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Analysis of Technical Efficiency of Subsidised Credit for Poverty Alleviation in Anantapur, Andhra Pradesh*

The concept of X-inefficiency enunciated by Leibenstein (1966) avers that the difference between actual and potential income exists mainly because of some inertia within individuals which may be due to certain socio-economic constraints or the high opportunity cost of his resources. Credit is an important ingredient in increasing production and incomes of entrepreneurs, more so when they are entangled in the vicious circle of poverty.

Shortage of capital is considered to be one of the most immediate and pressing as well as the most fundamental obstacle to private investment among the poor in rural India. Their low creditworthiness renders them ineligible for institutional loans and hence they face an imperfect market for capital. The Integrated Rural Development Programme (IRDP) which was launched during 1978 is the latest in a series of welfare programmes initiated by the Government of India. However, the IRDP, unlike the earlier measures, is target-oriented. The main thrust of the IRDP has been to provide loans to purchase income-generating assets which would create opportunities to the target group consisting of the families living below the poverty line. Assistance under this scheme consists of loan and subsidy components.

The effectiveness of this programme has been extensively debated. Perhaps the best known criticism of the effectiveness of providing credit to the poor is attributed to Schultz (1964), who propounded the 'poor but efficient' hypothesis that agricultural credit will be ineffective in improving productivity and incomes since investment opportunities are limited.

Methodology

Anantapur district, a chronically drought-hit region of Andhra Pradesh, was selected for the study. A sample of 200 beneficiaries was drawn using a two-stage random sampling technique. Two blocks were first chosen, Penukonda and Uravakonda. In both these blocks, the area development schemes were in operation. The former was a Drought-Prone Area Programme (DPAP) block and the latter a Command Area Development Agency (CADA) block. From each of these blocks a sample of 100 households who received benefits under IRDP during 1981-82 was randomly selected. The study pertained to the year 1984-85, which allowed a three-year period for the programme to operate.

Farrell (1957), in his seminal paper, dichotomised efficiency into allocative efficiency and technical efficiency. This can be illustrated as in Figure 1.

Figure 1(a) depicts a frontier production function, which can be represented by the curve $y = f(x,\upsilon)$, where υ is the input vector, x the input under study and y is the output. Points B and C represent points producing output, y, with the minimum input (x^*), and the frontier (maximum) output with the observed input x.

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Figure 1(b) demonstrates efficiency when there are two inputs x and z. The firm is at R in its resource use, using x quantity of X and obtaining output y. The best use of resource is at B. Based on these figures, Timmer's (1971) measure of technical efficiency is given by y/y^* from Figure 1(a) and OB/OR from Figure 1(b). Kopp's (1981) measure of technical efficiency, which is measured in terms of input use, is given by x^*/x. The measures of technical efficiency by Kopp's or Timmer's method will be similar if the production function is homogeneous of degree 1.

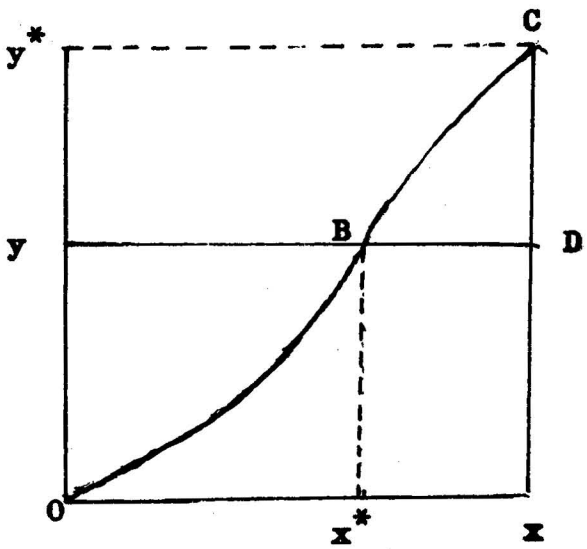

Figure 1 (a)

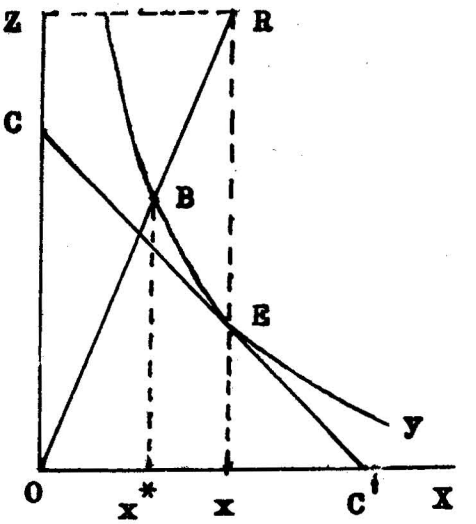

Figure 1 (b)

The income relationship of the beneficiaries is represented by a Cobb-Douglas production function:

$$Y = a \prod_{i=1}^{4} X_i^{b_i} \; e^{u} \qquad \text{.... (1)}$$

where Y = gross household income (rupees),
X_1 = total man-days of employment per household,
X_2 = total production assets (rupees),
X_3 = total production expenditure (rupees),
X_4 = loan amount received under IRDP (rupees),
u_i = disturbance term,
e = 2.3026,
a = intercept,
b_i = regression coefficients.

From the income relationship estimated by Ordinary Least Squares (OLS), the Frontier production function is derived by a method called Corrected Ordinary Least Squares (COLS). The frontier function could however be derived using linear programming or maximum likelihood estimation. It has been established that the COLS estimates give coefficients which are unbiased and consistent (Green, 1980). Therefore, it is employed in this study. However, the estimated function has the problems associated with the estimation of a Cobb-Douglas production function.

The procedure involves estimating the individual specific error terms from the income function, and revising the intercept by the magnitude of the largest error term. This results in output magnification not only at that point but over the entire production surface.

Thus the frontier function is given by:

$$Y^* = a^* \prod_{i=1}^{4} X_i^{b_i} \; e^{-u} \qquad \ldots (2)$$

where Y^* gives the frontier value of income.

Timmer's measure of technical efficiency of an individual beneficiary is the ratio of annual output Y, to potential output Y^*.

$$TE = Y/Y^* \leq 1 \qquad \ldots (3)$$

Kopp's measure of technical efficiency (the algebraic derivation of Kopp's measure is given in Appendix) derived from the income function for resource X_4^*, credit used, which is of primary interest in this study, is as follows:

$$\text{Let} \quad R_1 = \frac{X_1}{X_4}, \quad R_2 = \frac{X_2}{X_4}, \quad R_3 = \frac{X_3}{X_4} \qquad \ldots (4)$$

$$\text{Then } \ln X_4^* = \ln Y - \ln a - b_1 \ln R_1 - b_2 \ln R_2 - b_3 \ln R_3 / \Sigma b_i \qquad \ldots (5)$$

X_1^*, X_2^* and X_3^* can be calculated in an analogous way.

Kopp's measure X_4^* gives the least quantity of X_4 required to produce the given output Y; when it is compared with the actual level of credit used X_4, the magnitude of excess use of resources is identified for each individual.

Results and Discussion

The estimated log-linear regressions together with the derived frontier functions are presented in Table I. The R^2 values were high, testifying to the adequacy of the functions. Employment in man-days did not significantly influence income in the CADA block, whereas in the DPAP block it did to some extent. Production expenditure appears to be the only variable having a substantial effect on income. The response of income to the IRDP loan, albeit statistically significant, was marginal. A 10 per cent increase in the loan amount increases incomes by only 0.85 per cent in the CADA block and 0.67 per cent in the DPAP block. This indicates that the environment was not favourable to absorb the loan as incomes did not rise with the increase in the loan amount. This should be understood in the context of the lack of investment opportunities in the region.

The frontier production functions Y^* derived from the estimated regressions are also presented in Table I.

TABLE I. AVERAGE AND FRONTIER INCOME FUNCTIONS

Block	Intercept	Labour	Productive assets	Production expenditure	Loan under IRDP	R^2
(1)	(2)	(3)	(4)	(5)	(6)	(7)
CADA						
Log Y	5.2791	-0.0078	0.0166	0.3583	0.0847	0.83
	(14.5261)	(0.1425)	(1.799)	(15.2344)	(3.3112)	
Log Y*	5.7931	-0.0078	0.0166	0.3583	0.0847	
DPAP						
Log Y	4.5831	0.2872	0.0012	0.2671	0.0667	0.79
	(11.2941)	(4.7586)	(0.0556)	(7.4313)	(2.2336)	
Log Y*	5.0459	0.2872	0.0012	0.2671	0.0667	

Note:- Figures in parentheses are the calculated 't' values.

The levels of efficiency achieved by the individual beneficiaries were worked out using Timmer's and Kopp's indices. The efficiency ratings based on Timmer's measures are presented in Table II.

TABLE II. TIMMER'S EFFICIENCY RATING OF IRDP BENEFICIARIES

Rating (percentage) (1)	CADA (2)	DPAP (3)
< 25	36	1
> 25 < 50	51	58
> 50 < 75	9	35
> 75	4	6
Mean (per cent)	35.33	48.81
Standard deviation (per cent)	17.00	14.00

The level of efficiency in output was very low in both the CADA and DPAP blocks. On an average, the beneficiaries in CADA showed a lower level of efficiency (35.33 per cent) than those of the DPAP area (48.81 per cent). This brings into sharp focus the extent of inefficiency in the production process and consequently in the utilisation of credit. The excessive use of resource by the beneficiaries in the two blocks is of the order of 65 per cent and 51 per cent respectively.

Kopp's measure of technical efficiency explicitly expresses the magnitude of over-use of credit. The actual and frontier levels of resource use of the most efficient five beneficiaries and the least efficient are presented in Table III.

These results indicate that there is a high degree of inefficiency in credit use in both the blocks. The reasons for the gaps between the actual and efficient levels of use of credit among the beneficiaries may be due to certain socio-economic and infrastructural bottlenecks and the obvious diversion of credit for other non-productive purposes, notwithstanding, of course, the malpractices in project implementation.

The findings of the study in a way vindicate the hypothesis of Schultz (1964) that mere provision of financial assistance and asset creation do not contribute to enhance the incomes of the rural poor. Seventy-three per cent of the beneficiaries failed to repay the loan in the CADA block and 48 per cent in the DPAP block, consistent with their levels of inefficiency

in resource use. This shows that the capital shortage among the weaker sections of the society in the rural areas is illusory. Really, there is a shortage of viable projects. The low rate of repayment of loans coupled with the high incidence of technical inefficiency points to the lack of commercial viability of the projects. The reasons for this could be attributed to *(a)* badly conceived projects, *(b)* insufficient entrepreneurial ability, and *(c)* unfavourable external conditions to the enterprise.

TABLE III. ACTUAL AND ESTIMATED FRONTIER VALUES OF CREDIT USED

Household number (1)	Actual (Rupees) (2)	Frontier (Rupees) (3)	Percentage/over-use (4)
	CADA block		
1.	1,000	1,000.00	0.0
2.	4,000	3,899.49	2.5
3.	5,000	4,250.98	15.0
4.	4,000	4,132.23	17.0
5.	4,000	2,798.87	30.0
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
95.	1,000	202.81	80.0
96.	3,500	667.52	81.0
97.	2,000	353.19	82.0
98.	3,500	554.20	84.0
99.	3,500	492.17	86.0
100.	2,000	250.93	87.0
	DPAP block		
1.	6,000	6,000.00	0.0
2.	1,000	988.79	1.0
3.	3,000	2,649.14	12.0
4.	1,500	1,213.27	19.0
5.	3,500	2,648.63	24.0
.	.	.	.
.	.	.	.
.	.	.	.
.	.	.	.
97.	3,500	1,018.18	71.0
98.	2,160	606.66	71.0
99.	2,000	573.72	71.0
100.	3,500	781.39	78.0

Summing Up

Technical efficiency of subsidised credit under the IRDP is studied using the concept of frontier production function, in an arid region of Central India. The results revealed that credit contributed very little to improving the family income. Besides, the level of credit use efficiency was low.

The levels of output efficiency in relation to the maximum realisable potential averaged 35 per cent and 49 per cent which contributed to the high levels of default in the repayment of the IRDP loans. This brings into sharp focus that despite the indisputable fact that the overall economic development of the rural poor is possible only by integrating them into

the general process of development, it cannot be accomplished by merely pumping in capital as subsidised credit. Traditional farmers and village artisans are hypothesised to be efficient but are faced with technological and socio-economic barriers. Further, there should be adequate infrastructure to absorb this capital, without which the beneficiaries would be forced to default which will render them ineligible for assistance in future from institutional sources. The present situation warrants the establishment of institutions to cater to the new production structure organised for the small and the weak. They will have to involve themselves in much wider activities than mere purveying of credit. The 'service area' approach of banks appears to be a step in the right direction.

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APPENDIX

If the frontier function is given by

$$Y^* = a\prod_{i=1}^{4} x_i^{b} \quad e^{-u}$$

and in log-linear form as

$$\ln y^* = \ln a + b_1 \ln x_1 + b_2 \ln x_2 + b_3 \ln x_3 + b_4 \ln x_4$$

Then

$$b_4 \ln x_4 = \ln y^* - \ln a - b_1 \ln x_1 - b_2 \ln x_2 - b_3 \ln x_3$$

Adding $b_1 \ln x_4 + b_2 \ln x_4 + b_3 \ln x_4$ to both sides we get

$$b_4 \ln x_4 + b_1 \ln x_4 + b_2 \ln x_4 + b_3 \ln x_4 - \ln y^* - \ln a - b_1 \ln x_1 - b_2 \ln x_2 - b_3 \ln x_3 + b_1 \ln x_4 + b_2 \ln x_4 + b_3 \ln x_4$$

Re-arranging the terms, we get

$$\ln x_4(\Sigma b_i) = \ln Y^* - \ln a - b_1 \ln \frac{x_1}{x_4} - b_2 \ln \frac{x_2}{x_4} - b_3 \ln \frac{x_3}{x_4}$$

Therefore,

$$\ln x_4^* = \ln y^* - \ln a - b_1 \ln R_1 - b_2 \ln R_2 - b_3 \ln R_3 / \Sigma b_i$$

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where

$$R_1 = \frac{X_1}{X_4}, \quad R_2 = \frac{X_2}{X_4} \quad \text{and} \quad R_3 = \frac{X_3}{X_4}$$

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