-à-vis the advanced agricultural sector with respect to land. This implies that $\frac{a_{L2}}{a_{N2}} > \frac{a_{L1}}{a_{N1}}$, where a_{ji}s are input-output ratios. Available empirical evidence suggests that in developing economies child labour is used intensively directly or indirectly in backward agriculture that uses primitive production techniques. The advanced agricultural sector, on the other hand, uses mechanised techniques of production and does not require child labour in production. Child labour is, therefore, specific to backward agriculture.[8] Advanced agriculture is the export sector while backward agriculture produces a final agricultural commodity which is consumed domestically. The price of the latter sector's product is administratively determined by the government.[9] In the two agricultural sectors adult workers receive competitive wage, W. Sector 3 is the import-competing sector that produces a manufacturing commodity, X_3 using adult labour and capital. Child labour is not used in the manufacturing sector also. This is a formal sector of the economy where the use of child labour is legally banned.[10] It faces a unionised labour market where workers receive a contractual wage $\bar{W}$ with $\bar{W} > W$. The adult

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8 See footnote 10 in this context.

9 In a developing country for protecting the interests of the small and marginal farmers and the poorer section of the consumers the government often tinkers with market mechanism by its procurement and distribution activities. It declares in advance the minimum support prices (MSPs) for essential crops at which public agencies procure foodgrains and other essential crops from farmers. On the other hand, it distributes foodgrains among the weaker section of consumers at subsidized issue prices through its public distribution system. Another important objective of these operations is to maintain satisfactory level of operational and buffer stocks of foodgrains to ensure National Food Security. All these practices are being followed in a country like India. See http://fciweb.nic.in/ for more details.

10 According to ILO (2002) more than 70 per cent of economically active children in the developing countries are engaged in agriculture and allied sectors and less than 9 per cent are involved in manufacturing. Besides, child workers are used in informal manufacturing sector which constitutes unregistered units that mainly produce intermediate goods for the formal manufacturing sector. However, even if one introduces an informal manufacturing sector where child labour, adult labour and capital are used to produce a non-traded input for the formal sector the basic results of this paper still hold under different sufficient conditions containing terms of relative intensities in which child labour and other two inputs are used in the two child labour-using sectors.

labour allocation mechanism is as follows. Adult workers first try to get employment in the manufacturing sector that offers the higher wage and those who are unable to find employment in the said sector are automatically absorbed in the two informal sectors[11] (agricultural sectors), as the wage rate there is perfectly flexible. Capital is completely mobile between sectors 1 and 3. Owing to the small open economy assumption prices of the two traded commodities (1 and 3) are given internationally. Price of the product produced by backward agriculture is exogenous to the model. Competitive markets, excepting the formal sector labour market, constant returns to scale (CRS) technologies with positive and diminishing marginal productivities of inputs[12] and full-employment of resources are assumed. Commodity 1 is chosen as the numeraire.

The following three equations present the zero-profit conditions relating to the three sectors of the economy.

$$Wa_{L1} + Ra_{N1} + ra_{K1} = 1 \quad (1)$$

$$Wa_{L2} + W_C a_{C2} + Ra_{N2} = P_2 \quad (2)$$

$$\bar{W}a_{L3} + ra_{K3} = P_3 \quad (3)$$

where R, r and W_C stand for return to land, return to capital and child wage rate, respectively.

Complete utilization of adult labour, capital, land and child labour imply the following four equations, respectively.

$$a_{L1}X_1 + a_{L2}X_2 + a_{L3}X_3 = L \quad (4)$$

$$a_{K1}X_1 + a_{K3}X_3 = K \quad (5)$$

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[11] There is a vast theoretical literature that discusses various aspects of the informal sector in a developing economy. This includes works of Chaudhuri and Banerjee (2007), Marjit (2003), Chaudhuri et al. (2006), Chaudhuri (2001, 2002, 2003, 2005, 2006 a, b, 2007, 2010 a, b, c, 2011 a, b), Chaudhuri and Mukhopadhyay (2002 a, b), Chaudhuri and Dwibedi (2007), Chaudhuri and Yabuuchi (2010) etc.

[12] The land-output ratios in the two agricultural sectors (a_{N1} and a_{N2}) have been assumed to be technologically given. However, the other inputs exhibit CRS between themselves.

$$a_{N1}X_1 + a_{N2}X_2 = N \tag{6}$$

$$a_{C2}X_2 = L_C \tag{7}$$

While endowments of adult labour, land and capital[13] are fixed in the economy, the aggregate supply of child labour, L_C, is endogenously determined from the utility maximizing behavior of the households.

2.1. Household behaviour

We derive the supply function of child labour from the utility maximizing behaviour of the representative altruistic poor household. There are L numbers of 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 manufacturing sector comprise the richer section of the working population. On the contrary, labourers who are engaged in the two agricultural sectors 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. Following the '*Luxury Axiom*'[14] of Basu and Van (1998), we assume that there exists a critical level of family (or adult labour) income, W^*, 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 manufacturing sector earns a wage income, $\bar{W}$, sufficiently higher than this critical level[15]. So, these

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13 The capital endowment of the economy may, however, increase in the presence of foreign direct investment (FDI).

14 Basu and Van (1998) have shown that if child labour and adult labour are substitutes (Substitution Axiom) and if child leisure is a luxury commodity to the poor households (Luxury Axiom), unfavourable adult labour market, responsible for low adult wage rate, is the driving force behind the incidence of child labour. According to the Luxury Axiom, there exists a critical level of adult wage rate, and any adult worker earning below this wage rate, considers himself as poor and does not have the luxury to send his offspring to schools. He is forced to send his children to the job market to supplement low family income out of sheer poverty.

15 We can also quantify this critical value in our model. From equation (10) we can say that $l_C = 0$ if $W \geq \dfrac{n(1-\gamma)W_C}{\gamma}$.

workers do not send their children to work. On the other hand, adult workers employed in the two agricultural sectors earn W amount of wage income (we assume that this is their only source of income excluding income from child labour), which is less than the critical wage ,$W*$, and therefore send many of their children to the job market to supplement low family income. For the sake of simplicity, we assume that capital-owners and land-owners are separate classes and they do not supply any child labour.[16]

The supply function of child labour by each poor working family (all assumed to be identical) is determined from the utility maximizing behaviour of the representative altruistic household who works as wage labour in any of the agricultural sectors. 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 workplace (l_C). The utility function of the household is given by

$$U = U(C_1, C_2, C_3, (n - l_C))$$

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

$$U = A(C_1)^{\alpha}(C_2)^{\beta}(C_3)^{\rho}(n - l_C)^{\gamma} \quad (8)$$

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

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

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

$$P_1C_1 + \overline{P}_2C_2 + P_3C_3 = (W_C l_C + W) \quad (9)$$

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[16] Alternatively, one can assume that rental incomes are equally divided among the L number of working families. Consequently, share of rental incomes enters into the household maximization exercise.

where, W is the income of the adult worker and $W_C l_C$ measures the income from child labour and $\overline{P}_2$ is the Issue Price (Consumers' Price) of commodity 2 determined by the government.[17]

Maximizing the utility function with respect to its arguments and subject to the above budget constraint and solving for l_C the following family child labour supply function can be derived.[18]

$$l_C = \{(1-\gamma)n - \gamma(W / W_C)\} \tag{10}$$

From (10) it is easy to check that 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 fewer number of children to the workplace. An increase in W_C , on the other hand, implies increased opportunity cost of leisure and therefore produces a negative substitution effect, which increases the supply of child labour from each family.[19]

In our model there are $L_I (= L - a_{L3} X_3)$ number of adult workers engaged in the two agricultural (informal) sectors 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

$$L_C = [(1-\gamma)n - \gamma(W / W_C)](L - a_{L3} X_3) \tag{11}$$

2.2. The General Equilibrium Analysis

[17] The difference between the Producers Support Price and the Issue Price is the subsidy multiplied by quantity of production is the burden of the government, source of which has been kept exogenous in our model for the sake of simplicity. The subsidy may, however, be financed by imposing lump-sum taxes on capitalists, landowners and the richer section of the working class employed in the manufacturing sector of the economy.

[18] See Appendix I for mathematical derivations.

[19] It may be checked that the results of this paper hold for any utility function generating a supply function of child labour that satisfies these two properties.

Using (11), equation (7) can be rewritten as

$$a_{C2}X_2 = [(1-\gamma)n - \gamma(W / W_C)](L - a_{L3}X_3) \tag{7.1}$$

The general equilibrium structure of the economy is represented by equations (1) – (6), (7.1) and (11). There are eight endogenous variables in the system: $W, W_C, R, r, X_1, X_2, X_3$ and L_C and the same number of independent equations (namely equations (1) – (6), (7.1) and (11). The parameters in the system are: $P_2, P_3, L, K, N, \overline{W}, \alpha, \beta, \rho, \gamma$ and n. Equations (1) – (3) constitute the price system. This is an indecomposable system with three price equations and four factor prices, W, W_C, r and R. So factor prices depend on both commodity prices and factor endowments. Given the child wage rate, sectors 1 and 2 together effectively form a modified Heckscher-Ohlin system as they use both adult unskilled labour and land in their production. Given the price and the unionised wage $\overline{W}$, r is determined from equation (3). Now W, W_C, R, X_1, X_2 and X_3 are simultaneously obtained from equation (1), (2), (4) – (6) and (7.1). Finally, L_C is determined from (11).

3. Comparative Statics

As discussed earlier agriculture in many countries, especially backward agriculture in developing countries is supported by different government subsidies. The primary objective of such a fiscal support is poverty alleviation. As these policies are designed to benefit the poorer section of the working population, conventional wisdom suggests that these measures will raise the adult income of the poor households which in turn will put a brake on the problem of child labour in the society. This section is aimed at examining the efficacy of a price subsidy policy (in the form of increasing the Minimum Support Price) in mitigating the child labour problem in the economy.

For determining the consequences of the price subsidy policy to backward agriculture on factor prices and output composition after totally differentiating equations (1), (2), (4) – (6) and (7.1) and solving by Cramer's rule we can establish the following proposition.[20]

Proposition 1: A price subsidy to backward agriculture leads to (i) increases in both adult wage, W, and child wage, W_C; (ii) a fall in the (W/W_C) ratio and an expansion (a contraction) of the backward (advanced) agricultural sector. The manufacturing sector contracts if $\{S_{KL}^{1}\left|\lambda\right|_{NL}^{12} + \lambda_{N2}\lambda_{L1}S_{LL}^{1}\} \geq 0$ □[21].

Proposition 1 can be explained in economic terms in the following fashion. As r is determined from the zero-profit condition for sector 3 (equation (3)) and remains unchanged despite a change in P_2, sectors 1 and 2 together can effectively be regarded as a *Modified Hechscher-Ohlin subsystem (MHOSS)* because they use two common inputs: adults labour and land. The modification is due to the fact that apart from adult labour and land sector 2 uses child labour and sector 1 uses capital as inputs. An increase in the producer price of commodity 2, P_2, lowers the rate of return to land, R and raises the adult wage, W following a *Stolper-Samuelson type effect*, as sector 2 is more adult labour-intensive than sector 1 with respect to land. As adult wage rate increases producers in sector 1 substitute adult labour by capital while their counterparts in sector 2 substitute adult labour by child labour. As the adult labour-output ratios (a_{L1} and a_{L2}) in the two agricultural sectors fall the availability of adult labour to the *MHOSS* rises that in turn produces an expansionary (a contractionary) effect on sector 2 (sector 1) following a

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[20] See Appendix II for detailed derivations.

[21] Here S_{ji}^{k} is the degree of substitution between factors j and i in the kth sector with $S_{ji}^{k} > 0$ for $j \neq i$; and, $S_{jj}^{k} < 0$ while λ_{ji} is the allocative share of jth input in ith sector. Besides, $\left|\lambda\right|_{NL}^{12} = (\lambda_{N1}\lambda_{L2} - \lambda_{L1}\lambda_{N2}) > 0$ as the backward agriculture (sector 2) is more adult labour-intensive vis-à-vis the advanced agriculture (sector 1) with respect to land.

Rybczynski type effect. As backward agriculture expands the demand for child labour increases as child labour is specific to that sector. This raises the child wage rate (W_C). As both W and W_C increase there would be two opposite effects on the supply of child labour by each poor working families. It is easy to check that the proportionate increase in child wage rate is greater than that in adult wage so that (W/W_C) falls.[22] What happens to sector 3 will be determined by movement of capital between sector 1 and sector 3. As adult wage rate increases, with given rate of interest and constant land coefficient, wage-rental ratio in the advanced agricultural sector increases and producers in sector 1 substitute adult labour by capital resulting in an increase in a_{K1}. But as sector 1 has contracted the net effect on the use of capital in this sector is ambiguous. However, it can be proved that use of capital increases (decreases) in sector 1 (sector 3) under the sufficient condition that $\{S_{KL}^{1}\,|\lambda|_{NL}^{12} + \lambda_{N2}\lambda_{L1}S_{LL}^{1}\} \geq 0$. Consequently, sector 3 contracts.[23]

3.1 Price subsidy to backward agriculture and incidence of child labour

For examining the implication of the subsidy policy on the incidence of child labour in the economy we use the aggregate child labour supply function, which is given by equation (11). We note that any policy affects the supply of child labour in two ways: (i) through a change in the size of the adult labour force employed in the two agricultural sectors, $(L_I = L - a_{L3}X_3)$, as these families are considered to be the suppliers of child labour; 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. Differentiating equation (11) the following proposition can be proved.[24]

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[22] This result is consistent with specific factor models. For an understanding of how return to intersectorally mobile factors and specific factors react to changes in relative commodity prices, one can go through Jones (1971). See Appendix II for mathematical proof.

[23] Note that the capital-output ratio in sector 3 (a_{K3}) is given as r does not change.

[24] This has been mathematically proved in Appendix IV.

Proposition 2: A price subsidy policy directed towards backward agriculture worsens the problem of child labour in the economy either if $\{S_{KL}^1 |\lambda|_{NL}^{12} + \lambda_{N2}\lambda_{L1}S_{LL}^1\} \geq 0$; or if, $S_{LC}^2 S_{KL}^1 \geq S_{CC}^2 S_{LL}^1$.

As explained previously, a price subsidy policy to backward agriculture lowers the (W / W_C) ratio, which in turn increases the supply of child labour from each poor working family. On the other hand, as the formal sector contracts in terms of output and employment (under the sufficient condition mentioned earlier) the number of poor working families, which are considered to be the suppliers of child labour, $(L - a_{L3} X_3)$, increases. So, we have a situation where there are more poor families each supplying an increased number on child worker. Therefore, a price subsidy to backward agriculture aggravates the problem of child labour in the society.

We now turn our attention to examine implication of a Price Support Policy to backward agriculture on the welfare of the child labour-supplying families. We capture this using the family utility function. We substitute the optimum values of consumption of commodities $(C_1, C_2$ and $C_3)$ and children's leisure $(n - l_C)$ into the family utility function and then totally differentiating and rearranging terms the following proposition[25] can be established.

Proposition 3: A price support policy to backward agriculture unambiguously improves the welfare of the child labour-supplying families.

A price support given to backward agriculture raises both the adult wage, W and child wage, W_C. This generates income effect which leads to increased consumption of all the physical commodities (C_1, C_2 and C_3). The children's leisure, $(n - l_C)$, also increases due to positive income effect. But as the opportunity cost of leisure (W_C) rises, leisure falls due to a negative price effect. As (W / W_C) ratio falls, the price effect dominates over the

[25] For mathematical derivation see Appendix V.

income effect. The net outcome would be a decrease in children's leisure and hence an increase in the supply of child labour (l_C) by each family. This works negatively on welfare of the family. However, our analysis shows that the increase in family welfare caused due to rise in physical commodities dominates over the decrease in utility resulting from a fall in children's leisure.

4. Quest for alternative policies

What alternative policies this theoretical analysis recommends in combating the problem of child labour is the crucial question, the answer to which the present section attempts to provide. We have already demonstrated that a policy which only targets the supply side of the child labour problem may not be effective in mitigating the prevalence of the evil in the system. This is because a policy that encourages backward agriculture to grow does not only increase the non-child labour income (adult income) but also boosts up the demand for child labour. A policy that addresses the supply side as well as the demand side of the problem is likely to be effective under the given circumstances. Mechanized farming should be encouraged that lowers the demand for child labour. One such alternative policy could be growth with foreign capital. To capture the effects of foreign direct investment (FDI) flows[26] totally differentiating equations (1), (2), (4) – (6) and (7.1) and solving by Cramer's rule we get the following result.[27]

Proposition 4: An inflow of foreign capital leads to (i) an increase in adult wage, W; (ii) a fall in child wage, W_C; (iii) an increase in the (W/W_C) ratio; and, (iv) and an expansion (a contraction) of the advanced (backward) agricultural sector. The manufacturing sector also expands owing to capital inflows. All these lead to an unambiguous fall in the aggregate supply of child labour in the economy.

An FDI inflow raises the capital stock of the economy. But the rate of return to capital does not change as it is determined from equation (3). Both the capital-using sectors i.e.

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[26] Here foreign capital and domestic capital have been assumed to be perfect substitutes.

[27] For mathematical derivations see Appendices II and III.

sector 1 and sector 3 expand.[28] This raises the demand for adult labour. Consequently, the adult wage in the two agricultural sectors, W , rises. This lowers the return to land, R (see equation (1)). For supplying additional land required for expansion of sector 1, sector 2 has to contract. The contracting backward agriculture (sector 2) also supplies the extra adult labour to the expanding other two sectors. The demand for child labour goes down that lowers the child wage rate, W_C. As W rises and W_C falls the relative adult wage (W/W_C) increases unambiguously[29] which in turn lowers the supply of child labour by each poor working household. On the other hand, as sector 3 has expanded both in terms of output and employment the number of poor working families engaged in the two agricultural sectors falls. So, we have a situation where there are fewer potential child labour supplying families with each of them sending a fewer number of children to workplace. Thus, both the forces work together and result in an unambiguous fall in the aggregate supply of child labour in the society.

The welfare effect of an FDI led growth also works in favour of the child labour-supplying families.[30] As mentioned earlier an FDI raises the competitive adult wage (W) but lowers child wage rate (W_C). An increase in adult wage income generates a positive income effect that raises consumption of all the commodities including children's leisure, $(n - l_C)$. The latter rises even further as its opportunity cost (W_C) decreases. Welfare of each family improves unequivocally as consumption levels of all commodities including children's leisure increase.

It is worthwhile in this connection to point out that a policy of directly subsidizing advanced agriculture in the form of a price and/or a credit subsidy will also be effective in lessening the gravity of the child labour problem but at the cost of lowering the adult

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28 See Appendix III.

29 See Appendix II.

30 See Appendix V for mathematical proofs of this result.

wage rate and family welfare. A mere inspection of the price system (equations (1) – (3)) reveals that a price and/or a credit subsidy to advanced agriculture effectively raises the relative price of commodity 1. This produces a *Stolper-Samuelson effect* in the *MHOSS* that results in an increase in the return to land, R and a decrease in the adult wage, W as sector 1 is more land-intensive relative to sector 2 with respect to adult labour. This produces an expansionary (a contractionary) effect on sector 1 (sector 2). As sector 2 contracts the demand for child labour goes down as it is specific to this sector. Consequently, the child wage rate falls. It is easy to check that the proportionate fall in child wage rate is greater than that in adult wage so that (W/W_C) rises. This lowers the supply of child labour by each poor working family, l_C. It can be shown[31] that under the sufficient condition that $\{S^1_{KL}\,|\lambda|^{12}_{NL} + \lambda_{N2}\lambda_{L1}S^1_{LL}\} \geq 0$ sector 3 expands. So, we can have a situation where there are a fewer families with each of them supplying a lower number of child workers. Consequently, the aggregate supply of child labour falls at the cost of further impoverishment[32] of the child labour supplying families. This establishes the final proposition of the model.

Proposition 5: A price and/or a credit subsidy policy to advanced agriculture succeeds in bringing down the prevalence of child labour in the society under the sufficient condition that $\{S^1_{KL}\,|\lambda|^{12}_{NL} + \lambda_{N2}\lambda_{L1}S^1_{LL}\} \geq 0$. However, this policy lowers the family welfare of the child labour-supplying families.

5. Concluding remarks

The paper has provided a theoretical explanation as to why policies that affect only the supply side of the child labour problem may not be able in alleviating the incidence of

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[31] Interested readers can easily check this after going through Appendices II and III.

[32] Note that both W and W_C fall due to the policy. Aggregate income of each family unequivocally plummets as l_C falls too. As family welfare is a positive function of W and W_C, (see Appendix: V), welfare of the child labour-supplying families deteriorates.

child labour in a developing economy. Poverty alleviation programs are often recommended to fight against child labour as it is thought to be an outcome of utter poverty. It is a common belief that backward agriculture should be subsidized as poorer groups of the working population are employed in this sector who send many of their children out to work to supplement low family incomes. If the economic conditions of these people can be improved the social menace of child could automatically be mitigated. The analysis of this paper has challenged this populist belief using a three-sector general equilibrium model with child labour and agricultural dualism. The advanced agriculture is distinguished from backward agriculture as follows. The former uses capital in the form of agricultural machineries that prevents child labour to work on these farms. On the contrary, backward agriculture uses primitive techniques of cultivation and employs child labour in a significant number. Apart from this, backward agriculture uses more labour-intensive (adult labour) technique vis-à-vis advanced agriculture with respect to land. In this set-up we have shown that a price subsidy policy designed to benefit the poorer section of the working population that affects the child labour problem only through the supply side cannot ultimately be able to deliver the goods. Although the policy exerts a downward pressure on the child labour incidence through the supply side by raising adult wage income it increases the demand for child labour through an expansion of backward agriculture. But as the demand side effect dominates over the supply side effect the incidence of child labour gets a boost. On the contrary, a policy of overall economic growth in the form of an FDI is able to put downward pressures on the child labour problem both through the demand and supply sides. Not only it lessens the supply of child labour by raising non-child labour (adult wage) income of the poor families but also lowers the demand for child labour by expanding (contracting) advanced (backward) agriculture. Besides, the policy also unequivocally improves welfare of the child labour-supplying families. Our results, therefore, demonstrate that liberalized investment policies should be strictly preferred to poverty lessening measures both from the view points of poverty alleviation and reduction in the incidence of child labour in the developing nations.

Appendix I: Derivation of family supply function of child labour

Maximizing equation (8) with respect to C_1, C_2, C_3 and l_C and subject to the budget constraint (9) the following first-order conditions are obtained.

$$((\alpha U)/(P_1 C_1)) = ((\beta U)/(\overline{P}_2 C_2)) = ((\rho U)/(P_3 C_3)) = ((\gamma U)/(n - l_C)W_C) \qquad \text{(A.1)}$$

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

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

$$C_2 = \{\beta(n - l_C)W_C /(\gamma \overline{P}_2)\} \qquad \text{(A.3)}$$

$$C_3 = \{\rho(n - l_C)W_C /(\gamma P_3)\} \qquad \text{(A.4)}$$

Substitution of the values of C_1, C_2 and C_3 into the budget constraint and further simplifications give us the following child labour supply function of each poor working household.

$$l_C = \{(1-\gamma)n - \gamma(W / W_C)\} \qquad \text{(10)}$$

Appendix II: Changes in factor prices

As r is determined from equation (3), it is independent of any changes in P_2 and K. In other words, we have $\hat{r} = 0$.

Now we totally differentiate equations (1), (2), (4) – (6) and (7.1), collecting terms and arranging in a matrix notation we get the following expression.

$$\begin{bmatrix} \theta_{L1} & \theta_{N1} & 0 & 0 & 0 & 0 \\ \theta_{L2} & \theta_{N2} & \theta_{C2} & 0 & 0 & 0 \\ \bar{S}_{LL} & 0 & \lambda_{L2}S_{LC}^2 & \lambda_{L1} & \lambda_{L2} & \lambda_{L3} \\ \lambda_{K1}S_{KL}^1 & 0 & 0 & \lambda_{K1} & 0 & \lambda_{K3} \\ 0 & 0 & 0 & \lambda_{N1} & \lambda_{N2} & 0 \\ (S_{CL}^2 + \frac{\gamma W}{l_C W_C}) & 0 & (S_{CC}^2 - \frac{\gamma W}{l_C W_C}) & 0 & 1 & \frac{\lambda_{L3}}{(1-\lambda_{L3})} \end{bmatrix} \begin{bmatrix} \hat{W} \\ \hat{R} \\ \hat{W}_C \\ \hat{X}_1 \\ \hat{X}_2 \\ \hat{X}_3 \end{bmatrix} = \begin{bmatrix} 0 \\ \hat{P}_2 \\ 0 \\ \hat{K} \\ 0 \\ 0 \end{bmatrix} \qquad \text{(A.5)}$$

where,

$$\left.\begin{aligned} &\bar{S}_{LL} = (\lambda_{L1}S_{LL}^1 + \lambda_{L2}S_{LL}^2) < 0; \\ &\Delta = [\{\lambda_{L2}S_{LC}^2 A_1 - (S_{CC}^2 - \frac{\gamma W}{l_C W_C})A_2\}(\theta_{L1}\theta_{N2} - \theta_{N1}\theta_{L2}) \\ &\qquad + \theta_{N1}\theta_{C2}\{\bar{S}_{LL}A_1 - \lambda_{K1}S_{KL}^1 A_3 - (S_{CL}^2 + \frac{\gamma W}{l_C W_C})A_2\}] < 0 \\ &A_1 = \lambda_{K1}(\lambda_{N2}\frac{\lambda_{L3}}{1-\lambda_{L3}}) + \lambda_{N1}\lambda_{K3} > 0 \\ &A_2 = \lambda_{K3}(\lambda_{N1}\lambda_{L2} - \lambda_{L1}\lambda_{N2}) + \lambda_{K1}\lambda_{L3}\lambda_{N2} > 0 \\ &A_3 = \frac{1}{1-\lambda_{L3}}(\lambda_{N2}\lambda_{L3}\lambda_{L1} + \lambda_{N1}\lambda_{L3}\lambda_{L1}) = \frac{\lambda_{L3}\lambda_{L1}}{1-\lambda_{L3}} > 0 \end{aligned}\right\} \qquad \text{(A.6)}$$

$|\lambda|_{NL}^{12} = (\lambda_{N1}\lambda_{L2} - \lambda_{L1}\lambda_{N2}) > 0$ as we have assumed that the backward agricultural sector is more adult labour-intensive vis-à-vis the advanced agricultural sector with respect to land both in physical and value sense. The latter implies that $(\theta_{L1}\theta_{N2} - \theta_{N1}\theta_{L2}) < 0$ which in turn shows that $\Delta < 0$.

Solving (A.5) by Cramer's rule the following expressions are obtained.

$$\hat{W} = -\frac{1}{\Delta}\{\lambda_{L2}S_{LC}^2 A_1 - (S_{CC}^2 - \frac{\gamma W}{l_C W_C})A_2\}\theta_{N1}\hat{P}_2 - \frac{1}{\Delta}\theta_{N1}\theta_{C2}A_3\hat{K} \qquad \text{(A.7)}$$

(–) (+) (–) (+) (+) (–) (+)

$$\hat{W}_C = \frac{1}{\Delta}\{\bar{S}_{LL}A_1 - \lambda_{K1}S_{KL}^1 A_3 - (S_{CL}^2 + \frac{\gamma W}{l_C W_C})A_2\}\theta_{N1}\hat{P}_2 - \frac{1}{\Delta}(\theta_{L1}\theta_{N2} - \theta_{N1}\theta_{L2})A_3\hat{K} \qquad \text{(A.8)}$$

$$\begin{array}{c}(-)\ (-)(+)\quad (+)\quad (+)\quad (+)\ (+)\quad (-)\quad (-)\quad (+)\\ \hat{R}=\frac{1}{\Delta}\{\lambda_{L2}S^2_{LC}A_1-(S^2_{CC}-\frac{\gamma W}{l_C W_C})A_2\}\theta_{L1}\hat{P}_2+\frac{1}{\Delta}\theta_{L1}\theta_{C2}A_3\hat{K}\\ (-)\quad (+)\quad (-)\quad (+)\ (+)\ (-)\quad (+)\end{array} \quad (A.9)$$

Now subtraction of (A.8) from (A.7) yields

$$(\hat{W}-\hat{W}_C)=-\frac{1}{\Delta}[A_1(\lambda_{L2}S^2_{LC}+\bar{S}_{LL})-A_2(S^2_{CC}+S^2_{CL})-\lambda_{K1}S^1_{KL}A_3)]\theta_{N1}\hat{P}_2$$

$$-\frac{1}{\Delta}\{\theta_{N1}\theta_{C2}-(\theta_{L1}\theta_{N2}-\theta_{N1}\theta_{L2})\}A_3\hat{K}$$

Using the expression of $\bar{S}_{LL}$ from (A.6) we can further simplify the expression of $(\hat{W}-\hat{W}_C)$ as follows.

$$(\hat{W}-\hat{W}_C)=-\frac{1}{\Delta}[A_1\lambda_{L1}S^1_{LL}-\lambda_{K1}S^1_{KL}A_3]\theta_{N1}\hat{P}_2$$

$$(-)\ (+)\ (-)\quad (+)\quad (+)$$

$$-\frac{1}{\Delta}\{\theta_{N1}\theta_{C2}-(\theta_{L1}\theta_{N2}-\theta_{N1}\theta_{L2})\}A_3\hat{K} \quad (A.10)$$

$$(-)\quad (-)\quad (+)$$

[Note that $(S^2_{CC}+S^2_{CL})=0$ and $(S^2_{LL}+S^2_{LC})=0$, (note that as a_{N2} is constant $S^2_{CN}=0$ and $S^2_{LN}=0$.]

Using (A.6), from (A.7) – (A.9) and (A.10) we can obtain the following results.

$$\left.\begin{array}{ll}\text{(i)} & \hat{W}>0, \hat{R}<0 \text{ and } \hat{W}_C>0 \text{ when } \hat{P}_2>0;\\ \text{(ii)} & (\hat{W}-\hat{W}_C)<0 \text{ when } \hat{P}_2>0\\ \text{(iii)} & \hat{W}>0, \hat{R}<0 \text{ and } \hat{W}_C<0 \text{ when } \hat{K}>0;\\ \text{(iv)} & (\hat{W}-\hat{W}_C)>0 \text{ when } \hat{K}>0\end{array}\right\} \quad (A.11)$$

Appendix III: Changes in output composition

Solving (A.5) by Cramer's Rule we can derive the following expressions as well.

$$\hat{X}_1 = -\frac{1}{\Delta}[(S_{CL}^2 + \frac{\gamma W}{l_C W_C})\lambda_{L2}S_{LC}^2\lambda_{K3} - (S_{CC}^2 - \frac{\gamma W}{l_C W_C})(\bar{S}_{LL}\lambda_{K3} - \lambda_{K1}S_{KL}^1\lambda_{L3})$$

$$-\frac{\lambda_{L3}}{(1-\lambda_{L3})}\lambda_{L2}S_{LC}^2\lambda_{K1}S_{KL}^1)]\theta_{N1}\lambda_{N2}\hat{P}_2$$

$$+\frac{1}{\Delta}[\{\lambda_{L2}S_{LC}^2\lambda_{N2}\frac{\lambda_{L3}}{(1-\lambda_{L3})} - (S_{CC}^2 - \frac{\gamma W}{l_C W_C})\lambda_{L3}\lambda_{N2}\}(\theta_{L1}\theta_{N2} - \theta_{N1}\theta_{L2})$$

$$+\theta_{N1}\theta_{C2}\{\bar{S}_{LL}\lambda_{N2}\frac{\lambda_{L3}}{(1-\lambda_{L3})} - (S_{CL}^2 + \frac{\gamma W}{l_C W_C})\lambda_{L3}\lambda_{N2}\}]\hat{K}$$

Or,

$$\hat{X}_1 = -\frac{1}{\Delta}[-(S_{CC}^2 - \frac{\gamma W}{l_C W_C})(\lambda_{L1}S_{LL}^1\lambda_{K3} - \lambda_{K1}S_{KL}^1\lambda_{L3}) - \frac{\lambda_{L3}}{(1-\lambda_{L3})}\lambda_{L2}S_{LC}^2\lambda_{K1}S_{KL}^1)]\theta_{N1}\lambda_{N2}\hat{P}_2$$

(−) (−) (−) (+) (+)

$$+\frac{1}{\Delta}[\{\frac{\lambda_{L2}S_{LC}^2}{(1-\lambda_{L3})} - (S_{CC}^2 - \frac{\gamma W}{l_C W_C})\}\lambda_{L3}\lambda_{N2}(\theta_{L1}\theta_{N2} - \theta_{N1}\theta_{L2})$$

(−) (+) (−) (−)

$$+\theta_{N1}\theta_{C2}\lambda_{L3}\lambda_{N2}\{\frac{\bar{S}_{LL}}{(1-\lambda_{L3})} - (S_{CL}^2 + \frac{\gamma W}{l_C W_C})\}]\hat{K} \quad \text{(A.12)}$$

(−) (+)

$$\hat{X}_2 = \frac{1}{\Delta}[-(S_{CC}^2 - \frac{\gamma W}{l_C W_C})(\lambda_{L1}S_{LL}^1\lambda_{K3} - \lambda_{K1}S_{KL}^1\lambda_{L3}) - \frac{\lambda_{L3}}{(1-\lambda_{L3})}\lambda_{L2}S_{LC}^2\lambda_{K1}S_{KL}^1)]\theta_{N1}\lambda_{N1}\hat{P}_2$$

(−) (−) (−) (+) (+) (+)

$$-\frac{1}{\Delta}[\{\frac{\lambda_{L2}S_{LC}^2}{(1-\lambda_{L3})} - (S_{CC}^2 - \frac{\gamma W}{l_C W_C})\}\lambda_{L3}\lambda_{N1}(\theta_{L1}\theta_{N2} - \theta_{N1}\theta_{L2})$$

(−) (+) (−) (−)

$$+\theta_{N1}\theta_{C2}\lambda_{L3}\lambda_{N1}\{\frac{\bar{S}_{LL}}{(1-\lambda_{L3})} - (S_{CL}^2 + \frac{\gamma W}{l_C W_C})\}]\hat{K} \quad \text{(A.13)}$$

(−) (+)

[We have used the expression of $\bar{S}_{LL}$ and note that $S_{LC}^2 + S_{LL}^2 = 0$ and $S_{CC}^2 + S_{CL}^2 = 0$]

$$\hat{X}_3 = -\frac{1}{\Delta}[\{(S_{CC}^2 - \frac{\gamma W}{l_C W_C})\lambda_{L2}\lambda_{K1}S_{KL}^1 - \lambda_{L2}S_{LC}^2\lambda_{K1}S_{KL}^1\}\lambda_{N1}$$

$$-\{(S_{LC}^2 + \frac{\gamma W}{l_C W_C})\lambda_{L2}S_{LC}^2\lambda_{K1} - (S_{CC}^2 - \frac{\gamma W}{l_C W_C})(\bar{S}_{LL}\lambda_{K1} - \lambda_{L1}\lambda_{K1}S_{KL}^1)\}\lambda_{N2}]\theta_{N1}\hat{P}_2$$

$$+\frac{1}{\Delta}[\{\lambda_{L2}S_{LC}^2\lambda_{N1} - (S_{CC}^2 - \frac{\gamma W}{l_C W_C})(\lambda_{N1}\lambda_{L2} - \lambda_{L1}\lambda_{N2})\}(\theta_{L1}\theta_{N2} - \theta_{N1}\theta_{L2})$$

$$+\theta_{N1}\theta_{C2}\{\bar{S}_{LL}\lambda_{N1} - (S_{CL}^2 + \frac{\gamma W}{l_C W_C})(\lambda_{N1}\lambda_{L2} - \lambda_{L1}\lambda_{N2})\}]\hat{K}$$

Or,

$$\hat{X}_3 = -\frac{1}{\Delta}[-\lambda_{L2}S_{LC}^2S_{KL}^1\lambda_{N1} + (S_{CC}^2 - \frac{\gamma W}{l_C W_C})\{S_{KL}^1\left|\lambda\right|_{NL}^{12} + \lambda_{N2}\lambda_{L1}S_{LL}^1\}]\lambda_{K1}\theta_{N1}\hat{P}_2$$

(–) (+) (–) (+) (–) (+)

$$+\frac{1}{\Delta}[\{\lambda_{L2}S_{LC}^2\lambda_{N1} - (S_{CC}^2 - \frac{\gamma W}{l_C W_C})(\lambda_{N1}\lambda_{L2} - \lambda_{L1}\lambda_{N2})\}(\theta_{L1}\theta_{N2} - \theta_{N1}\theta_{L2})$$

(–) (+) (–) (+) (–)

$$+\theta_{N1}\theta_{C2}\{\bar{S}_{LL}\lambda_{N1} - (S_{CL}^2 + \frac{\gamma W}{l_C W_C})(\lambda_{N1}\lambda_{L2} - \lambda_{L1}\lambda_{N2})\}]\hat{K} \quad \text{(A.14)}$$

(–) (+) (+)

From (A.12) - (A.14) we get the following

(v) $\hat{X}_1 < 0, \hat{X}_2 > 0$ when $\hat{P}_2 > 0$;

(vi) $\hat{X}_3 < 0$ when $\hat{P}_2 > 0$

under the sufficient condition that $\{S_{KL}^1\left|\lambda\right|_{NL}^{12} + \lambda_{N2}\lambda_{L1}S_{LL}^1\} \geq 0$ (A.15)

(vii) $\hat{X}_1 > 0, \hat{X}_2 < 0$ when $\hat{K} > 0$;

(viii) $\hat{X}_3 > 0$ when $\hat{K} > 0$.

Also note that $\hat{K}_3 = \hat{X}_3$ where $K_3 = a_{K3}X_3$ (this is because $\hat{a}_{K3} = 0$). So,

(ix) $\hat{K}_3 < 0$ when $\hat{P}_2 > 0$; and, (A.16)

(x) $\hat{K}_3 > 0$ when $\hat{K} > 0$.

Appendix IV: Proof of proposition 3

Totally differentiating equation (11) we get the following

$$\hat{L}_C = -\frac{\gamma W}{l_C W_C}(\hat{W} - \hat{W}_C) - \frac{\lambda_{L3}}{(1-\lambda_{L3})}\hat{X}_3$$

We now substitute the expressions of $\hat{X}_3$ and $(\hat{W} - \hat{W}_C)$ from (A.14) and (A.10) respectively to get the following expression.

$$\hat{L}_C = -\frac{1}{\Delta}[-\frac{\gamma W}{l_C W_C}(A_1 \lambda_{L1} S^1_{LL} - \lambda_{K1} S^1_{KL} A_3)$$

(−) (−) (+)

$$-\frac{\lambda_{L3}}{(1-\lambda_{L3})}\{-\lambda_{L2} S^2_{LC} S^1_{KL} \lambda_{N1} + (S^2_{CC} - \frac{\gamma W}{l_C W_C})(S^1_{KL}\left|\lambda\right|^{12}_{NL} + \lambda_{N2}\lambda_{L1} S^1_{LL})\}\lambda_{K1}]\ \theta_{N1}\hat{P}_2 \qquad \text{(A.17)}$$

(+) (−) (+) (−) (+)

From (A.17) we get the following results.

$\hat{L}_C > 0$ when $\hat{P}_2 > 0$ under the sufficient condition $\{S^1_{KL}\left|\lambda\right|^{12}_{NL} + \lambda_{N2}\lambda_{L1} S^1_{LL}\} \geq 0$

Rewriting (A.17) in a different way it can be checked that the above result also hold under the sufficient condition that $S^2_{LC} S^1_{KL} \geq S^2_{CC} S^1_{LL}$.

Appendix V: Effects on family welfare

We substitute the optimum values of consumption of commodities (C_1, C_2 and C_3) (from equations (A.2)-(A.4)) and children's leisure $(n - l_C)$ (from equation (10)) into the utility function (equation (8)) to get the following expression.

$$V = H\frac{(nW_C + W)}{(W_C)^{\gamma}} \qquad \text{(A.18)}$$

where V stands for family welfare and $H = \gamma A(\frac{\alpha}{\gamma P_1})^{\alpha}(\frac{\beta}{\gamma \overline{P}_2})^{\beta}(\frac{\rho}{\gamma P_3})^{\rho} > 0$

Totally differentiating the above expression we get the following.

$$\hat{V} = \frac{(l_C W_C \hat{W}_C + W\hat{W})}{(nW_C + W)} \quad \text{(A.19)}$$

From the above expression it is clear that family welfare is an increasing function of both W and W_C.

We now substitute $\hat{W}$ and $\hat{W}_C$ from (A.7) and (A.8) into (A.19) to get the following.

$$\hat{V} = \frac{1}{\Delta(nW_C + W)}[-W\{\lambda_{L2} S^2_{LC} A_1 - (S^2_{CC} - \frac{\gamma W}{l_C W_C}) A_2\} + \{\bar{S}_{LL} A_1 - \lambda_{K1} S^1_{KL} A_3$$

(-) (+) (-) (-) (+)

$$-(S^2_{CL} + \frac{\gamma W}{l_C W_C}) A_2\}]\theta_{N1}\hat{P}_2 - \frac{1}{\Delta(nW_C + W)}[\theta_{N1}(W\theta_{C2} - l_C W_C \theta_{L2}) + l_C W_C \theta_{L1}\theta_{N2}] A_3 \hat{K} \quad \text{(A.20)}$$

(+) (+) (-) (+) (+)

Now from (A.20) we have

$$(W\theta_{C2} - l_C W_C \theta_{L2}) = (\frac{WW_C}{P_2})[a_{C2} - a_{C2} l_C] = (\frac{WW_C}{P_2})[a_{C2} - \frac{a_{L2} a_{C2} X_2}{(a_{L1} X_1 + a_{L2} X_2)}]$$

$$= (\frac{W\theta_{C2} a_{L1} X_1}{a_{L1} X_1 + a_{L2} X_2}) > 0. \quad \text{(A.21)}$$

(obtained after using (4), (7), (10) and (11).)

From (A.20) and (A.21) we can obtain the following results.

(i) $\hat{V} > 0$ when $\hat{P}_2 > 0$;

(ii) $\hat{V} > 0$ when $\hat{K} > 0$.

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