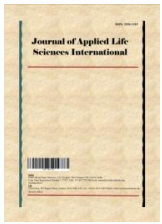

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Economic Analysis of Agricultural Credit on Production Efficiency of Borrower Farms

S. Padma Rani[1*]

[1]Department of Agricultural Economics, Tamil Nadu Agricultural University, Coimbatore -641003, India.

Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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ABSTRACT

Credit is one of the most crucial but scarce inputs used in agriculture. Farm credit is an important instrument, which has been used to increase agricultural productivity. The main focus of this research is to examine the role of agricultural credits, production and efficiency of farms in Erode District of Tamil Nadu. Kavunthapadi and Modakurichi block of Erode district was selected. A complete enumeration of farm households which borrowed institutional crop loan in each of the sample villages was made. The survey was conducted among 60 borrowers and 45 non-borrowers farm households. In the present study, the efficiency of farms among borrower and non-borrower sample households was determined by the Stochastic Frontier production function of the Cobb-Douglas type had been used. And Tobit analysis was also done to know the effect of credit on farm efficiency. The efficiency scores obtained from first stage Stochastic Frontier Approach for borrower and non-borrower farms were used as dependent variable and a dummy variable to represent credit (X5i) were used as one of the independent variables in addition to other socio economic independent variables. Results of the model revealed that the number of borrower farms with a technical efficiency of more than 90 per cent were more (57 per cent of the total borrower farms) than that of non- borrower farms (33.3 per cent) which implies that the more percentage of farmers availed credit and adopted technology had higher technical efficiency level (90 per cent). The results also indicated that technical efficiency ranged from 0.41 to 0.99 for non borrowers and from

**Corresponding author: E-mail: padmaranisenthil@yahoo.com;*

0.62 to 0.98 for borrowers. The results of Tobit regression analysis indicated that net operational area, farm experience, access to farm credit, had positive and significant relationship with the technical efficiency of the farmer.

Keywords: Agricultural credit; frontier production; technical efficiency; Tobit regression.

1. INTRODUCTION

Credit is one of the most crucial but scarce inputs used in agriculture. Farm credit is an important instrument, which has been used to increase agricultural productivity. Credit is the most important input of modern farming. The importance of credit has many facets in the Indian economy. It is the strategic input and integrated factor, which stimulates the growth impulses of the rural sector [1]. The limited capital availability has been acknowledged as the most limiting factor in the modernization of agriculture. The advent of modern technology has led to increased demand for inputs. As a result, adequate agricultural credit is required for agricultural development [2]. Provision of good credit facility to the farmers at the right time in the right place in the right proportion is a requisite for the transformation of agriculture [3]. The non-availability or scarcity of credit retards agricultural progress in particular and rural development in general. The low income of the agriculturist naturally results in low savings, low investment, low productivity, and keep them in the vicious circle of poverty [4]. It is clear, however, that the return to further investment in agriculture is normally low and low returns are likely to be an important limiting factor to increased savings and investment. But the farmers have to invest minimum amount for seasonal agricultural operations. In such situation, borrowing becomes inevitable [5].

About 52 percent of the agricultural households in the country were estimated to be indebted. At all India level, about 60 percent of the outstanding loans were taken from institutional sources which included Government (2.1 percent), Co-operative society (14.8 percent) and Banks (42.9 percent) [6]. Government/Reserve Bank of India (RBI) has taken several measures to increase institutional credit flow and bringing more and more farmers including small and marginal farmers within the fold of institutional credit [7]. As per RBI directions, Domestic Scheduled Commercial Banks are required to lend 18% of the Adjusted Net Bank Credit (ANBC) or Credit Equivalent to Off-Balance Sheet Exposure (CEOBE), whichever is higher, towards agriculture. A sub-target of 8% is also prescribed for lending to small and marginal farmers (SF/MF) including landless agricultural labourers, tenant farmers, oral lessees and share croppers. Similarly, in the case of Regional Rural Banks 18% of their total outstanding advances is required to be towards agriculture and a sub-target of 8% has been set for lending to small and marginal farmers. With a view to ensure availability of agriculture credit at a reduced interest rate of 7% p.a. to the farmers, the Government of India in the Department of Agriculture, Cooperation and Farmers' Welfare implements an interest subvention scheme for short term crop loans up to Rs. 3.00 lakh [8].

The agricultural credit flow has increased consistently over the years, exceeding the target set for each fiscal. For instance, credit worth Rs 11.68 lakh Crore was given to farmers in 2017-18, [9] Thus Credit plays a major role in achieving the major objective of agricultural policy and establishment of conditions under which increased agricultural production and higher levels of living for the rural population can be achieved. [10] In Tamil Nadu the total crop loan disbursed is about 79593.90 Crores and term loan disbursed is about 52550.67 crores during 2016-17 (GOI report). The main focus of this research is to examine the role of agricultural credits, production and efficiency of farms in Erode District of Tamil Nadu.

2. MATERIALS AND METHODS

Erode district is one among the few districts known for agriculture production in the State. Paddy, Sugarcane, Banana, Turmeric, Groundnut, and Cotton are the major crops grown in the district. With 43% share, the district is the top turmeric producer in the State. The major sources of irrigation are canal (51%), 33% dugwells/open wells, 12% by way of borewells and the remaining 4% by tanks & other sources. The Lead Bank of the district is Canara Bank. Banking and financial services are provided by 37 commercial banks with 300 branches, Erode DCCB (with 21 branches) & 163 PACS and Pallavan Grama Bank (with 20 branches).

Kavunthapadi and Modakurichi block of Erode district was selected randomly, a complete enumeration of farm households which borrowed institutional crop loan in each of the sample villages was made. The total number of respondents was fixed at ninety farm households. The sample size of the borrowers and non- borrowers were fixed at forty five of each category The sample farmers who borrowed short term credit for crop production purposes from institutional sources were classified as borrower farm households and the sample farmers who did not borrow crop loan from any of the sources were classified as non-borrower farm households.

Primary data from the selected borrower and non-borrower sample farms were collected with the help of a pre-tested interview schedule through personal interview method. The information regarding the basic details of the sample farmers, resource availability, land use, crop enterprise, levels and cost of different inputs used for crops and livestock enterprises were collected. Also, information on farmer's cash expenses, borrowings, repayments, over dues and problems and suggestions on the usage of borrowed capital was also collected.

In the present study, the efficiency of farms among borrower and non-borrower sample households was determined by the Stochastic Frontier production function of the Cobb-Douglas type had been used.

The study attempted to measure the technical efficiency of production for both borrower and non-borrower farm households.

The empirical model was as stated below:

$$\ln Y = a0 + a1\ln X1 + a2\ln X2 + a3\ln X3 + a4\ln X4 + a5\ln X5 + a6\ln X6 + Vi - Ui$$

Y = Total output in Kgs per ha,
X1 = Farm Yard Mannure in tonnes per ha
X2 = Seeds (Kg)
X3 = Human Labour in man days per ha
X4 = Value of fertilizers in Rs per ha
X5 = No. of Irrigation per ha
X6 = Other Costs (Plant Protection chemicals and others) in Rs. per ha
Ui = Farm technical efficiency related factor,
Vi = Random Variable

The consequential technical efficiency was estimated in the form of a fraction between the examined production points of the production unit being analyzed (yi) and the maximum output point (y). The production units having efficiency point of one were considered to be technically efficient while the production units having scores strictly lesser than one were technically inefficient. Thus the estimated efficiency scores of the production units are bounded by 0 and 1. The efficiency estimates through Stochastic Frontier Analysis are the radial efficiency measures showing unit indifference i.e., the estimated efficiency points do not vary with the transformation of estimation entries [11] (Coelli et al., 1998).

To examine the factors affecting the technical efficiency or inefficiency otherwise, the technical efficiency index acquired from stochastic frontier production function analysis were further regressed with the farm specific variables by utilizing Tobit regression technique [12].

In this study, the scores of technical efficiency obtained through the frontier production function were regressed on various explanatory variables which included: net operational area (hectares), farming experience (years), education (years), household size (Nos.), dummy to represent availing of credit, cultivation practices (Nos) and plant protection measures adopted (Nos.). This model was fitted for borrowers and non-borrowers.

Therefore, in order to measure the impact of farm specific and socio- economic characteristics on the efficiency / inefficiency of farm, the following form of Tobit model was used:

$$TE = \alpha 0 + \alpha 1X1i + \alpha 2X2i + \alpha 3X3i + \alpha 4X4i + \alpha 5X5i + \mu i$$

Where:

TE = Farm Efficiency Scores (from first stage Stochastic Frontier Approach)
X1i = Operational land holding of the ith farm in hectares.
X2i = Farming experience of the ith farm's operator in years.
X3i = Education level of the ith farmer in years. (No.of Schooling years)
X4i = Number of family members of the ith farmer,
X5i = Dummy variable to represent the access to credit of ith farm (1, if farmer was obtaining loan, zero otherwise)

α's = Unidentified parameters to be estimated.
μi = Error term.

Tobit analysis was done to know the effect of credit on farm efficiency, the efficiency scores obtained from first stage Stochastic Frontier Approach for borrower and non-borrower farms were used as dependent variable and a dummy variable to represent credit (X5i) were used as one of the independent variables in addition to other socio economic independent variables.

3. RESULTS AND DISCUSSION

Age of the head of sample households would be directly related to their farm experience. Hence, details on age of the respondents are given in Table 1.From the table it could be inferred that the average age of all the sample farmers was 50and 52in case of borrowers and non-borrowers farmers respectively. Majority of farmers are in the middle age group in both the borrower and non-borrower category of farm households.

Educational status would empower the farmers to take up prudent decisions on farming and they would also have easy access to banks and other institutions which would support farming. Hence, educational status of the heads of sample farm household is given in the Table2. it could be observed from the table that among the sample farmers, the total literacy level was higher in borrowers' farm household when compared with that of non-borrowers.

About 28.33 per cent of borrower respondents had education level of above higher secondary and collegiate level while 20.00 percent of the heads of non-borrower farm households were educated above higher secondary level. Further, illiteracy was more pronounced among non-borrowers.

Table 1. General Profile of the sample farmers

Sl. no.	Age Particulars (Years)	Borrowers (No)	Per cent	Non-Borrowers (No)	Per cent
1.	31- 40	3	5.00	0	0
2.	41-50	31	51.67	17	37.78
3.	51-60	19	31.67	23	51.11
4.	more than 60	7	11.67	5	11.11
5.	Total	60	100	45	100
	Average	50		52	

Table 2. Educational Status of the farm households

Sl. no.	Education	Borrower		Non Borrower	
		No	Percent	No	Percent
1.	Illiterate	4	6.67	5	11.11
2.	Primary	17	28.33	19	42.22
3.	SSLC	22	36.67	12	26.67
4.	Secondary	6	10.00	7	15.56
5.	Collegiate	11	18.33	2	4.44
	Total	60	100.00	45	(100.0)

Table 3. Land holding pattern of the borrower farm households

Sl. no	Size of holding	No	Hec	Average hect	percent
1	Marginal (< 1 ha)	26	17.36	0.67	43.33
2	Small (1 to 2 ha)	23	33.22	1.44	38.33
3	Medium (2to 4 ha)	6	23.04	3.84	10.00
4	large (> 4 ha)	5	22.6	4.52	8.33
	Total	60	96.22	1.60	100.00

Size of land holdings would determine the credit requirements as well as the income and employment generation. Hence, in Table 3 land holding pattern of the sample farm households are given.

It could be seen from the table that the average size of the net operated area was 1.60 hectares in borrower farm house holds. In case of borrowers, most of the sample respondents comes under .the category of marginal farmers 43.33 percent followed by small, medium and large size farm holdings.

From Table4.It could be observed that machineries contributed to about 49.08 per cent of the total asset value in borrower farm and the corresponding figure for non-borrower farms was 49.96 per cent. It was followed by value of farm buildings which accounted for 39.89 per cent in borrower's farm and 40.05 per cent in non-borrower farm. The overall total asset value of farm buildings, machineries and equipment was more in borrower farm than that of non-borrower farm.

The amount of borrowing by the sample borrowers is presented in Table .5. From the table it could be inferred that the average amount of credit borrowed per hectare of farm by the marginal farmers is more (Rs.97562.67/ha) than that of the large farmers(Rs.71153.85/ha). Whereas, the average amount borrowed per farm is found to be higher among large farmers than that of the other categories of farmers.

Farmers grew different crops in their farms and per hectare cost and returns for the crops grown are presented in Table 6.

The total cost of cultivation, on an average per hectare was more in borrower farm than that of non-borrower farm. The increase in the total cost was attributed by increase in labour charges and cost of machine power, seeds, manures, fertilizers and the plant protection chemicals. Inspite of the increase in cost owing to increase in gross returns, the net returns in borrower farm was more than that in non-borrower farm. The crop loan availed by the borrowers helped them to choose the cash crop and there by profitability was increased as indicated in the following table.

3.1 Stochastic Frontier Analysis

The technical efficiency of sample farmers was estimated by applying Stochastic Frontier Analysis (SFA). The technical efficiency was estimated in the form of a fraction between the examined production points of the production unit being analyzed (Yi) and the maximum output point (Y). The production units having the suffix Yi with efficiency point equal to one were said to be technically efficient, while the production units having less than one were considered as technically inefficient. Thus, the estimated efficiency scores of the production units are bounded by 0 and 1.The output oriented technical efficiency would explain that how much feasible output could be maximized for a given level of input. Thus the efficiency scores through stochastic frontier analysis were worked out for sample farmers mentioned above.

The farm level technical efficiencies of borrower and non borrower sample farmers are presented in Table 7. Further, the number of borrower farms with a technical efficiency of more than 90 per cent were more (64.44 per cent of the total borrower farms) than that of non- borrower farms (33.3 per cent i.e., only one- third of the total non borrower farms), which indicated that the more percentage of farmers availed credit and adopted technology had higher technical efficiency level (90 per cent). The results also indicated that technical efficiency ranged from 0.41 to 0.99 for

Table 4. Asset value position of the sample respondents

S. no	Particulars	Borrowers (Rs)	Percentage	Non-borrowers (Rs)	Percentage
1.	Farm house	63258.08	32.09	61387.93	32.45
2.	Pump shed	11255.17	5.71	10263.38	5.42
3.	Cattle shed	4130.24	2.09	4127.71	2.18
4.	Livestock	18326.44	9.29	16744.75	8.85
5.	Tractor	82313.91	41.76	83362.70	44.07
6.	Electric motor	8651.30	4.38	7033.12	3.71
7.	Sprayer	5800.27	2.94	4119.35	2.18
8.	Minor implements	3331.95	1.69	2117.93	1.12
	Total	197088.15	100	189156.90	100

Table 5. Amount of crop loan borrowed

Size of holding	No	Average size of farms	Amount of ST loan borrowing (Rs. per farm)	Amount of ST borrowing (Rs. per ha)
Marginal	26	0.65	63681.82	97562.67
Small	23	1.27	97500.00	76486.37
Medium	6	2.16	112600.0	52129.63
Large	5	5.20	370000.00	71153.85
Total	60	1.60	160945.45	74333.13

Table 6. Cost and returns of borrower and non borrower farms

S. no	Particulars	Borrowers farms		Non Borrowers farms	
		Amount (Rs/ha)	Percentage	Amount (Rs/ha)	Percentage
A.	**Variable Cost**				
1.	Human labour	31525.21	24.09	29,899.91	23.89
2.	Animal labour	5000	3.8	5,000	3.99
3.	Machine power	10895	8.32	10,900	8.71
4.	Seed/ seedlings	8621.36	6.5	8,621	6.89
5.	Manures and fertilizers	15789.36	12.06	15,789	12.61
6.	Plant protections	8625.52	6.59	8,513	6.80
7.	Miscellaneous	10895.37	8.32	10,369	8.28
8.	Interest on working capital	4000	3.05	-	-
	Subtotal (1)	95351.82	72.87	89,091.81	71.20
B.	**Fixed Cost**				
1.	Rental value of land	25000	19.10	25,000	19.98
2.	Interest of owned fixed capital	5368	4.1	5,632	4.50
3.	Depreciation of implements & buildings	4623	3.53	4,895	3.91
4.	Payments land revenue and cess	500	0.38	500	0.3
	Subtotal (2)	35491	27.12	36,027	28.79
	Total (A+B)	130842.82	100	1,25,118.81	100
	Gross income	255681.36	-	2,31,351.33	-
	Net income	124838.54	-	1,06,232.52	-

non borrowers and from 0..53 to 0.97 for borrowers. The efficiency distribution had shown that, 11.11 per cent of non-borrower farmers and 4.44 per cent of borrower- farmers were below 70 per cent level of efficiency. This level of efficiency showed that 11.11 per cent farmers not using credit were at low efficiency level.

3.2 Determinants of Farm Efficiency in borrowing Farm Households -Tobit Regression Model

The technical efficiency scores estimated through the Stochastic Frontier Analysis indicated that the levels of farm technical inefficiency ranged between 15 per cent in non-borrowers farms to 11 per cent in borrowers. The results also indicated that minimum average efficiency score was 0.53 for borrowers and 0.41 for non-borrowers. Thus, to investigate the factors affecting technical efficiency of sample farms, Tobit model was applied. To know whether credit, were influencing the technical efficiency of farm, or not, Tobit model was applied for borrower and non borrower farms; More specifically, it was decided to identify the major factors influencing the extent of farm technical efficiency. The dependent variable was the technical efficiency (scores), while operational area (ha), respondents' farm experience '(number of years), respondents' educational status (number of years), number of family members, number of cultivation practices and number of plant protection sprays were the independent variables [11].

Table 7. Distribution of technical efficiencies of sample farmers (per cent)

Sl. no.	Technical efficiencies	Borrowers	Non borrowers
A.	**Distribution of Farms**		
1.	≤.70	4.44	11.11
2.	0.71 to 0.80	8.89	17.78
3.	0.80 to 0.90	22.22	35.56
4.	0.90 to 1.0	64.44	33.33
	Total	100.0	100.0
B.	**Technical Efficiency Scores**		
5.	Mean	0.90	0.85
6	Minimum	0. 53	0.41
7.	Maximum	0.97	0.99

Table 8. Determinants of farm efficiency in borrowing sample farms-estimates of Tobit regression model

Dependent Variable: Technical Efficiency Scores
n= 90

Sl. no.	Independent variables	Borrower and Non Borrower	't' values
1	Net operated area (ha)	0.032* **	(4.82)
2	Experience (Years)	0.002**	(2.53)
3	Education (Years)	0.0057	(0.08)
4	Family size (Number)	-0.02*	(-1.71)
5	Dummy of Credit (Borrower=1: otherwise = 0)	0.12*	(1.79)
6	Number of cultivation practices	0.004*	(1.87)
7	No of sprays	-0.0026	(0.48)
	LR chi2(7)	30.64	
	Log likelihood	90.38	

**** significant at 1%; ** significant at 5%; * significant at 10%.*
Figures in parentheses indicate

A dummy variable to represent the influence of borrowing was introduced in the model; The results of Tobit regression analysis is presented in Table 8

The parameters estimated through Tobit regression model illustrated the extent of factors influencing the technical efficiency of borrower and non-borrowing farms. The LR chi square value and log likelihood values were significant, which would suggest a fairly good fit of the model. The positive and statistically significant (0.05 probability level) credit dummy (0.12) indicated that access to credit would increase the technical efficiency of the farms. For a one per cent increase in the access to credit would result in the increase of technical efficiency of farmers by 0.12 per cent. Access to agricultural credit allows timely use of farm inputs and application of modern technology which ultimately increase the output of the farms. The credit dummy showed the highest coefficient value than all other factors determining technical efficiency.

Net operated area was significant and positive sign (0.032) and this implied that an increase in the net operated area would result in the increase in farm efficiency. The household size exhibited negative relationship with technical efficiency and was significant at 0.05 probability level. An increase in the family size by one per cent would decrease the efficiency of farms by 0.02 per cent. The total number of sprays of plant protection chemicals was statistically insignificant but had negative relationship with technical efficiency with the coefficient value of -0.002. However, the contribution of no. of sprays of plant protection chemicals in influencing the efficiency of farms was quite negligible. The results of regression indicated that net operational area, farm experience, access to farm credit, had positive and significant

Table 9. Opinion of borrowers in availing bank loans

S. no	Problems	Score	Rank
1	Inadequacy of loan amount	4	I
2	Untimely disbursement	1	IV
3	More documents are demanded/ complex procedures	3	II
4	High cost of credit	2	III
5	Subsidy is not available	1	IV
6	Repayment schedule is not flexible	2	III

relationship with the technical efficiency of the farmer. Therefore, these factors are to be considered in improvising the efficiency of farms.

3.3 Opinion of Borrowers in Availing Bank Loans

The ranks assigned by the sample respondents were converted into scores using Garrett's table. It was inferred from the analysis that inadequacy of loan amount was ranked first.

From the above table it could be inferred that inadequacy of loan amount and complex procedures are the major constraints faced by borrowers.

Further it was observed that low crop yield and low price for agricultural commodities, are the major problems been expressed by the sample farm households in the study area.

4. CONCLUSION

From the above study it could be inferred that agricultural credit has a significant impact on farm investment, income and production efficiency of farms. Hence policy makers should focus on this aspect to strengthen agricultural farm investment.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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