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Introduction :

The problem of restraining the growth of population is the main issue in most of the developing countries (Gills et. al. 1996). In the developing countries (DCs), birth rates today are substantially higher than that of the current developed countries in their pre industrial stage (Kuznets 1966). Several studies have been tried to explain from various angles regarding high birth rates of the developing countries covering social, cultural, institutional, economic and other aspects of population (Lindert 1983, Vlassoff 1979, Aghajanian 1978, Nag et. al. 1978, Cain 1977, Agami 1976, Mamadani 1972, Kasarda 1971).

Existing Literature :

Many social scientists are in the opinion that demand for child labour in various activities in the developing countries play a major role in deciding the family size. In their view, farmers in the developing countries employ child labour in large number in agricultural activities. The crucial question, therefore, is : what factors explain the such behaviour of the farmers? According to Nadkarni (1976), peak season shortage of adult labour may explain the employment of child labour in agriculture. Khuda (1991) blames the subsistence agriculture for the existence of child labour and Shariff (1991) identifies the application of labour intensive technology in agriculture as the responsbile factor. Following these, a few writers hold the view that agricultural moderniztion in capital using stage may reduce the demand for child labour and in turn reduce the economic benefit of having more children (Hutaserani and Roumasset 1991, Murthy 1991, Levy 1985, Basu et. al. 1979 and Rosenzweig 1977). According to them, as agricultural modernisation takes place, farmers largely adopt capital intensive technology replacing labour intensive technology. Because in this stage, farmers generally opt for time saving as well as cost saving technology. Induced by higher wage, labour saving technology encourages farm households to introduce them in lieu of hired adult labour to child labour which induces labour market evolution. It leads to the emergence of specialised labour teams for different types of work beginning from land preparation to threshing. The increased specialisation of labour makes it profitable for farm households to employ them for each type of work and thus leads to lesser demand for child labour. In other words, as specialisation (gained through experience by adoption of modern technology) and mechanisation proceds, child labour becomes a poorer substitute and this leads to a lesser demand for them. In this way, economic utility of children is reduced which ultimately discourages farm households to have a large families. Contradictory evidence of the above opinions are also exist -- i.e., mechanisation and modernisation of agriculture do not necessarily reduce the demand for child labour and fertility (Vemuri and Sastry 1991).

Objective of the Paper :

Keeping the above alternative views of the existing literature in mind, in this paper an attempt has been made to explain the causes of high incidence of child employment in agriculture and high fertility especially in rural West Bengal, India in a situation when Indian agriculture have passed some way towards modernisation since the introduction of HYV programme (which is capital intensive in nature) in the mid-sixties of 20th Century.

As of now, India is predominantly a rural economy, nearly 75 per cent of the population live in the country side and about 60 per cent of the work force depends mainly on agriculture. Indian agriculture at present, is rapidly experiencing changes in techniques as well as evoluation of labour and product market. This sector is behaving now like the industrial sector. Profit - i.e., commercial motive is emerging first. Capital intensity in agricultural technology is spreading. At the same time, it is observed by various estimates and studies (R.G. 1987, 1978, 1976, 1964; GOI 1985, 1980; Rural Labour Enquiry 1980, Agricultural Labour Enquiry Report 1960, 1955, Kulshreshtha 1978) that the prevalence of child labour in agriculture is growing in absolute as well as in ratio terms overtime. To explain this paradoxical scenario of Indian agriculture, a few writers explain it by the argument of peak season shortage of adult labour. But others disagree because they think that there exist surplus labour in rural areas even in peak period of work (Rudra 1973, Mitra 1976). Hence the actual reason behind the paradoxical result remains to be explored.

In this paper, it has been tried to explore the reason following the logical sequence of argument provided by George (1990) for explaining the reason behind the child employment in small scale and cottage industries. According to her, workers of small scale and cottage industries cannot adopt modern sophisticated technology in optimum scale (which helps them to produce at competitive cost) due to their financial constraint. So to survive in the strong competition of product market they have to cut down the cost anyhow. For this reason, they employ child labour to reduce cost. Therefore, in this paper an attempt has been made to find out the effictiveness of the above logic in explaining the child employment in agriculture.

Framework for analysis :

In India, like other developing countries most of the farmers are not capital rich. They have small and fragmented operational holdings. Hence they cannot adopt the modern technology in optimal scale. They adopt it partially. In fact they adopt a technology which is neither a modern one nor a traditional one - but a combination of both modern and traditional methods. In this situation, farmers cannot produce crops at sufficiently low cost so that they can survive in the face of strong competition in crop market. Therefore, they have to reduce cost by employing child labour which is the easiest available option open to them.

At present, Indian agriculture is passing through the capital using stage of agricultural development. It is generally observed that the rise in capital intensity makes possible greater division of labour. The division of labour in agricultural operations generates some types of jobs in which children are equally efficient to their adult counterparts. So child labour may not be poorer substitute of adult labour in terms of savings or in terms of profitability of farming. Employment of children in such jobs in place of adult labour adult labour reduce the cost of production. Thus the employment of child labour provides a higher competitive edge to the farmers. Thus on one hand, adoption of relatively capital intensive technique provides the scope for employing children and on the other hand stiff market competition forces the farmers to employ child labour. In other words, wider adoption of capital intensive technique at sub optimal level can explain the increased demand for child labour which in turn leads to increased preference for bigger family by the rural households via rise in the economic utility of children.

Survey and Methodology :

To establish our above views, path analysis technique has been applied to primary data generated through a field survey. The survey was conducted in two agriculturally diversed Block of West Bengal from July 1995 to December, 1995 with a reference period between July 1994 to June 1995. One is Tarakeswar Block which is near about 50 k.m. away from Kolkata - capital city of West Bengal and other is Dantan Block-1 which is near about 200 k.m. away from Kolkata. Relevant data and informations have been collected

from 681 rural households residing in 36 villages in the two Blocks (18 villages from each Block) by a combination of direct observation and interviews through structured schedules benefiting from the advantages of both while at the same time, minimising the weakness of both the methods. In this paper, our intention is to use direct variables (which are best fitting for explaining the relevant dependent variables) instead of using indirect/proxy variables. For example, capital intensive technology is represented here by capital labour cost ratio. Often it is measured by the amount of applied chemical fertilizer or by employment decline rate (Rosenzweigh 1977, Hutaserani and Roumasset 1991, Vemuri and Sastry 1991). In our analysis each measure, stated above, has been considered only one component of modern technology. So to cover the whole aspect of the said technology, all costs incurred for capital and labour inputs have been considered here. Another example is that agricultural modernisation/development is usually represented by farm productivity and it is often measured by considering the production of one major crop such as production of paddy per acre (Roumasset and Smith 1981). However, such a measure does not reflect the whole scenario of agricultural modernisation. To capture whole picture, the amout of production of all crops cultivated in our reference period, has been considered for measuring farm productivity and hence agricultural modernisation. Multiple cropping is another indicator of agricultural modernisation which represent intensity of cultivation. It is often represented by the number of crop cultivated in a calendar year. But this measure does not reflect the actual intensity of cultivation. In this paper, it is measured by considering not only the number of crop cultivated, but also by considering the areas under each crop cultivated in a calendar year. Thus an attempt has been made in this paper to measure the relevant variables more directly and realistically.

Path Analysis :

To establish the logical consequences of the above formulated framework, in this paper the method of path analysis has been adopted. Because here our interest is to find out the paths by which agricultural modernisation influences the demand for child labour and under what path it affects the fertioity of rural household. Path analysis is a useful method for studying the direct and indirect effects of variables taken as causes on variables taken as effects (Kerlinger and Pedhazur 1973). To use this method, path diagram have been

developed. Because it is a useful device for displaying graphically the pattern of causal relation among a set of variables. In this causal model, a distinction is made between exogenous and endogenous variables. An exogenous variable is a variable whose variability is assumed to be determined by causes outside the causal model. An endogenous variable is one those variation is explained by exogenous and/or endogenous variables in the system. In path diagram paths are drawn in the form of directional arrows from the variables taken as cause (independent) to the variables taken as effect (dependent). In this paper, it is assumed at a given point of time, a variable is not both a cause and an effect of another variable, then there are unidirectional causal flows. In other words, in this paper our analysis is within the periphery of recursive model -- i.e., model without feed back loops and with uncorrelated crrors between equations as well as within equations. By path analysis, direct, indirect as well as total effect can be traced. Direct and indirect effedcts can be observed from path co-efficient written generally on the side of arrow drawn to indicate the direction of causation between vcariables. The variable which is at the base of the arrow is called cause or independent variable and the variable which is at the head of the arrow is called effect or dependent variable. Path co-efficients are here represented by standardised regression coefficient (Retherford and Choe 1973) and these are found by simultaneous multiple regression.

Assumption behind path analysis :

i) The relations among the variables in the model are linear, additive and causal. ii) The residuals are not correlated among themselves, nor are they correlated with the variables in the system. iii) These is a one may causal flow in the system. iv) The variables are measured in an interval scale.

Theoretical Framework behind The Path Diagramme :

Transition in agricultural development may be occured through three stages - i.e., (i) land using, (ii) labour using, and (iii) capital using (Hutasarani and Roumasset 1991). To overcome the forces of diminishing return rising from employment on given land at the third stage of agricultural transition, capital accumulation and technological changes proceed rapidly which lead to land and labour saving innovations. The common feature at the final

stage of agricultural development are the application of various types of machines, use of HYV seeds, chemical fertilisers, pesticides, and controlled irrigation for watering and the evolution of new institution for organising production especially the emergence of labour markets as well as specialised labour teams. In this stage of development, as mechanisation and specialisation in agricultural activities proceed, division of labour to a greater extent, becomes possible. Because division of labour in agricultural operation generates some types of job in which children are equally efficient to their adult counterparts.

For example, in potato cultivation, the whole work related to seedling the potato including drawing the rows in the prepared bed, watering the bed in required amount by 'jara' (i.e., a specially built implement), putting the potato seeds in the rows with a fixed space and then covering these with the soil, the children are found to be equally efficient to their adult counterparts. Similarly, the whole work related to harvesting of potato including the opening the potato bed with plough or other implements, picking up of potatoes from opened bed after removing soil as well as dust and putting them into baskets and loaded these into cycle van (one kind of goods carrier) and driven the cycle van in store houses do not involve any skill or laborious labour. Therefore, children are equally efficient to carry out these type of work with their adult counterpart.

In paddy cultivation, the children are mainly engaged in some work related to threshing by thresher machine especially removing loose straws from the mouth of the machine when it operates and carrying the bundles of hay to preserving place. Children are not inferior to carryout these work with respect to their adult counterpart.

In jute cultivation, the work related to the procurement of jute fibre including the seperation of jute skin from the jute plant and washing the skin thoroughly in water and drying the jute fibre as well as jute sticks, the children appears to be better than their adult counterpart and so children are preferred.

In cultivating various crops and vegetables children are often seen to act as helper at the time of watering in a controlled manner. Besides these, in weeding and in picking up

different crops, to a large extent children are often preferred. One can cite many more examples from various other crop cultivation. These types of employment became possible owing to division of labour and application of various types of machine.

The employment of children in such works greatly benefits the farmers. It reduces the burden of total cost on labour. It gives some kind of relief in the face of steep and strong competition in the crop market to the farmers who cannot adopt upto date technology owing to lack of sufficient fund, of sufficient large farm size and of farm asset. So it can be said that improvement in technology provides the scope for child employment and market competition compels farmers to employ child labour. In other words, agricultural modernisation in sub optimal scale encourages higher demand for child labour (A1). The demand for child labour in total (TCL^d/A2) can be divided into two : demand for family child labour ($SFCL^d$/A3) and demand for hired child labour ($WGCL^d$/A4). As agricultural modernisation takes place demand for family child labour in agricultural operation rises. Thus economic utility of children increases. It motivates farm households to prefer large family size -- i.e. the route of demand for family child labour during agricultural modernisation intensifies population growth. On the other side, enlarged family enhances the supply of child labour (A.5). It is here classified into two : supply of family child labour in agricultural work ($SFCL^s$/A6) and supply of wage child labour ($WGCL^s$/A7). Through the route of $WGCL^s$, fertility (F/A8) affects inversely child schooling (SCH/A9) when agricultural modernisation gets momentum.

Path Diagram :

In this section, considering the above path model, three path diagrams have been developed. For the path analysis, it is necessary to specify the causal link between and/or among the variables. Agricultural modernisation can be viewed as the result of inprovement in agricultural technology (AgT/A10) and intensive cultivation which is measured by multiple cropping (MCR/A11) and ultimately agricultural modernisation is reflected by the

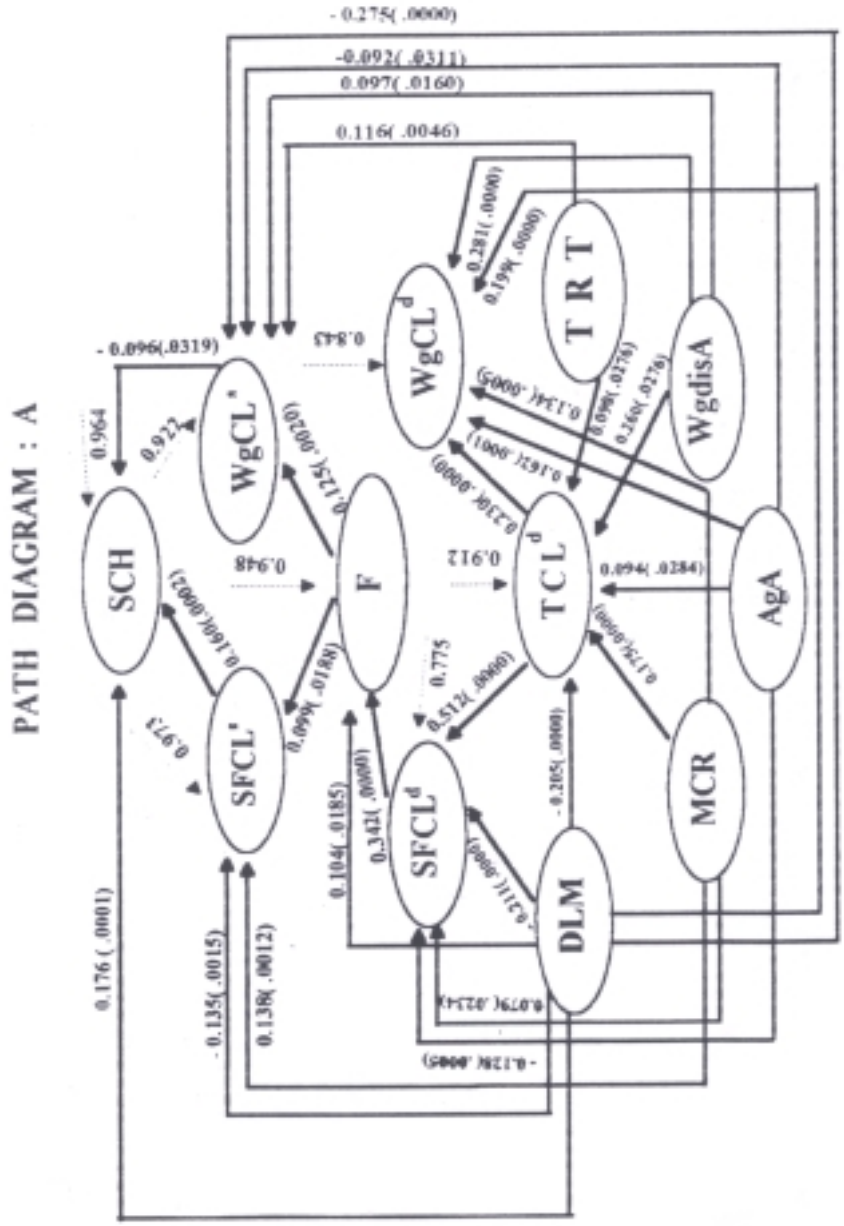
Table 1 : Pearsonian correlation coefficients among study variables

	F	TCL^{d}	SFCL^{d}	WgCL^{d}	SFCL^{s}	WgCL^{s}	SCH	DLM	AgT	MCR	AgD	TRT	AgA	WgdisA
Fertility (F)	1.000													
TCL^{d}	0.1769	1.000												
SFCL^{d}	0.2953	0.5412	1.000											
WgCL^{d}	-0.0753	0.3621	-0.2928	1.000										
SFCL^{s}	0.1132	0.3340	0.4293	-0.1315	1.000									
WgCL^{s}	0.1383	0.2114	0.3812	-0.1561	-0.0975	1.000								
SCH	0.1041	0.0449	0.0607	0.0208	0.1149	-0.1664	1.000							
DLM	-0.0103	-0.1932	-0.3430	0.1484	-0.1504	-0.3254	0.1834	1.000						
AgT	-0.0283	0.1042	0.0946	0.1571	0.0728	0.0382	-0.0059	-0.0068	1.000					
MCR	0.0182	0.2196	0.1618	0.2494	0.1555	0.0629	0.0477	-0.1148	0.5296	1.000				
AgD	0.0045	0.1709	0.1203	0.2649	0.1441	0.0320	0.0528	-0.0973	0.5536	0.9347	1.000			
TRT	0.0294	0.1238	0.1696	-0.0664	0.0202	0.1779	-0.0744	-0.2057	0.1003	0.1184	0.0909	1.000		
AgA	0.0453	0.0765	-0.1467	0.2948	0.0148	-0.2100	0.0972	0.3088	0.1247	0.1569	0.2657	-0.1119	1.000	
WgdisA	0.0251	0.2798	0.1259	0.4137	0.0584	0.0126	0.0916	0.0226	0.0133	0.0618	0.0783	-0.0263	0.2120	1.000

improvement in productivity which is here called by AgD /A12. So here we have three indicators of agricultural modernisation : MCR, AgT and AgD. These are the prime focussed exogenous variable considered in our path analysis. The primary objective is to find out how these factors affect fertility through the route of demand for child labour. But these are highly correlated with one another as shown in Table : 1 [For explantion of symbols see Appendix I]. As path analysis has been done within the simultaneous equation system, all these factors have not been included in one path diagram. So three path diagrams - i.e. path diagram-A, B and C have been developed to include MCR, AgT and AgD separately in our path analysis. In each path diagram, four other exogenous variables have been included to get some insights. These are : Tenancy rate (TRT/A13), Wagedisadvantage of child labour (WgdisA/A14), farm asset (AgA/A15) and dependence on labour market (DLM/A16).

In each diagram endogenous (response) variables are : i) TCL^d, ii) $SFCL^d$, iii) $WgCL^d$, iv) F, v) $SFCL^s$, vi) $WGCL^s$ and vii) SCH. These are causally interliked between/among them together with the different exogenous variables as portrayed by arrows in different path diagrams. Say for example, in diagram-A it has been portrayed MCR, TRT, WgdisA, AgA and DLM directly affect TCL^d simultaneousely. In turn TCL^d directly affects $SFCL^d$ and $WGCL^d$ simultaneousely with the direct effects of some exogenous variables considered in the model. All exogenous variables indirectly affect $SFCL^d$ and $WGCL^d$ through the intervening variable - TCL^d. Endogenous variable - $SFCL^d$ is directly interlinked to other endogenous variable, F. F directly affects $SFCL^s$ and $WGCL^s$ and in turn $SFCL^s$ and $WGCL^s$ are directly linked with SCH.

All exogenous and endogenous variables are supposed to have direct and indirect effect through one or more intervening variables on all endogenous variables. But here only significant path (at 5% level) have been considered. So in the path diagram in many cases, there is no direct path / effect on endogenous variables. Insignificant paths have been eliminated by method of trial and error (A17). After elimination, final paths have been portrayed as shown in different diagrams. The path co-efficient presented by standardised

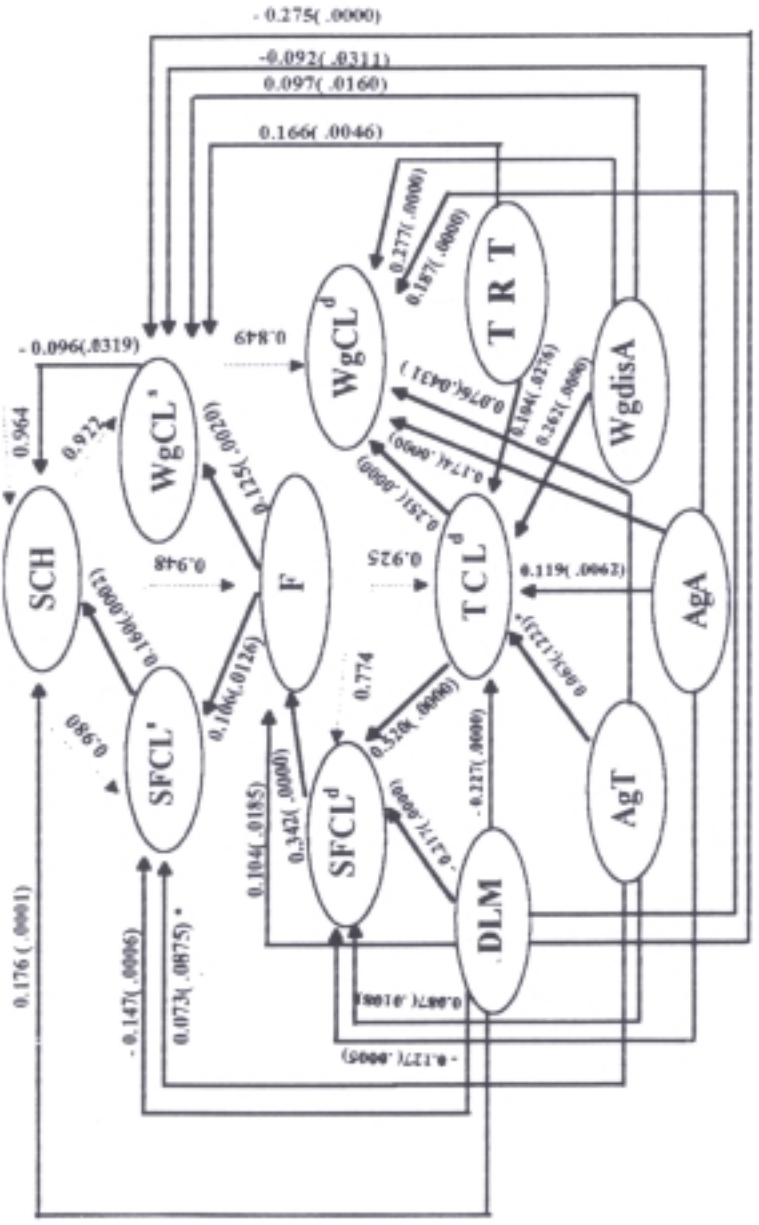


Exogenous variables : i) MCR : Multiple cropping ; ii) DLM : Dependence on labour market ; iii) AgA : Agricultural asset ; iv) WgdisA : Wage disadvantage of child labour ; v) TRT : Tenancy rate.

Endogenous variables : i) TCL^d : Demand for child labour in total ; ii) $SFCL^d$: Demand for self field work active child labour ; iii) $WgCL^d$: Demand for child labour against wage ; iv) F : Fertility ; v) $SFCL^s$: Supply of self field work active child labour ; vi) $WgCL^s$: Supply of child labour against wage ; vii) SCH : Child schooling.

Figure in ( ) : Significant level.

PATH DIAGRAM : B

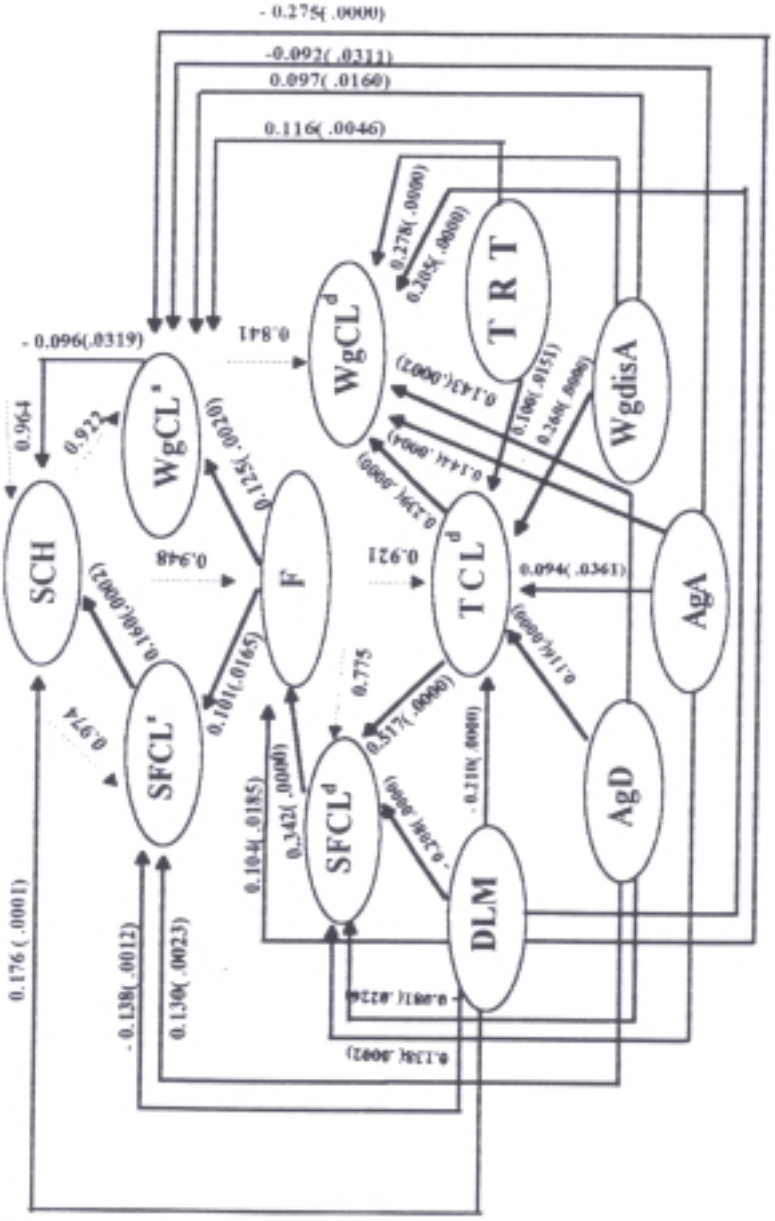


Exogenous variables : i) AGT : Agricultural technology ; ii) DLM : Dependence on labour market ; iii) AgA : Agricultural asset ; iv) WgdisA : Wage disadvantage of child labour ; v) TRT : Tenancy rate.

Endogenous variables : i) TCL^d : Demand for child labour in total ; ii) $SFCL^d$: Demand for self field work active child labour ; iii) $WgCL^d$: Demand for child labour against wage ; iv) F : Fertility ; vi) $SFCL^s$: Supply of self field work active child labour ; vi) $WgCL^s$: Supply of child labour against wage ; vii) SCH : Child schooling.

Figure in ( ) : Significant level. ( )* : Not Significant at 5 % level.

PATH DIAGRAM : C



Exogenous variables : i) AGD : Agricultural development ; ii) DLM : Dependence on labour market ; iii) AgA : Agricultural asset ; iv) WgdisA : Wage disadvantage of child labour ; v) TRT : Tenancy rate.

Endogenous variables : i) TCL^d : Demand for child labour in total ; ii) SFCL^d : Demand for self field work active child labour ; iii) WgCL^d : Demand for child labour against wage ; iv) F : Fertility ; v) SFCL^s : Supply of self field work active child labour ; vi) WgCL^s : Supply of child labour against wage ; vii) Child schooling.

Figure in ( ) : Significant level.

regression co-efficient(s) is written on the right side of the paths along with its significant level in the bracket. By adopting the OLS method of estimation for simultaneous equation system β co-efficients have been estimated (SPSS/Norusis 1991). Details of the system of equations and estimated equation of the path models is shown in Appendix II. Here one point is to be noted that since it is almost never possible to account for the total variance of a variable, residual variables have been introduced to indicate the effect of variables not included in the model. In path diagrams by broken arrows the latent paths have been portrayed with its path co-efficient, corresponding to said residual variables (Retherford and Choe 1973).

Observation, and interpretation from path models :

The conclusions drawn from path models are based on direct, indirect and total effect of cause variables on effect variables. These effects have been estimated with the help of path co-efficient in terms of numerical values (Retherford and choe 1973). From these values the extent of effect can be judged on various response variables considered in the analysis.

Effect on demand for child labour (TCL^d) :

The numerical values of direct effect of various predictor (cause) variables on TCL^d have been displayed in Table 2. From the Table, it appears that agricultural modernisation have positive effect on TCL^d (as confirmed by all three indicators namely MCR, AgT and AgD used in the paper). That means agricultural modernisation enhances demand for child labour. This finding is contrary to our general expectation. Generally, it is believed that modernisation of agriculture reduce child employment. It indicates that there exist same problems associated with the present agricultural modernisation in the LDCs like India. Why modernisation affect TCL^d positively? The answer may be found from the motive of child employment. The path running from WgdisA indicates that WgdisA has positive direct effect on TCL^d. It implies that as wage of child labour relative to the wage of adult labour rises, demand for child labour relative to that of adult labour rises. It is a quite paradoxical result. Because normally one can expect negative

relation between WgdisA and employment of child labour following profit maximisation principle of labour employment. But, here, the reverse trend is found. It implies that there is cost reduction motive working behind the child employment. It is observed in the study field that the average wage rate for a child labour is around 60% of the wage of an adult labour. So by employing a child labour, a farmer is in a position to save more or less 40% of the wage of a hired adult labour. Probably for this reason, farmers demand more and more child labour paying higher and higher wages upto a certain maximum limit of wage rate for the reduction of cultivation cost.

Table 2 : Effect on demand for child labour in total (TCL^d)

Variable	Type of effect (D-direct)	Numerical value of effect PATH DIAGRAMME		
		A	B	C
Multiple cropping (MCR)	D	0.175	***	***
Agricultural technology (AgT)	D	***	0.063	***
Agricultural development (AgD)	D	***	***	0.116
Wage disadvantage (WgdisA)	D	0.260	0.262	0.260
Tenancy rate (TRT)	D	0.090	0.104	0.100
Agricultural asset (AgA)	D	0.094	0.119	0.094
Dependence on labour market (DLM)	D	-0.205	– 0.227	-0.210

***** Not applicable.**

Now the next question is why farmers eager to save cost by employing child labour. The answer can be found from the paths running from TRT and from AgA. The paths show

that TRT and AgA have both positive effect on TCL^d. It indicates that as farmers became wealthier in terms of volume of farm asset and farm size, demand more child labour in total. This is also contrary to our normal expectation -- i.e., it is expected that farmers having sufficiently large volume of farm asset and land are able to apply modern technology in proper way. Hence need for child employment for survival in cultivation is not there. However, this positive trend has reverse implication. Most of the farmers in India are marginal and small in terms of farm size and farm asset (GOI, 1981). Therefore, they cannot apply input packages, prescribed by modern technology in required doses at appropriate time in cultivation of various crops. As a result, more often they face losses in cultivation. Thus the question of survival in agriculture is there and therefore, they compel to have child labour.

The path running fram DLM shows that dependence on market for labour (DLM) has negative direct effect on TCL^d. It means market orientation in agricultural activities may lead to reduction of child employment. All these results establish our views that due to poor adaptation of modern technology, agricultural modernisation in Indian (which is passing through the capital using stage) is responsible for the high incidence of child employment in agriculture.

Effect on demand for family child labour ($SFCL^d$) and wage child labour ($WgCL^d$) :

The numerical values of direct, indirect and total effect of various cause variables on $SFCL^d$ and on $WgCL^d$ are provided respectively in Table 3 and in Table 4. More or less same analysis and conclusion as done in earlier section can be drawn from the path running to $SFCL^d$ and to $WgCL^d$. All indicators of modernisation used here, have positive direct, indirect and total effect on $SFCL^d$ as well as on $WgCL^d$. Tenant farmers use family as well as hired child labour. But relatively wealthier farmers in terms of farm asset hire more wage child labour and use less family children in fields. It is confirmed by the paths running from AgD and from TRT. Reason behind this finding may be that as agricultural modernisation gets momenturn, at first, the benefit from modernisation is reaped by relatively wealthier

farmers, because they are more accessible to adopt modern technology to some extent but not in optimum scale. As result their economic position improves at first. In this situation, they opt for child quality and hence they protect family children from working at an early age. But at the same time, hire wage child labour for the survival in cultivation which is confirmed by the paths running from WgdisA from DLM. Positive effect of WgdisA and of DLM on $WgCL^d$ show that farmers having insufficient land and asset to adopt modern technology in optimum degree, hire child labour against wage from a market guided by cost-reduction motive.

Table 3 : Effect on demand for self field work active child labour ($SFCL^d$)

Variable	Type of effect [D-Direct, ID-Indirect, T-Total] [T = D + ID]	Numerical value of effect PATH DIAGRAMME		
		A	B	C
Demand for child labour in total (TCL^d)	D	0.512	0.520	0.517
Multiple cropping (MCR)	D	0.079	*	*
	ID : $MCR \rightarrow TCL^d \rightarrow SFCL^d$	0.090	*	*
	T	0.169	*	*
Agricultural technology (AgT)	D	*	0.087	*
	ID : $AgT \rightarrow TCL^d \rightarrow SFCL^d$	*	0.033	*
	T	*	0.120	*
Agricultural development (AgD)	D	*	*	*
	ID : $AgD \rightarrow TCL^d \rightarrow SFCL^d$	*	*	*
	T	*	*	*
Wage disadvantage (WgdisA)	ID : $WgdisA \rightarrow TCL^d \rightarrow SFCL^d$	0.133	0.136	0.134
Tenancy rate (TRT)	ID : $TRT \rightarrow TCL^d \rightarrow SFCL^d$	0.046	0.054	0.052
Agricultural asset (AgA)	D	-0.128	-0.127	-0.138
	ID : $AgA \rightarrow TCL^d \rightarrow SFCL^d$	0.048	0.062	0.049
	T	-0.080	-0.065	-0.089
Dependence on labour market (DLM)	D	-0.211	-0.217	-0.208
	ID : $AgD \rightarrow TCL^d \rightarrow SFCL^d$	-0.105	-0.118	-0.109
	T	-0.316	-0.335	-0.317

*** : Not Applicable.**

Table 4 : Effect on demand for child labour against wage ($WgCL^d$)

Variable	Type of effect [D-Direct, ID-Indirect, T-Total] [T = D + ID]	Numerical value of effect PATH DIAGRAMME		
		A	B	C
Demand for child labour in total (TCL^d)	D	0.230	0.251	0.239
Multiple cropping (MCR)	D ID : $MCR \rightarrow TCL^d \rightarrow WgCL^d$ T	0.134 0.040 0.174	* * *	* * *
Agricultural technology (AgT)	D ID : $AgT \rightarrow TCL^d \rightarrow WgCL^d$ T	* * *	0.076 0.016 0.092	* * *
Agricultural development (AgD)	D ID : $AgD \rightarrow TCL^d \rightarrow WgCL^d$ T	* * *	* * *	0.143 0.028 0.171
Wage disadvantage (WgdisA)	D ID : $WgdisA \rightarrow TCL^d \rightarrow WgCL^d$ T	0.281 0.060 0.341	0.277 0.066 0.343	0.278 0.062 0.340
Tenancy rate (TRT)	ID : $TRT \rightarrow TCL^d \rightarrow WgCL^d$	0.021	0.026	0.024
Agricultural asset (AgA)	D ID : $AgA \rightarrow TCL^d \rightarrow WgCL^d$ T	0.162 0.022 0.184	0.174 0.030 0.204	0.144 0.022 0.166
Dependence on labour market (DLM)	D ID : $AgD \rightarrow TCL^d \rightarrow WgCL^d$ T	0.199 -0.047 0.152	0.187 -0.057 0.130	0.205 -0.050 0.155

*** : Not Applicable.**

Effect on Fertility :

Table 5 shows the effect of various predictor variables on feretility (F). Demand for child labour (TCL^d) through the route of $SFCL^d$ affect F positively. $SFCL^d$ has direct positive effect on F which implies higher demand for child labour, specially higher demand for child labour from family children as labour induces higher fertility. Here it should be

noted that through the route of $WgCL^d$, F is not affected. In path diagrams the path running from $WgCL^d$ to F is insignificant and hence is excluded. That means farmers who demand wage child labour do not prefer large family size.

Table 5 : Effect on fertility (F)

Variable	Type of effect [D-Direct, ID-Indirect, T-Total] [T = D + ID]	Numerical value of effect PATH DIAGRAMME		
		A	B	C
Demand for self field work active childlabour ($SFCL^d$)	D	0.342	0.342	0.342
Demand for child labour in total (TCL^d)	ID : $TCL^d \rightarrow SFCL^d \rightarrow F$	0.175	0.178	0.177
Multiple cropping (MCR)	ID : i) $MCR \rightarrow SFCL^d \rightarrow F$ ii) $MCR \rightarrow TCL^d \rightarrow SFCL^d \rightarrow F$ T	0.027 0.031 0.058	* * *	* * *
Agricultural technology (AgT)	ID : i) $AgT \rightarrow SFCL^d \rightarrow F$ ii) $AgT \rightarrow TCL^d \rightarrow SFCL^d \rightarrow F$ T	* * *	0.030 0.011 0.041	* * *
Agricultural development (AgD)	ID : i) $AgD \rightarrow SFCL^d \rightarrow F$ ii) $AgD \rightarrow TCL^d \rightarrow SFCL^d \rightarrow F$ T	* * *	* * *	0.028 0.021 0.049
Wage disadvantage (WgdisA)	ID : $WgdisA \rightarrow TCL^d \rightarrow SFCL^d \rightarrow F$	0.046	0.047	0.046
Tenancy rate (TRT)	ID : $TRT \rightarrow TCL^d \rightarrow SFCL^d \rightarrow F$	0.016	0.019	0.018
Agricultural asset (AgA)	ID : i) $AgA \rightarrow SFCL^d \rightarrow F$ ii) $AgA \rightarrow TCL^d \rightarrow SFCL^d \rightarrow F$ T	-0.044 0.016 -0.028	-0.043 0.021 -0.022	-0.047 0.017 -0.030
Dependence on labour market (DLM)	D ID : i) $DLM \rightarrow SFCL^d \rightarrow F$ ii) $DLM \rightarrow TCL^d \rightarrow SFCL^d \rightarrow F$ T	0.104 -0.072 -0.036 -0.004	0.104 -0.074 -0.040 -0.010	0.104 -0.071 -0.037 -0.004

*** : Not Applicable.**

It is observed that MCR, AgT, AgD, AgA, wgdisA and TRT have no direct effect on fertility (F) but have positive indirect effect through the route of TCL^d and $SFCL^d$. It implies small and tenant farmers, guided by cost reduction motive, prefer large family, because they have large demand for family children in fields.

Only one exogenous cause variable, DLM have positive direct effect on fertility. It also confirms our cost reduction logic for employing child labour. DLM has negative indirect effect through intervening variables. In total the effect is negative. That means, on the whole, farmers who depend on market for labour do not prefers large family. That is, greater market motivation may lead to reduction in population growth.

AgA has negative effect on F in total. It has no direct significant effect, but it has greater negative effect via $SFCL^d$ than positive effect via TCL^d and $SFCL^d$. Thus it can be said that the farmers having relatively large volume of assets do not prefer high fertility because they generally employ wage child labour and not family children.

Any indicator of agricultural modernisation has no direct effect on fertility. But each has positive indirect effect. So by raising the demand for child labour, basically demand for family child labour, agricultural modernisation affect fertility. Thus here causal ordering is running from demand for children to fertility. That means fertility is high because demand for children is high. Demand for child labour arises due to the inability to apply input package in required doses at proper time. This may be the cause of high population growth in the developing countries like India where agricultural development is at sub-optimal scale. All these establishes our views.

Effect on supply of family child labour ($SFCL^s$), of wage child labour ($WgCL^s$) and on child schooling (SCH) :

It can be seen from Table 6, Table 7 and Table 8 respectively that the numerical value of the effect of various cause variables on $SFCL^s$, $WgCL^s$ and an SCH respectively. Fertility has positive direct effect on $SFCL^s$ and on $WgCL^s$. That means as fertility rises

Table 6 : Effect on supply of self field work active child labour ($SFCL^s$)

Variable	Type of effect [D-Direct, ID-Indirect, T-Total] [T = D + ID]	Numerical value of effect PATH DIAGRAMME		
		A	B	C
Fertility (F)	D	0.099	0.106	0.101
Demand for self field work active childlabour ($SFCL^d$)	ID : $SFCL^d \rightarrow F \rightarrow SFCL^s$	.0339	.0363	.0345
Demand for child labour in total (TCL^d)	ID : $TCL^d \rightarrow SFCL^d \rightarrow F \rightarrow SFCL^s$	.0173	.0189	.0179
Multiple cropping (MCR)	D ID : i) $MCR \rightarrow SFCL^d \rightarrow F \rightarrow SFCL^s$ ii) $MCR \rightarrow TCL^d \rightarrow SFCL^d \rightarrow F \rightarrow SFCL^s$ T	.138 .0027 .0031 .1438	* * * *	* * * *
Agricultural technology (AgT)	D ID : i) $AgT \rightarrow SFCL^d \rightarrow F \rightarrow SFCL^s$ ii) $AgT \rightarrow TCL^d \rightarrow SFCL^d \rightarrow F \rightarrow SFCL^s$ T	* * * *	.073 .0032 .0012 .0774	* * * *
Agricultural development (AgD)	D ID : i) $AgD \rightarrow SFCL^d \rightarrow F \rightarrow SFCL^s$ ii) $AgD \rightarrow TCL^d \rightarrow SFCL^d \rightarrow F \rightarrow SFCL^s$ T	* * * *	* * * *	0.1300 .0028 .0021 .1349
Wage disadvantage (WgdisA)	ID : $WgdisA \rightarrow TCL^d \rightarrow SFCL^d \rightarrow F \rightarrow SFCL^s$	.0046	.0050	.0046
Tenancy rate (TRT)	ID : $TRT \rightarrow TCL^d \rightarrow SFCL^d \rightarrow F \rightarrow SFCL^s$	0.0016	0.0020	.0019
Agricultural asset (AgA)	ID : i) $AgA \rightarrow SFCL^d \rightarrow F \rightarrow SFCL^s$ ii) $AgA \rightarrow TCL^d \rightarrow SFCL^d \rightarrow F \rightarrow SFCL^s$ T	-.0044 .0016 -.0028	-.0046 .0022 -.0024	–.0048 .0017 –.0031
Dependence on labour market (DLM)	D ID : i) $DLM \rightarrow F \rightarrow SFCL^s$ ii) $DLM \rightarrow SFCL^d \rightarrow F \rightarrow SFCL^s$ iii) $DLM \rightarrow TCL^d \rightarrow SFCL^d \rightarrow F \rightarrow SFCL^s$ T	-.135 .0103 -.0071 -.0036 -.1354	-.147 .0110 -.0078 -.0042 -.1440	– .1380 .0105 – .0072 – .0038 – .1385

*** : Not Applicable**

Table 7 : Effect on supply of child labour against wage ($WgCL^s$)

Variable	Type of effect [D-Direct, ID-Indirect, T-Total] [T = D + ID]	Numerical value of effect PATH DIAGRAMME		
		A	B	C
Fertility (F)	D	0.125	0.125	0.125
Demand for self field work active child labour ($SFCL^d$)	ID : $SFCL^d \rightarrow F \rightarrow WgCL^s$	.0428	.0428	.0428
Demand for child labour in total (TCL^d)	ID : $TCL^d \rightarrow SFCL^d \rightarrow F \rightarrow WgCL^s$	.0219	.0223	.0221
Multiple cropping (MCR)	ID : i) $MCR \rightarrow SFCL^d \rightarrow F \rightarrow WgCL^s$ ii) $MCR \rightarrow TCL^d \rightarrow SFCL^d \rightarrow F \rightarrow WgCL^s$ T	.0034 .0039 .0073	* * *	* * *
Agricultural technology (AgT)	ID : i) $AgT \rightarrow SFCL^d \rightarrow F \rightarrow WgCL^s$ ii) $AgT \rightarrow TCL^d \rightarrow SFCL^d \rightarrow F \rightarrow WgCL^s$ T	* * *	.0038 .0014 .0052	* * *
Agricultural development (AgD)	ID : i) $AgD \rightarrow SFCL^d \rightarrow F \rightarrow WgCL^s$ ii) $AgD \rightarrow TCL^d \rightarrow SFCL^d \rightarrow F \rightarrow WgCL^s$ T	* * *	* * *	.0035 .0026 .0061
Wage disadvantage (WgdisA)	D ID : $WgdisA \rightarrow TCL^d \rightarrow SFCL^d \rightarrow F \rightarrow WgCL^s$ T	.097 .0058 .1028	.097 .0059 .1029	.097 .0058 .1028
Tenancy rate (TRT)	D ID : $TRT \rightarrow TCL^d \rightarrow SFCL^d \rightarrow F \rightarrow WgCL^s$ T	.116 .0020 .1180	.116 .0024 .1184	.116 .0023 .1183
Agricultural asset (AgA)	D ID : i) $AgA \rightarrow SFCL^d \rightarrow F \rightarrow WgCL^s$ ii) $AgA \rightarrow TCL^d \rightarrow SFCL^d \rightarrow F \rightarrow WgCL^s$ T	-.092 -.0055 .0020 -.0955	-.092 -.0054 .0026 -.0948	-.092 -.0059 .0021 -.0958
Dependence on labour market (DLM)	D ID : i) $DLM \rightarrow F \rightarrow WgCL^s$ ii) $DLM \rightarrow SFCL^d \rightarrow F \rightarrow WgCL^s$ iii) $DLM \rightarrow TCL^d \rightarrow SFCL^d \rightarrow F \rightarrow WgCL^s$ T	-.275 .0130 -.0090 -.0045 -.2755	-.275 .0130 -.0093 -.0050 -.2763	-.275 .0130 -.0089 -.0046 -.2755

*** : Not Applicable.**

Table 8 : Effect on child schooling (SCH)

Variable	Type of effect [D-Direct, ID-Indirect, T-Total] [T = D + ID]	Numerical value of effect PATH DIAGRAMME		
		A	B	C
I	II	III	IV	V
Supply of self field work active child labour ($SFCL^s$)	D	.160	.160	.160
Supply of child labour against wage ($WgCL^s$)	D	-.096	-.096	-.096
Fertility (F)	ID : i) $F \rightarrow SFCL^s \rightarrow SCH$	.0158	.0170	.0162
	ii) $F \rightarrow WgCL^s \rightarrow SCH$	-.0120	-.0120	-.012
	T	.0038	.0050	.0042
Demand for self field work active child labour ($SFCL^d$)	ID : i) $SFCL^d \rightarrow F \rightarrow SFCL^s \rightarrow SCH$	.0054	.0058	.0055
	ii) $SFCL^d \rightarrow F \rightarrow WgCL^s \rightarrow SCH$	-.0041	-.0041	-.0041
	T	.0013	.0017	.0014
Demand for child labour in total (TCL^d)	ID : i) $TCL^d \rightarrow SFCL^d \rightarrow F \rightarrow SFCL^s \rightarrow SCH$	.0028	.0030	.0029
	ii) $TCL^d \rightarrow SFCL^d \rightarrow F \rightarrow WgCL^s \rightarrow SCH$	-.0021	-.0021	-.0021
	T	.0007	.0009	.0008
Multiple cropping (MCR)	ID : i) $MCR \rightarrow SFCL^s \rightarrow SCH$	.0221	*	*
	ii) $MCR \rightarrow SFCL^d \rightarrow F \rightarrow SFCL^s \rightarrow SCH$	.0004	*	*
	iii) $MCR \rightarrow SFCL^d \rightarrow F \rightarrow WgCL^s \rightarrow SCH$	-.0003	*	*
	iv) $MCR \rightarrow TCL^d \rightarrow SFCL^d \rightarrow F \rightarrow SFCL^s \rightarrow SCH$	.0005	*	*
	v) $MCR \rightarrow TCL^d \rightarrow SFCL^d \rightarrow F \rightarrow WgCL^s \rightarrow SCH$	-.0004	*	*
	T	.0223	*	*
Agricultural technology (AgT)	ID : i) $AgT \rightarrow SFCL^s \rightarrow SCH$	*	.0117	*
	ii) $AgT \rightarrow SFCL^d \rightarrow F \rightarrow SFCL^s \rightarrow SCH$	*	.0005	*
	iii) $AgT \rightarrow SFCL^d \rightarrow F \rightarrow WgCL^s \rightarrow SCH$	*	-.0004	*
	iv) $AgT \rightarrow TCL^d \rightarrow SFCL^d \rightarrow F \rightarrow SFCL^s \rightarrow SCH$	*	.0002	*
	v) $AgT \rightarrow TCL^d \rightarrow SFCL^d \rightarrow F \rightarrow WgCL^s \rightarrow SCH$	*	-.0001	*
	T	*	.0119	*
Agricultural development (AgD)	ID : i) $AgD \rightarrow SFCL^s \rightarrow SCH$	*	*	.0208
	ii) $AgD \rightarrow SFCL^d \rightarrow F \rightarrow SFCL^s \rightarrow SCH$	*	*	.0004
	iii) $AgD \rightarrow SFCL^d \rightarrow F \rightarrow WgCL^s \rightarrow SCH$	*	*	-.0003
	iv) $AgD \rightarrow TCL^d \rightarrow SFCL^d \rightarrow F \rightarrow SFCL^s \rightarrow SCH$	*	*	.0003
	v) $AgD \rightarrow TCL^d \rightarrow SFCL^d \rightarrow F \rightarrow WgCL^s \rightarrow SCH$	*	*	-.0003
	T	*	*	-.0209

Table 8 contd…..

Table 8 Concluded

Variable	Type of effect [D-Direct, ID-Indirect, T-Total] [T = D + ID]	Numerical value of effect PATH DIAGRAMME		
		A	B	C
I	II	III	IV	V
Wage disadvantage (WgdisA)	ID : i) WgdisA → TCL^d → $SFCL^d$ → F → $SFCL^s$ → SCH ii) WgdisA → TCL^d → $SFCL^d$ → F → $SFCL^s$ → SCH iii) WgdisA → $WgCL^s$ → SCH T	.0007 -.0006 -.0093 -.0092	.0008 .0006 -.0093 -.0091	.0007 -.0006 -.0093 -.0092
Tenancy rate (TRT)	ID : i) TRT → TCL^d → $SFCL^d$ → F → $SFCL^s$ → SCH ii) TRT → TCL^d → $SFCL^d$ → F → $SFCL^s$ → SCH iii) TRT → $WgCL^s$ → SCH T	.0003 -.0002 -.0011 -.0010	.0003 -.0002 -.0011 -.0010	.0003 -.0002 -.0011 -.0010
Agricultural asset (AgA)	ID : i) AgA → $SFCL^d$ → F → $SFCL^s$ → SCH ii) AgA → $SFCL^d$ → F → $WgCL^s$ → SCH iii) AgA → TCL^d → $SFCL^d$ → F → $SFCL^s$ → SCH iv) AgA → TCL^d → $SFCL^d$ → F → $WgCL^s$ → SCH v) AgA → $WgCL^s$ → SCH T	-.0007 .0005 .0003 -.0002 .0088 .0087	-.0007 .0005 .0004 -.0002 .0088 .0088	-.0008 .0006 .0003 -.0002 .0088 .0087
Dependence on labour market (DLM)	D ID : i) DLM → $SFCL^s$ → SCH ii) DLM→ F → $SFCL^s$ → SCH iii) DLM → F → $WgCL^s$ → SCH iv) DLM→ $SFCL^d$ → F → $SFCL^s$ → SCH v) DLM→ $SFCL^d$ → F → $WgCL^s$ → SCH vi) DLM→ TCL^d → $SFCL^d$ → F → $SFCL^s$ → SCH vii) DLM→ TCL^d → $SFCL^d$ → F → $WGCL^s$ → SCH viii) DLM → $WgCL^s$ → SCH T	.176 -.0216 .0016 -.0012 -.0011 .0009 -.0006 .0004 .0264 .1808	.176 -.0235 .0018 -.0012 -.0012 .0009 -.0007 .0005 .0264 .1790	.176 -.0221 .0017 -.0012 -.0011 .0009 -.0006 .0004 .0264 .1804

- **: Not Applicable.**

supply of child labour increases. All the indicators of agricultural modernisation have positive direct and indirect effect on $SFCL^S$ but each has only positive indirect effect an $WgCL^S$. It implies agricultural modernisation induces higher supply of child labour. DLM has negative direct effect on both $SFCL^S$ and $WgCL^S$. That is farmers who depend on market for labour, supply less children for working in the fields; while tenant farmers having less farm asset, supply more wage child labour in market as shown by the path running from AgA and from TRT. Path diagrams also show wage of child labour relative to that of adult labour affects $WgCL^S$ positively and directly. Thus it can be said increased fertility resulting from agricultural modernisation, enhances the supply of child labour and at the same time, it can be said market orientation in agriculture can reduce the supply of child labour.

On child schooling, supply of wage child labour has negative direct effect, whereas supply of family child labour has positive direct effect. It indicates that family child labour not only work in fields but also attend school. This schooling motivation is the result of development to some extent. WgdisA and TRT both have negative indirect effect in total on SCH. It implies that as wage increases the demand for wage child labour rises and in turn, it enhances the supply of wage child labour via fertility and it ultimately affect schooling in negative direction. As tenant and small farmers supply most of the wage child labourers, TRT has negative effect on schooling, but AgA and DLM - both have positive total effect on schooling. Because wealthier farmers who depend mainly on market for labour, send their children to school instead of sending them to work in the fields.

Concluding Remarks :

All path diagrams show the specific ways how agricultural modernisation affects the demand for child labour, fertility, supply of child labour and child schooling. Multiple cropping, agricultural technology and agricultural development (- i.e., indicator of agricultural modernisation) have positive effect on child labour and fertility. Among other factors considered in our path analysis, agricultural asset, tenancy rate, wagedisadvantage of child labour have positive effect on child labour while dependence on labour market has inverse effect on child labour.

From the analysis, it appears that small operational landholding, small and insufficient asset base, financial constraint, and uncertainty of crop prices are responsible for sub-optimal use of modern technological package and in turn is responsible for large incidence of child labour. As we know that success of modern technology in raising production and in reducing cost of production largely depends on timely application of various inputs in optimum combination. Farmers in this survey area (rural West Bengal) can not apply various inputs in required amount timely due to insufficient volume of farm asset as well as small and fragmented farm size. As a result, lower produce and higher cost of production make it difficult for a farmer to earn a marginal profit for survival in agriculture in the face of strong market competition. In this situation, farmers do not have any other alternative but have to employ child labour to reduce the cost. All these support our view that modern technology applied sub optimally can explain the higher demand for child labour, higher fertility rate and higher supply of child labour in the capital using stage of agricultural modernisation.

Policy Prescriptions :

From the analysis, it can be said that land reform policy and agricultural pricing policy of India may be given a second thought. Because economically viable farm size, stability in crop prices and adequate credit to acquire sufficiently large volume of farm asset for adopting modern technology may work fruitfully to solve the problem of child labour in agriculture as well as high population growth in rural India.

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A p p e n d i x - I
Definitions and symbols

A-1 Demand for child labour : It is defined as the number of child labourers required by a farm household to operate farm activities. Here it has been assumed that requirement is an observed phenomenon and it is measured by the number of labourers aged upto 14 years employed by a farm household for cultivation of one acre of land in a year.

A-2 TCL^d : It is the proportion of child labour employed in various agricultural activities out of total labour (= adult male + adult female + child) employed in cultivation per acre per year.

$$TCL^d = SFCL^d + WgCL^d$$

A-3 $SFCL^d$: Children who are directly engaged in the cultivation of their own family farm

are considered. It is measured as the percentage number of self field work active child labour to total labour employed per acre of land in a year.

A-4 $WgCL^d$: It is measured by percentage number of child labour employed against wage for performing different agricultural activities to total labour employed per acre of land in a year.

A-5 Supply of child labour : By this concept, we would like to mean the number of children sent by a household to the agricultural fields for working. Households may send their children to their family fields for working and may also send them to other's fields for earning wage. So there are two types of supply of child labour : the first type of supply of child labour may be termed as supply of self field work

active child labour ($SFCL^S$) and the second type as supply of child labour against wage ($WgCL^S$).

A-6 $SFCL^S$: It is the number of children supplied by a household for working in the family owned agricultural fields. It is measured by the percentage number of children working in family owned agricultural fields to the total number of children in a household.

A-7 $WgCL^S$: It is the number of children supplied by a household for earning wages through working in some other's agricultural fields. It is measured by the percentage number of children working against wage in other's fields to the total number of children in a household.

A-8 F : It is measured as the average number of living children per couple in a household.

A-9 SCH : Child schooling. By it the intention is to reflect the extent of schooling of a farm household. If a child member goes to school he / she has been classified as schooling child. This variable is measured by the percentage number of schooling child to the total number of children in the age group (5-14) years in a household.

A-10 AgT : It is the ratio of capital cost to labour cost incurred for cultivation in a year and is expressed in percentage term.

A-11 MCR : It is the ratio of gross cropped area to net cropped area of a farm.

A-12 AgD : Improvement in productivity of land reflects the extent of agricultural development. It is measured in value term in a year and is the weighted average gross revenue per acre of land, generated from cultivation considering all crops that have been cultivated in a year.

A-13 TRT : This is defined as the ratio of the difference between operational land holding and owned land holding to owned landholding and is expressed in percentage term.

A-14 WgdisA : It is a measure of disadvantage associated behind the employment of child labour. In this paper, the disadvantage is measured in financial terms -- i.e., in terms of wage paid to a child labour relative to wage paid to an adult labour. Wage disadvantage of child labour is defined as the ratio of wage of a child labour to that of an adult labour and expressed in percentage term. The disadvantage associated with child labour increases with the increase in the value of WgdisA. It should be noted that farmers who do not employ child labour does not have data on wages of child labour. Thus estimation of WgdisA is not possible for the said type of farmers. To include them in the analysis, the assumption has been made that they have zero demand for child labour in the face of a certain degree of WgdisA. On average, farmers who employ child labour face a wage disadvantage of 60% (as found from our data at modal value). Therefore, the assumption has been made that on the average farmers who have zero demand for child labour face 60% wage disadvantage.

A-15 AgA : It includes cultivatable land, farm house, farm machineries and implements, livestocks etc. and is measured in value term.

A-16 DLM : It is a measure of market orientation of cultivation. It is defined by the percentage number of hired labour employed to total labour employed in the cultivation of all crops in a year. Increasing dependence on labour market (DLM) indicates greater marketisation in agriculture.

A-17 In path diagram-B, only to insignificant paths (running from AgT to TCL^{d} and from DLM to $SFCL^{S}$) are included in the analysis to make the diagram-B compatible with diagram A and diagram.

APPENDIX II

1. **Symbols used in path models**

(a) For endogenous variables :

Y_1 = Demand for child labour in Total (TCL^d),

Y_2 = Demand for self field work active child labour ($SFCL^d$),

Y_3 = Demand for child labour against wage ($WgCL^d$),

F = Fertility rate (F),

S_2 = Supply for self field work active child labour ($SFCL^s$),

S_3 = Supply of child labour against wage ($WgCL^s$),

S = Child schooling (SCH).

(b) For exogenous variables :

Cr = Multiple cropping (MCR),

T = Agricultural Technology (AgT),

D = Agricultural Development (AgD),

L_m = Dependence on labour market (DLM),

A = Agricultural/farm asset (AgA),

W = Wage disadvantage of child labour (WgdisA),

T_t = Tenancy rate (TRT),

(c) Constant terms, parameters and random error (for equation 1 to 7 in order)

Constant terms : $a_1, b_1, c_1, d_1, e_1, f_1, g_1$

Random error : $\varepsilon_1, \varepsilon_2, \varepsilon_3, \varepsilon_4, \varepsilon_5, \varepsilon_6, \varepsilon_7$

Parameters : a_2, a_3, a_4, a_5, a_6
b_2, b_3, b_4, b_5
c_2, c_3, c_4, c_5, c_6
d_2, d_3
e_2, e_3, e_4
f_2, f_3, f_4, f_5, f_6
g_2, g_3, g_4

It should be noted that though same symbols for constant terms, parameters and random errors have been used in all path-models, however these are not same in terms of numerical value.

2. The System of Equations and Estimated Equations of the Path Models

A) The system of equations of the path model - A :

A1) $Y_1 = a_1 + a_2 L_m + a_3 A + a_4 C_r + a_5 W + a_6 T_r + \varepsilon_1$

A2) $Y_2 = b_1 + b_2 L_m + b_3 A + b_4 C_r + b_5 Y_1 + \varepsilon_2$

A3) $Y_3 = c_1 + c_2 L_m + c_3 A + c_4 C_r + c_5 W + c_6 Y_1 + \varepsilon_3$

A4) $F = d_1 + d_2 L_m + d_3 Y_2 + \varepsilon_4$

A5) $S_2 = e_1 + e_2 L_m + e_3 C_r + e_4 F + \varepsilon_5$

A6) $S_3 = f_1 + f_2 L_m + f_3 A + f_4 W + f_5 T_r + f_6 F + \varepsilon_6$

A7) $S = g_1 + g_2 L_m + g_3 S_2 + g_4 S_3 + \varepsilon_7$

Estimated equations of the path model - A :

A1) $\hat{Y}_1 = -12.406 + -0.062\,L_m + 0.0004\,A + 0.021\,C_r + 0.284\,W + 0.012\,T_r \quad \hat{R}^2 = .1685$
(3.0322) (.0129) (.0002) (.0050) (.0435) (.0053)

$= -0.205\,L_m + 0.094\,A + 0.175\,C_r + 0.260\,W + 0.090\,T_r$
[.0000] [.0284] [.0000] [.0000] [.0276]

A2) $\hat{Y}_2 = 17.291 - 0.252\,L_m - 0.002\,A + 0.038\,C_r + 2.027\,Y_1 \quad \hat{R}^2 = .3991$
(4.3191) (.0439) (.0006) (.0169) (.1398)

$= -0.211\,L_m - 0.128\,A + 0.079\,C_r + 0.512\,Y_1$
[.0000] [.0005] [.0234] [.0000]

A3) $\hat{Y}_3 = -97.081 + 0.256\,L_m + 0.003\,A + 0.070\,C_r + 1.311\,W + 0.985\,Y_1 \quad \hat{R}^2 = .2901$
(12.162) (.0517) (.0007) (.0199) (.1786) (.1706)

$= +0.199\,L_m + 0.162\,A + 0.134\,C_r + 0.281\,W + 0.230\,Y_1$
[.0000] [.0001] [.0005] [.0000] [.0000]

A4) $\hat{F} = 2.585 + 0.005\,L_m + 0.013\,Y_2 \quad \hat{R}^2 = .1022$
(0.135) (.0020) (.0017)

$= 0.104\,L_m + 0.342\,Y_2$
(.0185) (.0000)

A5) $\hat{S}_2 = 0.534 - 0.096\,L_m + 0.040\,C_r + 1.560\,F \quad \hat{R}^2 = .0525$
(3.743) (.0301) (.0122) (.6616)

$= -0.135\,L_m + 0.128\,C_r + 0.099\,F$
[.0015] [.0012] [.0188]

A6) $\hat{S}_3 = -2.086 - 0.178\,L_m - 0.0008\,A + 0.230\,W + 0.033\,T_r + 1.790\,F \quad \hat{R}^2 = .1502$
(6.532) (.0279) (.0004) (.0950) (.0115) (.5751)

$= -0.275\,L_m - 0.092\,A + 0.097\,W + 0.116\,T_r + 0.125\,F$
[.0000] [.0311] [.0160] [.0046] [.0020]

A7) $\hat{S} = 49.757 + 0.206\,L_m + 0.264\,S_2 - 0.173\,S_3 \quad \hat{R} = .0712$
(3.487) (.0526) (.0703) (.0803)

$= 0.176\,L_m + 0.160\,S_2 - 0.096\,S_3$
[.0001] [.0002] [.0319]

B) **The system of equations of the path model - B :**

B1) $Y_1 = a_1 + a_2 L_m + a_3 A + a_4 T + a_5 W + a_6 T_r + \varepsilon_1$

B2) $Y_2 = b_1 + b_2 L_m + b_3 A + b_4 T + b_5 Y_1 + \varepsilon_2$

B3) $Y_3 = c_1 + c_2 L_m + c_3 A + c_4 T + c_5 W + c_6 Y_1 + \varepsilon_3$

B4) $F = d_1 + d_2 L_m + d_3 Y_2 + \varepsilon_4$

B5) $S_2 = e_1 + e_2 L_m + e_3 T + e_4 F + \varepsilon_5$

B6) $S_3 = f_1 + f_2 L_m + f_3 A + f_4 W + f_5 T_r + f_6 F + \varepsilon_6$

B7) $S = g_1 + g_2 L_m + g_3 S_2 + g_4 S_3 + \varepsilon_7$

Estimated equations of the path model - B :

B1) $\hat{Y}_1 = \underset{(3.090)}{-9.822} - \underset{(.0130)}{0.068}\, L_m + \underset{(.0002)}{0.0005}\, A + \underset{(.0077)}{0.021}\, T + \underset{(.0442)}{0.286}\, W + \underset{(.0054)}{0.014}\, T_r$ $\quad \hat{R}^2 = .1436$

$= \underset{[.0000]}{-0.227}\, L_m + \underset{[.0062]}{0.119}\, A + \underset{[.1223]}{0.063}\, T + \underset{[.0000]}{0.262}\, W + \underset{[.0118]}{0.104}\, T_r$

B2) $\hat{Y}_2 = \underset{(4.392)}{16.121} - \underset{(.0436)}{0.258}\, L_m - \underset{(.0006)}{0.002}\, A + \underset{(.0253)}{0.065}\, T + \underset{(.1375)}{2.061}\, Y_1$ $\quad \hat{R}^2 = .4006$

$= \underset{[.0000]}{-0.217}\, L_m - \underset{[.0005]}{0.127}\, A + \underset{[.0108]}{0.087}\, T + \underset{[.0000]}{0.520}\, Y_1$

B3) $\hat{Y}_3 = \underset{(12.232)}{-90.726} + \underset{(.0518)}{0.241}\, L_m + \underset{(.0007)}{0.003}\, A + \underset{(.0300)}{0.061}\, T + \underset{(.1798)}{1.293}\, W + \underset{(.1691)}{1.074}\, Y_1$ $\quad \hat{R}^2 = .2792$

$= \underset{[.0000]}{0.187}\, L_m + \underset{[.0000]}{0.174}\, A + \underset{[.0431]}{0.076}\, T + \underset{[.0000]}{0.277} W + \underset{[.0000]}{0.251}\, Y_1$

B4) $\hat{F} = \underset{(.1351)}{2.585} + \underset{(.0020)}{0.005}\, L_m + \underset{(.0017)}{0.013}\, Y_2$ $\quad \hat{R}^2 = .1022$

$= \underset{[.0185]}{0.104}\, L_m + \underset{[.0000]}{0.342}\, Y_2$

B5) $\hat{S}_2 = \underset{(3.840)}{4.211} - \underset{(.0301)}{0.105\,L_m} + \underset{(.0189)}{0.032\,T} + \underset{(.6658)}{1.667\,F}$ $\quad \hat{R}^2 = .0390$

$= \underset{[.0006]}{-0.147\,L_m} + \underset{[.0874]}{0.073\,T} + \underset{[.0126]}{0.106\,F}$

B6) $\hat{S}_3 = \underset{(6.532)}{-2.086} - \underset{(.0279)}{0.178\,L_m} - \underset{(.0003)}{0.0009\,A} + \underset{(.0950)}{0.230\,W} + \underset{(.0115)}{0.033T_r} + \underset{(.5751)}{1.789\,F}$ $\quad \hat{R}^2 = .1502$

$= \underset{[.0000]}{-0.275\,L_m} - \underset{[.0311]}{0.092\,A} + \underset{[.0160]}{0.097\,W} + \underset{[.0046]}{0.116T_r} + \underset{[.0020]}{0.125\,F}$

B7) $\hat{S} = \underset{(3.487)}{49.757} + \underset{(.0526)}{0.206\,L_m} + \underset{(.0703)}{0.264\,S_2} - \underset{(.0803)}{0.172\,S_3}$ $\quad \hat{R}^2 = .0712$

$= \underset{[.0001]}{0.176\,L_m} + \underset{[.0002]}{0.160\,S_2} - \underset{[.0319]}{0.096\,S_3}$

C) **The system of equations of the path model - C :**

C1) $Y_1 = a_1 + a_2 L_m + a_3 A + a_4 D + a_5 W + a_6 T_r + \varepsilon_1$

C2) $Y_2 = b_1 + b_2 L_m + b_3 A + b_4 D + b_5 Y_1 + \varepsilon_2$

C3) $Y_3 = c_1 + c_2 L_m + c_3 A + c_4 D + c_5 W + c_6 Y_1 + \varepsilon_3$

C4) $F = d_1 + d_2 L_m + d_3 Y_2 + \varepsilon_4$

C5) $S_2 = e_1 + e_2 L_m + e_3 D + e_4 F + \varepsilon_5$

C6) $S_3 = f_1 + f_2 L_m + f_3 A + f_4 W + f_5 T_r + f_6 F + \varepsilon_6$

C7) $S = g_1 + g_2 L_m + g_3 S_2 + g_4 S_3 + \varepsilon_7$

Estimated equations of path model - C :

C1) $\hat{Y}_1 = \underset{(2.972)}{-10.020} - \underset{(.0131)}{0.063\,L_m} - \underset{(.0002)}{0.0004\,A} + \underset{(.0041)}{0.011\,D} + \underset{(.0439)}{0.284\,W} + \underset{(.0053)}{0.013\,T_r}$ $\quad \hat{R}^2 = .1518$

$= \underset{[.0000]}{-0.210\,L_m} - \underset{[.0361]}{0.094\,A} + \underset{[.0060]}{0.116\,D} + \underset{[.0000]}{0.260\,W} + \underset{[.0151]}{0.100\,T_r}$

C2) $\hat{Y}_2 = 19.554 - 0.248\,I_m - 0.002\,A + 0.031D + 2.047\,Y_1$ $\quad \hat{R}^2 = .3991$
(3.639) (.0441) (.0006) (.0136) (.1384)

$= -0.208 I_m - 0.138\,A + 0.081\,D + 0.517\,Y_1$
[.0000] [.0002] [.0226] [.0000]

C3) $\hat{Y}_3 = -92.531 + 0.264\,L_m + 0.003\,A + 0.059\,D + 1.297\,W + 1.021\,Y_1$ $\quad \hat{R}^2 = .2920$
(11.721) (.0518) (.0007) (.0160) (.1782) (.1685)

$= 0.205\,I_m + 0.144\,A + 0.143\,D + 0.278\,W + 0.239\,Y_2$
[.0000] [.0004] [.0002] [.0000] [.0000]

C4) $\hat{F} = 2.585 + 0.005\,L_m + 0.013\,Y_2$ $\quad \hat{R}^2 = .1022$
(.1351) (.0020) (.0017)

$= 0.104\,L_m + 0.342\,Y_2$
[.0185] [.0000]

C5) $\hat{S}_2 = 3.237 - 0.098\,L_m + 0.030\,D + 1.592\,F$ $\quad \hat{R}^2 = .0504$
(3.299) (.0300) (.0097) (.6620)

$= -0.138\,L_m + 0.130\,D + 0.101\,F$
[.0012] [.0023] [.0165]

C6) $\hat{S}_3 = -2.086 - 0.178\,L_m - 0.0008\,A + 0.230\,W + 0.033T_1 + 1.789\,F$ $\quad \hat{R}^2 = .1502$
(6.531) (.0279) (.0004) (.0950) (.0115) (.5751)

$= -0.275\,L_m - 0.092\,A + 0.097W + 0.116\,T_1 + 0.125\,F$
[.0000] [.0311] [.0160] [.0046] [.0020]

C7) $\hat{S} = 49.757 + 0.206\,L_m + 0.264\,S_2 - 0.173\,S_3$ $\quad \hat{R}^2 = .0712$
(3.487) (.0526) (.0703) (.0803)

$= 0.176\,L_m + 0.160\,S_2 - 0.096\,S_3$
[.0001] [.0002] [.0319]

Figure in ( ) indicates standard error.
Figure in [ ] indicates significant level
1st line = general estimated equation with $\hat{R}^2$
2nd line = standardised regression equation.