Vol. XLVIII
No. 2

ISSN 0019-5014

APRIL-
JUNE
1993

INDIAN JOURNAL OF AGRICULTURAL ECONOMICS

INDIAN SOCIETY OF
AGRICULTURAL ECONOMICS,
BOMBAY

Ind. Jn. of Agri. Econ.
Vol. 48, No. 2, April-June 1993

RESEARCH NOTES

Test of Trickle-Down Hypothesis in Rural West Bengal

Trickle-down hypothesis is concerned with the question whether improved agricultural performance in the absence of any major institutional reform has been associated with reductions in the incidence of rural poverty in India. It has been a subject of empirical research and intense debate since the publication of Ahluwalia's (1978) study in which he reported an inverse relationship between rural poverty and agricultural production per head of rural population and thereby asserted the existence of trickle-down mechanism in Indian rural economy during 1956-57 to 1973-74. The results reported in the subsequent studies, namely, by Saith (1981) Mundle (1983), Bardhan (1984), Prasad (1985), Ahluwalia (1986), Gaiha (1989), Ghose (1989), Kakwani and Subbarao (1990 *a*, *b*) Jain and Tendulkar (1990), Tendulkar and Jain (1991) and Bhattacharya *et al.* (1991), however, yielded a far from uniform picture.

The unresolved debate over the issue and the lack of comprehensive research at the state level prompted us to undertake the present study which examines the existence of trickle-down mechanism in rural West Bengal during 1957-58 to 1986-87. Inter-temporal movements in the incidence of rural poverty during this period and the factors behind such movements are examined in Section I. The major findings are summed up and conclusions are drawn in Section II. The data used in the study are taken from diverse sources which are cited in the Appendix.

I

INCIDENCE OF RURAL POVERTY AND THE UNDERLYING FACTORS

Data presented in the Appendix reveal marked fluctuations over time in the incidence of rural poverty measured by Head-count ratio, POV(HC), and Sen's index, POV(SI). The head-count ratio is based upon the poverty cut-off point of Rs. 15 per capita monthly expenditure at 1960-61 prices. The Sen's index is given by $H[e^* - \bar{e}(1-G)] / e^*$, where H is the head-count ratio, e^* is the poverty line, $\bar{e}$ is the average per capita expenditure of the poor, and G is the Gini coefficient of the distribution of consumption expenditure among the poor. Both measures display almost identical pattern of fluctuations - rural poverty declined initially and reached its lowest level in 1960-61, then rose sharply to its highest level in 1967-68, and again started declining with fluctuations. The estimated results of linear and exponential trends (shown in Table A1 in the Appendix) provide no evidence of any discernible time trend in the incidence of rural poverty - all the coefficients of time (T) being statistically insignificant. Nevertheless, inter-temporal fluctuations in rural poverty need explanations.

The Explanatory Variables

Rural poverty, by the very procedure in which it has been measured, is a function of poverty line at constant prices, per capita consumption expenditure at constant prices (RPCE) and Lorenz ratio of per capita consumption expenditure (LRPCE). However, in view of the invariance of the poverty line at constant prices for all the years, RPCE and LRPCE have been considered as the relevant explanatory variables. Moreover, in view of the fact that

the Engel ratio is very high in the rural areas (see Bhattacharya *et al.*, 1991, p. 161), per capita consumption expenditure on food items at constant prices (RPCEF) and Lorenz ratio of per capita consumption expenditure on food items (LRPCEF) have also been considered as explanatory variables of special significance.

Some of the important factors which determine the living conditions of the rural people in general and rural poor in particular may now be identified. Since rural people derive their livelihood primarily from agriculture, their living conditions depend significantly on the performance of this sector. Agricultural performance has been measured here in terms of state domestic product from agriculture at constant prices per head of rural population (SDPAR). Identification of the factors influencing the living conditions of the rural poor in particular becomes relatively easy once the persons or households living below poverty line are properly identified. As per the 32nd Round (1977-78) of the National Sample Survey (NSS) report, 81.13 per cent of the agricultural labour households and 45.96 per cent of the households self-employed in agriculture are living below poverty line in West Bengal. Together, they constituted 75.11 per cent of rural households living below poverty line (see Dev, 1988). Thus agricultural labour households and primarily cultivator households consisting of mainly marginal and small farmers are identified as the rural poor. Naturally, the levels of living of these people depend upon the levels of income they derive from agriculture. The 38th Round (1983) of the NSS report shows that 50.4 per cent of the rural workforce are wage labourers; 75.4 per cent of them are casual. This means that at least 50 per cent of the rural workforce depends exclusively on wage employment for their livelihood. Alongside, the Agricultural Census (1985-86) data show that 90.1 per cent of the operationa holdings are marginal and small and the average size of these operational holdings is very small, being 0.645 hectare.[1] This means that the marginal and small farmers have to depend, at least partially, on wage employment to supplement their income from cultivation. In the absence of any time-series data on rural employment (unemployment), productivity of agricultural labourers (ALP) and consumer price index for agricultural labourers (CPIAL) have been considered here as the factors influencing directly the real levels of living of the households identified as the rural poor.[2]

Econometric Results

The estimated results of linear and log linear regressions showing the effects of the selected factors on rural poverty are presented in Tables I, II and III. The estimated equations do not involve any serious multicollinearity problem.[3] Expectedly, the coefficients of RPCE and RPCEF turn out to be negative and highly significant which indicate that these variables are inversely related to the incidence of rural poverty. However, the effect of RPCEF on rural poverty is found to be stronger than that of RPCE, because the absolute values of all the coefficients of RPCEF are larger than those of RPCE. Moreover, whereas there is no significant residual time trend in rural poverty when allowance is made for the changes in its incidence associated with RPCEF and LRPCEF (see Table II), there has been significantly positive residual time trend when allowance is made for changes in rural poverty associated with RPCE and LRPCE (see Table I). These results strongly suggest the need for considering

per capita consumption expenditure on food items in order to go deeper and get more insight into the working of the factors behind inter-temporal changes in the incidence of rural poverty.

TABLE I. DETERMINANTS OF RURAL POVERTY: RESULTS OF MULTIPLE REGRESSIONS

Dependent variable (1)	Intercept (2)	RPCE (3)	LRPCE (4)	T (5)	R^2 (6)	D-W (7)
A. Linear regressions						
POV(HC)	124.44	-2.695*	-69.077	0.352**	0.726	1.964
		(0.487)	(67.322)	(0.187)		
POV(HC)	115.52	-2.350*	-41.851	-	0.645	1.566
		(0.493)	(71.839)			
POV(SI)	0.616	-0.016*	-0.377	0.0032**	0.644	1.793
		(0.0035)	(0.492)	(0.0013)		
POV(SI)	0.535	-0.013*	-0.129	-	0.482	1.298
		(0.004)	(0.557)			
B. Log linear regressions						
ln POV(HC)	6.295	-0.791*	-0.021	0.031	0.679	1.949
		(0.161)	(0.329)	(0.03)		
ln POV(HC)	6.414	-0.785*	0.027	-	0.650	1.771
		(0.162)	(0.328)			
ln POV(SI)	1.584	-1.070*	0.033	0.08***	0.598	1.606
		(0.271)	(0.554)	(0.05)		
ln POV(SI)	1.889	-1.056*	0.156	-	0.514	1.312
		(0.286)	(0.579)			

Notes: *, ** and *** significant at 1 per cent, 5 per cent and 10 per cent levels respectively for one-tail test.
Figures in parentheses are standard errors of the coefficients.
n = 16.

TABLE II. DETERMINANTS OF RURAL POVERTY: RESULTS OF MULTIPLE REGRESSIONS

Dependent variable (1)	Intercept (2)	RPCEF (3)	LRPCEF (4)	T (5)	R^2 (6)	D-W (7)
A. Linear regressions						
POV(HC)	119.033	-4.037*	-28.813	0.161	0.664	1.895
		(0.845)	(113.118)	(0.313)		
POV(HC)	109.123	-3.909*	17.283	-	0.656	1.847
		(0.785)	(66.918)			
POV(SI)	0.443	-0.023*	0.525	0.0005	0.611	1.791
		(0.006)	(0.781)	(0.0021)		
POV(SI)	0.409	-0.023*	0.681***	-	0.609	1.793
		(0.005)	(0.458)			
B. Log linear regressions						
ln POV(HC)	6.561	-0.903*	0.091	0.0008	0.660	2.051
		(0.189)	(0.367)	(0.0421)		
ln POV(HC)	6.571	-0.904*	0.096	-	0.660	2.052
		(0.181)	(0.258)			
ln POV(SI)	2.997	-1.253*	0.752***	-0.009	0.653	1.911
		(0.287)	(0.557)	(0.064)		
ln POV(SI)	2.876	-1.249*	0.694***	-	0.652	1.906
		(0.275)	(0.392)			

Notes: Same as in Table I.

Distributional factors, however, are not found to have any significant effect on rural poverty. The coefficients of LRPCE turn out to be statistically insignificant; and the coefficients of LRPCEF are found to be significant in the case of Sen's index but not in the case of head-count measure. Thus growth effect (*i.e.*, change in RPCE or RPCEF) on rural poverty

is found to be stronger than distribution effect (*i.e.*, change in LRPCE or LRPCEF). This was also demonstrated by the results derived from decomposition exercises done by Kakwani and Subbarao (1990 *a, b*), Jain and Tendulkar (1990) and Tendulkar and Jain (1991).

The relative insignificance of the distributional factor in accounting for the variations in rural poverty may be attributed to the fact that there has not been any significant change in the distribution of consumption expenditure in favour of the rural poor. This is indicated by the absence of any discernible time trend in LRPCE. On the other hand, the change that has taken place in the distribution of consumption expenditure on food items goes against the rural poor which is indicated by a significantly positive trend in LRPCEF.[4] Moreover, there has not been any significant change in the distribution of land, the most important income generating asset of the rural people. The estimated Gini coefficient of concentration of operated area has been found to have declined only marginally from 0.478 in 1970-71 to 0.433 in 1985-86 in West Bengal. Furthermore, there has been a gradual marginalisation and proletarianisation of the peasantry in the state. While the absolute number and the proportion of marginal holdings have increased tremendously, their average size has declined during 1970-71 to 1985-86. Again the number of landless agricultural labourers has increased by 18.95 per cent during 1971-81.

What is, however, important for the trickle-down hypothesis is that the coefficients of SDPAR in all the equations are negative and also highly significant, which indicate an inverse relationship between rural poverty and agricultural production per head of rural population (see Table III). This means that improved agricultural performance measured in terms of an increase in SDPAR has been associated with reductions in the incidence of rural poverty, confirming thereby the existence of trickle-down process in rural West Bengal during 1957-58 to 1986-87. The observed positive relationship between per capita consumption expenditure of the bottom 50 per cent of the rural population (RPCEBT) and SDPAR (reported below) may be considered as corroborative evidence to trickle-down hypothesis.

$$\text{RPCEBT} = -5.774 + 0.094\ \text{SDPAR}; \quad R^2 = 0.473$$
$$(0.026)^*$$

(The figure in parenthesis is standard error; * Significant at 1 per cent level).

These results strongly contradict the findings of Bardhan (1984) and Gaiha (1989) who observed that agricultural growth in West Bengal is 'immiserising'.[5]

What also emerges from the results presented in Table III is that after allowance is made for the changes in the incidence of rural poverty associated with agricultural performance measured by SDPAR, there has been a positive (and in most cases significant) residual time trend in the incidence of rural poverty. This means that while improved agricultural performance measured in terms of an increase in SDPAR has significant influence in reducing rural poverty, there may be 'other factors' at work in rural West Bengal which by themselves tended to increase the incidence of rural poverty. Similar results have also been reported by Ahluwalia (1978).

However, when agricultural labour productivity (ALP) is considered as an independent variable (instead of SDPAR), we observe significantly negative coefficient of ALP and negative residual time trend in the incidence of rural poverty. This indicates that when allowance is made for changes in rural poverty associated with agricultural performance

measured by ALP, there has been a definite downward trend in the incidence of rural poverty.[6] This result strongly advocates the need for considering ALP as an independent variable in order to explain inter-temporal changes in the incidence of rural poverty. The result also suggests that labour productivity augmenting growth process would undoubtedly be more effective in reducing the incidence of rural poverty than any other that does not augment labour productivity significantly.[7]

TABLE III. DETERMINANTS OF RURAL POVERTY: RESULTS OF MULTIPLE REGRESSIONS

Intercept (1)	SDPAR (2)	ALP (3)	CPIAL (4)	T (5)	R^2 (6)	D-W (7)
A. Linear regressions						
1. Dependent variable - POV(HC)						
138.72	-0.436*	-	-	0.336	0.413	1.656
	(0.145)			(0.275)		
134.24	-0.403**	-	-0.036	0.882	0.440	1.792
	(0.154)		(0.047)	(0.764)		
118.93	-	-0.958*	0.021	-0.884	0.618	2.015
		(0.242)	(0.044)	(0.769)		
116.02	-	-0.897*	-	-0.516**	0.611	2.004
		(0.199)		(0.217)		
2. Dependent variable - POV(SI)						
0.79	-0.0031*	-	-	0.0036**	0.505	1.949
	(0.0008)			(0.0016)		
0.77	-0.003*	-	-0.00014	0.006	0.515	1.994
	(0.0009)		(0.00028)	(0.005)		
0.63	-	-0.0066*	0.00023	-0.006	0.663	1.968
		(0.0014)	(0.00026)	(0.0048)		
0.60	-	-0.0059*	-	-0.0022***	0.641	1.942
		(0.0012)		(0.0013)		
B. Log linear regressions						
1. Dependent variable - ln POV(HC)						
10.92	-1.332*	-	-	0.066***	0.457	1.902
	(0.410)			(0.039)		
10.94	-1.379*	-	0.053	0.042	0.465	1.863
	(0.439)		(0.129)	(0.072)		
7.86	-	-0.923*	0.025	-0.103***	0.581	2.276
		(0.231)	(0.112)	(0.074)		
7.93	-	-0.914*	-	-0.089**	0.579	2.284
		(0.219)		(0.042)		
2. Dependent variable - ln POV(SI)						
9.22	-2.086*	-	-	0.137**	0.544	1.977
	(0.564)			(0.054)		
9.28	-2.270*	-	0.210	0.040	0.596	2.000
	(0.572)		(0.168)	(0.094)		
4.02	-	-1.469*	0.160	-0.188**	0.693	2.405
		(0.297)	(0.144)	(0.095)		
4.45	-	-1.411*	-	-0.103**	0.661	2.256
		(0.295)		(0.057)		

Notes: Same as in Table I.

Many researchers have argued that higher CPIAL, through its adverse effect on real income of the poor, generally aggravates the incidence of rural poverty. Gaiha (1989) reported significantly positive coefficient of some measure of fluctuations in CPIAL around its trend values (FCPIAL) in West Bengal during 1960-73. Our results, however, contradict this finding. The coefficient of CPIAL is found to be insignificant in all the equations indicating that CPIAL did not have any significant effect on rural poverty in West Bengal

during 1957-58 to 1986-87. It is found to be so in spite of a significantly positive time trend in CPIAL during this period.[8] Hence, the observed insignificance of the coefficients of CPIAL may be supposed to be due to the fact that the adverse effect of rising CPIAL on real level of living of the rural poor has been counter-balanced by the favourable effects of other factors at work in rural West Bengal. Significantly inverse relationship between rural poverty and real wage rate (RWRAL) lends empirical support to such proposition.[9]

II

SUMMARY AND CONCLUSION

This study has examined the working of the factors behind inter-temporal fluctuations in the incidence of rural poverty in West Bengal during 1957-58 to 1986-87. Available data on rural poverty measured by head-count ratio and Sen's index showed marked fluctuations and thus there is no discernible time trend in its incidence during the period. The estimated results of regressions revealed significantly inverse relationship between rural poverty and agricultural performance measured either by SDPAR or ALP, confirming thereby the existence of trickle-down process in rural West Bengal. The results also established the special significance of labour productivity and real wage rate in reducing the incidence of rural poverty over time. Labour productivity augmenting growth in agriculture appeared to be more effective in achieving a trend decline in rural poverty than any other that does not increase labour productivity significantly. Therefore, for sustainable reduction in rural poverty, what is required is not merely growth in agriculture but that type of growth process which enhances labour productivity.

Apparently, an attempt to increase labour productivity seems to call for high doses of investment in machinery. This is, however, neither necessary nor desirable. In the presence of disguised and open unemployment of a large part of labour force in agriculture, high doses of investment in machinery would unnecessarily increase rural unemployment and thus rural poverty. Under such conditions and where various economies are associated with scale, labour productivity can be increased immensely through appropriate organisational changes and investments in agriculture. There is ample scope for diversification and value addition through vertical integration of agricultural enterprises through which labour productivity can be increased considerably. Thus instead of making high doses of investment in machinery, the scope for increasing labour productivity through appropriate organisation-building can be tapped where West Bengal's score has been found to be very low in this respect.

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Received June 1992. Revision accepted May 1993.

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The author is grateful to the anonymous referee of the Journal for his valuable comments and suggestions on an earlier draft of this paper.

NOTES

1. See *Agricultural Situation in India*, Vol. 44, No. 5, August 1989.

2. Alternatively, we have used real wage rate for male agricultural labourers (RWRAL) as the factor influencing the living conditions of the poor and thus rural poverty.

3. According to Klein (1962), collinearity between explanatory variables $\left(r^2_{x_i x_j}\right)$ is not necessarily a problem unless it is high relative to the overall degree of multiple correlation among all variables simultaneously $\left(R^2_{Y.x_1,x_2,\ldots,x_k}\right)$, *i.e.*, unless $r^2_{x_i x_j} \geq R^2_{Y.x_1,x_2,\ldots,x_k}$. Estimated R^2 for each pair of explanatory variables (presented in Table A2 in the Appendix) shows relatively high correlation between CPIAL and T only. But that does not create any serious multicollinearity problem. Inclusion of CPIAL in the equations involving SDPAR/ALP and T does not either improve R^2 significantly or affect to any considerable extent the values of the individual coefficients. For Klein's rule and Frisch's (1934) 'confluence analysis', see Koutsoyiannis (1977, pp. 234-242).

4. Estimated linear and exponential trends in LRPCE and LRPCEF are:

$$\text{LRPCE} = \underset{(0.0007)}{0.256 + 0.0006\ T}; \quad R^2 = 0.052$$

$$\ln \text{LRPCE} = \underset{(0.0025)}{-1.365 + 0.0021\ T}; \quad R^2 = 0.045$$

$$\text{LRPCEF} = \underset{(0.0004)^*}{0.196 + 0.0021\ T}; \quad R^2 = 0.609$$

$$\ln \text{LRPCEF} = \underset{(0.0019)^*}{-1.622 + 0.0094\ T}; \quad R^2 = 0.612$$

(Figures in parentheses are standard errors; * Significant at 1 per cent level).

5. Applying logit model to cross-section data for 1977-78, Bardhan (1984) observed the possibility of growth induced pauperisation of agricultural labour households and primarily cultivator households in rural West Bengal. Gaiha (1989) estimated multiple regressions with time-series data (1960-73) and observed significantly positive relationship between rural poverty and some measure of agricultural production per head of rural population, and a rising residual time trend in West Bengal. On the basis of such results, he concluded that his results are consistent with Bardhan's (1984) findings.

6. Observed change in the residual time trend due to inclusion of ALP in place of SDPAR may be supposed to be the outcome of the labour productivity augmenting growth process which might have reversed the poverty aggravating effect of 'other factors' at work in the state. Growth process which significantly augments labour productivity and in turn wages in agriculture is likely to produce a change in the distribution of income towards greater equality. In such condition, the trend variable (T) which captures, among other things, the distribution factor, is expected to have a negative coefficient.

7. These results are quite consistent with World Bank's (1990) prescription of a two-part strategy of improving the quality of life of the rural poor.

8. Estimated linear and exponential trends in CPIAL are:

$$\text{CPIAL} = \underset{(1.439)^*}{33.402 + 16.097\ T}; \quad R^2 = 0.899$$

$$\ln \text{CPIAL} = \underset{(0.004)^*}{4.586 + 0.059\ T}; \quad R^2 = 0.947$$

9. Estimated linear and log linear regressions showing the relationship between rural poverty and RWRAL are:

$$\text{POV(HC)} = \underset{(12.037)^*}{134.041 - 35.211\ \text{RWRAL}}; \quad R^2 = 0.379$$

$$\text{POV(SI)} = \underset{(0.067)^*}{0.808 - 0.267\ \text{RWRAL}}; \quad R^2 = 0.531$$

$$\ln \text{POV(HC)} = \underset{(0.429)^*}{4.954 - 1.176\ \ln \text{RWRAL}}; \quad R^2 = 0.349$$

$$\ln \text{POV(SI)} = \underset{(0.575)^*}{0.113 - 2.074\ \ln \text{RWRAL}}; \quad R^2 = 0.482$$

(Figures in parentheses are standard errors; * Significant at 1 per cent level).

APPENDIX

TABLE A1. TRENDS IN RURAL POVERTY IN WEST BENGAL

$$POV(HC) = 63.41 - \underset{(0.294)}{0.078}\ T; \quad R^2 = 0.005$$

$$POV(SI) = 0.28 - \underset{(0.0019)}{0.0006}\ T; \quad R^2 = 0.008$$

$$\ln POV(HC) = 4.14 - \underset{(0.0051)}{0.0009}\ T; \quad R^2 = 0.003$$

$$\ln POV(SI) = -1.40 + \underset{(0.0076)}{0.0036}\ T; \quad R^2 = 0.016$$

Note: Figures in parentheses are standard errors. n = 16.

TABLE A2. ESTIMATED r^2 BETWEEN EXPLANATORY VARIABLES

Variable	RPCE	LRPCE	T	
RPCE	1.00			
LRPCE	0.006	1.00		
T	0.148	0.052	1.00	
	RPCEF	LRPCEF	T	
RPCEF	1.00			
LRPCEF	0.00008	1.00		
T	0.036	0.609	1.00	
	SDPAR	ALP	CPIAL	T
SDPAR	1.00			
ALP	0.173	1.00		
CPIAL	0.304	0.076	1.00	
T	0.251	0.202	0.899	1.00

TABLE A3. DATA BASE

Year	POV(HC)	POV(SI)	RPCEBT (Rs.) at 1960-61 prices	RPCE (Rs.) at 1960-61 prices	RPCEF (Rs.) at 1960-61 prices
(1)	(2)	(3)	(4)	(5)	(6)
1957-58	62.3	0.26	11.53	17.93	13.22
1959-60	61.4	0.25	11.80	18.42	13.71
1960-61	40.4	0.14	14.38	22.38	16.27
1961-62	58.3	0.20	12.90	19.46	14.63
1963-64	63.3	0.26	11.39	17.67	13.06
1965-66	56.5	0.22	10.08	15.68	11.56
1966-67	64.3	0.27	9.67	14.71	10.71
1967-68	80.3	0.40	9.11	13.52	10.29
1968-69	74.9	0.33	10.20	14.88	11.03
1969-70	67.7	0.28	10.97	16.58	12.26
1970-71	70.1	0.31	10.47	16.19	11.98
1972-73	66.1	0.31	10.18	17.27	12.43
1973-74	66.0	0.31	9.96	16.99	12.08
1977-78	62.0	0.26	11.18	18.48	12.56
1983	54.5	0.22	12.28	19.92	13.46
1986-87	50.8	0.224	17.92	26.48	17.63

(Contd.)

TABLE A3 *(Concld.)*

Year	LRPCE	LRPCEF	RWRAL (Rs.) per day	SDPAR (Rs.) at 1960-61 prices	ALP	CPIAL (1960-61 = 100)
(1)	(7)	(8)	(9)	(10)	(11)	(12)
1957-58	0.265	0.210	2.02	172.95	65.00	124
1959-60	0.261	0.206	2.12	168.74	62.23	110
1960-61	0.252	0.193	2.17	201.86	69.71	100
1961-62	0.267	0.193	2.39	194.23	63.93	123
1963-64	0.261	0.202	2.08	193.65	60.22	155
1965-66	0.260	0.231	2.00	173.78	49.03	170
1966-67	0.252	0.218	1.97	168.35	44.14	197
1967-68	0.237	0.222	1.74	172.58	41.27	241
1968-69	0.227	0.207	1.93	172.12	47.56	201
1969-70	0.247	0.211	2.05	186.15	46.75	198
1970-71	0.258	0.221	1.96	185.66	46.12	206
1972-73	0.305	0.261	1.98	167.14	42.12	217
1973-74	0.296	0.259	1.78	170.54	42.51	275
1977-78	0.292	0.235	2.17	207.38	53.63	321
1983	0.284	0.241	1.93	210.50	52.46	525
1986-87	0.243	0.261	2.25	208.52	53.83	607

Sources: Ahluwalia (1978); Bhattacharya *et al.* (1991); Jose (1988); Kakwani and Subbarao (1990 *b*); NSS 42nd Round (1986-87) as reported in *Sarvekshana*, Vol. 12, No. 4, April-June 1989; Government of West Bengal, *Statistical Abstract (West Bengal)*, various issues; Government of West Bengal, *Economic Review (West Bengal)*, various issues; and Government of West Bengal (1986).

Note: ALP = Output per hectare multiplied by land-labour ratio.

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