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Conclusion

In this paper an attempt is made to formulate a project for investment in minor irrigation development. While doing so some of the conceptual problems are brought into sharp focus. Investment criteria are discussed and evaluated in terms of technical and economic feasibilities of the proposed project. Further refinements in evaluation of projects in the context of overall strategy for developing and sustaining groundwater resources through programming sites of investment, and crop mix are possible.

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A STUDY OF IMPACT OF MEDIUM AND LONG-TERM LOANS ON SHORT-TERM CREDIT NEEDS OF THE PUNJAB FARMERS

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Introduction

In the context of technological break-through in agriculture, the problem of farm finance has assumed new and wider dimensions. The core of this

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new strategy implies the application of heavy doses of fertilizers, intensive use of irrigation and high-yielding crop varieties which essentially assume the development of adequate infra-structure on the farm. The development of the infra-structure puts a pressure on medium and long-term loans to effect permanent and semi-permanent improvements, *viz.*, installation of tube-wells, pumping sets, reclamation and development of lands, construction of farm buildings and structures, purchases of livestock, machinery and equipment on the farm.

Whether and how far these medium and long-term investments affect the absorption capacity of short-term investment on the farm, has not been quantitatively worked out in India. Realising the need for such a study as would help co-ordinate the lending activities of various farm credit institutions, *viz.*, co-operatives, land mortgage banks and commercial banks, an attempt has been made in this study to examine the nature and magnitude of the impact of medium and long-term investments (along with other relevant factors) on short-term operational capital/credit requirements on the farms. More specifically, the objective of the study was to quantify the impact of medium and long-term loan on short-term credit absorption capacity of the farm-firms.

MATERIAL AND METHODS

This study was confined to two types of long-term investment loans, *viz.*, tube-well and tractor and to only those cases which shifted from Persian wheel to tube-well sources of irrigation and from animal power to tractor power respectively in the year 1968-69. For this Ludhiana development block was purposively selected on account of (1) Special Development Scheme for advancing long-term tube-well loans being in operation in this area for the past three years; and (2) Primary Land Mortgage Bank itself had advanced a sizable number of long-term tractor loans during the same period.

Selection of Sample

Two separate lists of tube-well and tractor loan cases in Ludhiana block were obtained from the Primary Land Mortgage Bank, Ludhiana. Tube-well loans were advanced in 30 villages out of which three villages (10 per cent) with highest number of loan cases were selected. In all, there were 75 tube-well loan cases in these three villages and out of these, 30 cases where a shift from Persian wheel to tube-well source of irrigation had taken place during the year 1968-69 were selected. The tractor loan list provided 25 cases in all out of which 15 cases who were previously operating on animal power but shifted to tractor power were selected. The study sample thus consisted of 30 tube-well loan cases and 15 tractor loan cases.

Collection of Data

The selected farmers were interviewed in person during the year 1969-70 and the required information was collected for the period 1968-69 and 1969-70,

with the help of specially designed and pre-tested schedule. The schedule *inter alia* collected information on cropping pattern, disposable income, investment pattern and utilization pattern of different types of loans, for the above-mentioned period.

Analysis of Data

It was hypothesized that short-term investment depended upon long-term investment, medium-term investment, disposable income and irrigated acreage on the farm. Based upon this assumption two types of multiple regression models given below were fitted separately for tube-well and tractor farms.

1. Linear Model :

$$Y = a + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4$$

2. Cobb-Douglas Model :

$$Y = a X_1^{b_1} X_2^{b_2} X_3^{b_3} X_4^{b_4}$$

Where

Y = Short-term investment during 1969-70.

X_1 = Long-term investment made during the years 1968-69 and 1969-70.

X_2 = Medium-term investment made during the years 1968-69 and 1969-70.

X_3 = Disposable income of the farmer during the year 1968-69.

X_4 = Irrigated acreage in the year 1969-70.

a = Value of the constant.

b_i's = Regression coefficients of X_i's.

Specification of Variables

Short-term investment (Y) was chosen as dependent variable which comprised of the following items:

(*a*) Value (imputed or actual) of seed, manures and fertilizers whether purchased or produced on the farm.

(*b*) Payment of wages both in kind and cash to hired farm labour—permanent and casual. Family labour was not counted on the assumption that it was fully occupied in the pre-loan situation.

(*c*) Expenses incurred on oils, fuel, repairs, custom hire and electricity.

(*d*) Payment of land revenue, water charges and crop cess.

(*e*) Payment of rent both in kind and cash to landlord for leased-in land.

(*f*) Payment of annual instalment including interest on medium and long-term loans and interest charges on short-term loans.

The independent variables were specified as under:

Y_1 = (*a*) Amount invested on tube-wells and purchase of tractors.

(*b*) Amount spent on development of land including levelling, water channels and drainage pipes, etc.

Y_2 = For tube-well farms—amount spent on purchase of draught animals and bullock driven implements and other equipment. For tractor farms—amount spent on purchase of seed-cum-fertilizer drill, maize sheller, power thresher and tractor driven implements and other equipment.

X_3 = This included income from farming and other activities.

X_4 = Irrigated acreage of the farm in the year 1969-70.

Assumption

Since the owned funds formed a varying percentage of the total investment from farm to farm, likewise the actual loans also formed a varying percentage of investments. Thus in order to make the data comparable from farm to farm, the actual short-term, medium-term and long-term investments on the farm were used as variables.

Limitation

The expenses incurred on farm buildings and structure, *viz.*, cattle shed, implement shed, store room, etc., during the year 1968-69 and 1969-70 were not included in the long-term investment variable (X_1) because these structures were attached to the household and as such were being used for a variety of purposes, both farm and non-farm.

RESULTS AND DISCUSSIONS

Before fitting the model, zero order correlation matrix for tube-well and tractor farms was worked out separately to examine the problems of multicollinearity. The correlation matrices are given in the Appendix.

The correlation matrix in the case of tube-well farms revealed that the irrigated acreage (X_4) had high correlation with long-term investment (X_1) and disposable income (X_3).[1] On tube-well farms the long-term investment

1. This reflects the problem of multicollinearity. If correlation coefficient between a pair of explanatory variables is greater than 0·81 the problem of multicollinearity may arise. E. O. Heady and J. L. Dillon : Agricultural Production Functions, Iowa State University Press, Ames, Iowa, U.S.A., 1964, pp. 115.

(X_1) was primarily on irrigation. Also irrigated acreage influenced the disposable income. Irrigated variable (X_4) was, therefore, dropped and functions were fitted with the remaining variables. In the case of tractor farms also, (X_4) was significantly correlated with (X_1) and (X_3).[2] The disposable income had high correlation with long-term investment. The long-term investment included investment on irrigation and as such takes account of (X_4) variables. Moreover (X_1) was the objective variable and hence retained.[3] As such (X_4) variable was dropped in the tractor farm analysis also. The zero order correlation matrix worked out with Cobb-Douglas model also gave similar results as in the case of linear model explained above.

The equations estimated through linear model in the case of tube-well and tractor farms with the rest of the variables are given below :

Tube-well farms: $Y = 5258.44 + 1.5455^{*}\ X_1 + 0.0977\ X_2 + 0.1853^{\dagger}\ X_3$
(0.2699) (0.3321) (0.0949)
$R^2 = 0.8175$

Tractor farms: $Y = -7754.43 + 0.4895^{*}\ X_1 + 0.3112\ X_2 + 0.3290^{\dagger} X_3$
(0.1174) (0.2734) (0.1539)
$R^2 = 0.9539$

* Significant at 1 per cent level.
† Significant at 10 per cent level.

It is observed that the three independent variables, *viz.*, long-term investment, medium-term investment and disposable income explained about 82 per cent and about 95 per cent variation in short-term investment (Y) in the case of tube-well and tractor farms respectively. The coefficients of (X_1) and (X_3) were found to be statistically significant at one per cent and ten per cent level in both the cases whereas it was not significant in the case of medium-term investment though it was positively correlated with short-term investment.

The Cobb-Douglas model gave the following equations:

Tube-well farms: $Y = 17.54\ X_1^{1.2860^{*}}\ X_2^{0.0439}\ X_3^{0.0028}$
(0.2860) (0.1065) (0.1064)
$R^2 = 0.8175$

Tractor farms : $Y = 20.40\ X_1^{0.5660^{*}}\ X_2^{0.0982}\ X_3^{0.6062^{*}}$
(0.1528) (0.0737) (0.1304)
$R^2 = 0.9215$

* Significant at 1 per cent level.

It is evident from the above equations that the same three selected variables explained about 82 per cent and 92 per cent of the variation in short-term investment in the case of tube-well and tractor farms respectively. A

2. See footnote 1.
3. Since R value is high (·97) as compared to zero order correlation coefficient between (X_1) and (X_3) (·86), (X_3) was not dropped.
L. R. Klien : An Introduction to Econometrics, Prentice Hall, Delhi, 1969, p. 101.

Cobb-Douglas function gives elasticities with respect to various variables directly. The elasticity coefficient of long-term investment was statistically significant at 1 per cent level in both the cases which indicates that one per cent change in long-term investment would result in about 1.29 and 0.57 per cent change in short-term investment respectively. The elasticity coefficients of medium-term investment and disposable income were not statistically significant in the case of tube-well farms but were positively influencing short-term investment. In the case of tractor farms the coefficient of disposable income was significant at one per cent level and one per cent change in disposable income would result in 0.61 per cent change in short-term investment.

Elasticity estimates obtained from the linear model are compared with those of the Cobb-Douglas model in Table I. The elasticities for the linear model were calculated at the mean levels of the variables.

TABLE I—ELASTICITIES OF LONG-TERM, MEDIUM-TERM AND DISPOSABLE INCOME WITH RESPECT TO SHORT-TERM INVESTMENT ON DIFFERENT TYPES OF FARMS, LUDHIANA : 1969-70

Elasticity	Linear model**		Cobb-Douglas model	
	Tube-well farms	Tractor farms	Tube-well farms	Tractor farms
Long-term	1·4452* (0·2524)	0·7144* (0·1713)	1·2860* (0·2860)	0·5760* (0·1528)
Medium-term	0·0288 (0·0978)	0·1109 (0·0974)	0·0439 (0·1065)	0·0982 (0·0737)
Disposable income ..	0·2299* (0·1161)	0·4661† (0·2177)	0·0028 (0·1064)	0·6062* (0·1304)

* Significant at 1 per cent level.
† Significant at 10 per cent level.
** The following formulas were used to work out the elasticities and to test their significance :

1. Elasticity of $X_i = b_i \frac{\overline{X_i}}{\overline{Y}}$

2. $t = \frac{\text{Elasticity of } X_i}{\sqrt{\text{Var. Elasticity } X_i}}$

Where Var. Elasticity = Var. $(b_i) \left(\frac{\overline{X_i}}{\overline{Y}}\right)^2$

Linear estimates revealed that one per cent increase in long-term investment would generate absorption capacity of short-term investment to the extent of about 1.45 and 0.71 per cent on tube-well and tractor farms respectively. Similarly, one per cent change in disposable income would result in 0.23 and 0.47 per cent change in short-term investment in both the cases studied.

The elasticity of medium-term investment with respect to short-term investment was very low and not significant in none of the cases studied.

It was 0.03 and 0.04 from linear and Cobb-Douglas models for tube-well farms and 0.11 and 0.10 from linear and Cobb-Douglas models for tractor farms respectively.

The foregoing analysis clearly indicated that loans given for long-term investment had significantly increased the requirements of short-term loans.

APPENDIX

ZERO ORDER CORRELATION AMONG SELECTED VARIABLES, TUBE-WELL AND TRACTOR FARMS, LUDHIANA : 1969-70

	Short-term investment (Y)	Long-term investment (X_1)	Medium-term investment (X_2)	Disposable income (X_3)	Irrigated acreage (X_4)
Linear Model					
Y	1·0000 (1·0000)*	·8997 (·9341)	·4796 (·6186)	·7566 (·9526)	·8641 (·9633)
X_1		1·0000 (1·0000)	·5264 (·4322)	·6927 (·8605)	·8003 (·8855)
X_2			1·0000 (1·0000)	·4777 (·6730)	·4508 (·6293)
X_3				1·0000 (1·0000)	·8383 (·9393)
X_4					1·0000 (1·0000)
Cobb-Douglas Model					
Y	1·0000 (1·0000)*	·8820 (·9230)	·5564 (·6080)	·7461 (·9460)	·8922 (·9611)
X_1		1·0000 (1·0000)	·5814 (·4170)	·6691 (·8420)	·8241 (·8676)
X_2			1·0000 (1·0000)	·5219 (·6094)	·5134 (·6486)
X_3				1·0000 (1·0000)	·7764 (·9492)
X_4					1·0000 (1·0000)

* Figures in parentheses pertain to tractor farms.