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Research Note

IMPACT OF INSTITUTIONAL CREDIT ON FOOD GRAIN PRODUCTION IN BANGLADESH

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ABSTRACT

This study is aimed at developing a theoretically consistent methodology to measure the impact of institutional credit on food grain production in Bangladesh using time series data from various government and non-government sources. This paper has made use of a multi equation model consisting of a production function and a set of input demand function to determine the impact of credit on food gain production. Elasticities of production with respect to institutional credit were found to be positive for all food grains excep Boro paddy. This suggests that credit is a catalyst in production, the increasing flow of which may result in improving the per acre productivity. The increasing flow of credit and proper utilization of the same in buying necessary inputs can bring about favourable responses in crop production.

I. INTRODUCTION

Bangladesh is a food deficit country. To increase food grain production, Green Revolution was launched in the country in the mid sixties. Because the new technology is capital intensive, which the small farmers could not afford, great importance was placed on the provision of institutional credit to farmers as rural financial markets were highly imperfect and overwhelmingly dominated by the informal lenders who charge exorbitant rates of interest.

To increase the flow of institutional credit in Bangladesh, several steps have been undertaken. First, agricultural credit and cooperative institutions have been established to specifically cater to the needs of the farmers. Second, commercial banks have been involved in agricultural lending in a large way who usually shy away from the agricultural sector. Third, interest rates have been subsidized for making these loans attractive to farmers. Finally, administrative allocations are made and refinancing facilities are provided to the lending institutions so that agricultural lending is not affected due to shortage of funds.

Food grain production has also increased in Bangladesh overtime. But question remains as to how much of the increased food production is attributed to the increased supply of agricultural credit? The information is unfortunately missing, because there has been very little research on the area. Hossain (1985) and Rusdhi (1989) estimated the impact of institutional credit on food grain

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production taking credit as one of the arguments in production function, i.e., they assumed that credit directly influences production. Elahi (1985) estimated the impact by excluding credit from the production function.

It appears that the methodology of most of the studies cited above are theoretically and economically deficient. First, credit is not an input in the production process. Production may respond to the changes in the supply of credit only if the demands for input used in the production process are influenced by the changes in the supply of credit. Secondly, production does not depend on a few factors but also on a number of other factors. It was therefore felt essential to elaborate the production function and input demand function to construct a more rational model for measuring the impact of institutional credit on food grain production.

The present study was undertaken with the objective of developing a theoretically more consistent methodology for estimating the impact of institutional credit on food grain production in Bangladesh. The study is confined to only four major food grains, namely, Aus Paddy, Aman Paddy, Boro Paddy and Wheat.

II. SOURCES OF DATA

Secondary data were collected from different government agencies and research organizations covering entire Bangladesh to carry out this research. Data on output, irrigation, human labour, animal labour, seed/ seedling and fertilizer were collected for the period of 1974-75 to 1993-94. Data on output, and irrigated area were collected from the various issues of Year Book of Agricultural Statistics of Bangladesh, Statistical Year Book of Bangladesh, and Agricultural Year Book of Bangladesh, BBS. Data on irrigation cost, human labour, animal labour, seed/ seedling and fertilizer were collected from Agro-Economic Research (AER) Section of the Ministry of Agriculture for the period of 1978-79 to 1993-94. Data collected from AER were unpublished data.

Data on irrigation cost, human labour, seed/ seedling and fertilizer for the period of 1974-75 to 1977-78 were collected from the various issues of Annual Report, BRRI, provided by the Agro-Economic Survery (AES) of BRRI. Data on agricultural credit and crop credit were collected from the head office of Bangladesh Bank.

III. ANALYTICAL METHODS

The present study has made use of a 20-year time series data to determine mainly the impact of credit on food grain production of the Bangladesh agriculture. The conceptual framework and theoretical discussion on constrained optimization of this paper were drawn from Elahi (1990) and Henderson and Quandt (1980) respectively.

Theoretical Methodology

The linkage between credit and production can be established from the theory of firms operating under conditions of capital constraint. The objective of the firm operating under capital constraint is to maximize output (Henderson and Quandt, 1980). The optimization process can be described as follows:

The short-run production function and total cost equation of a firm are given by equations (1) and (2) respectively:

$$Y = g(x_1, x_2) \quad (1)$$

$$C^\circ = r_1x_1 + r_2x_2 + b^\circ \quad (2)$$

Where,

Y = output

C° = total cost indicating available capital

x_1 and x_2 are two inputs used in production

r_1 and r_2 are prices of x_1 and x_2 respectively

b° = cost of fixed inputs.

The Lagrangian function is defined as follows:

$$Z = g(x_1, x_2) + \lambda\,(C^\circ - r1x1 - r_2x_2 - b^\circ) \quad (3)$$

Where, λ is an undetermined lagrngian multiplier.

The input demand functions can be derived from the first order conditions of output maximization :

$$x_1 = x_1^*\,(r_1, r_2, C^\circ) \quad (4)$$

$$x_2 = x_2^*\,(r_1, r_2, C^\circ) \quad (5)$$

Equation (4) and (5) show that inputs x_1 and x_2 are functions of input prices and the amount of capital available to the firm. Input demand and availability of capital are positively related. This indicates that credit affects production positively through increased use of inputs.

Empirical Methodology

It is obvious that the impact of credit on food grain production cannot be measured from a single equation. Rather, to measure truely the impact of credit on production, several equations need to be estimated. Thus this study used multi equation econometric models consisting of production and input demand functions to measure the impact of institutional credit on food grain production.

Since the impact of credit will be measured on food grain production, the production function to be estimated should be specific. This, instead of measuring a loose food grain production function, in this study, Aus, Aman, Boro and Wheat production functions were estimated separately. All the data collected were related to Aus, Aman, Boro, Wheat and food grain production and input demands.

To measure in impact of institutional credit on food grain production, the following models were specified.

$$Y_i = f_{i1} (I_i, L_i, Z_i, S_i, F_i) + e_{i1} \quad (6)$$

$$I_i = f_{i2} (PY_{i-1}, PI_i, C_i) + e_{i2} \quad (7)$$

$$L_i = f_{i3} (PY_{i-1}, PL_i, C_i) + e_{i3} \quad (8)$$

$$Z_i = f_{i4} (PY_{i-1}, PZ_i, C_i) + e_{i4} \quad (9)$$

$$S_i = f_{i5} (PY_{i-1}, PS_i, C_i) + e_{i5} \quad (10)$$

$$F_i = f_{i6} (PY_{i-1}, PF_i, C_i) + e_{i6} \quad (11)$$

Where,

Y_i = Production of ith food grain in thousand metric tonnes.

I_i = Area under ith food grain under irrigation in thousand hectares.

L_i = Amount of human labour used for ith food grain in million man-days.

Z_i = Amount of animal labour used for ith food grain in million pair-days.

S_i = Amount seed/ seedling used for ith food grain in thousand metric tonnes.

F_i = Amount of chemical fertilizer used for ith food grain in thousand metric tonnes.

PY_{i-1} = Price of ith food grain one year lagged in Taka/metric tonnes.

C_i = Amount of institutional credit disbursed for ith food grain in million Taka.

P_{Ii} = Cost of irrigation charged for ith food grain in Taka/hectare.

PL_i = Price of human labour charged for ith food grain in Taka/man-day.

PZ_i = Price of animal labour charged for ith food grain in Taka/pair-day.

PS_i = Price of seed charged for ith food grain in Taka/Kg.

PF_i = Price of chemical fertilizer for ith food grain in Taka/Kg.

e_i = Error term for ith food grain.

i = a, m, b, w and t, where the symbols stand for Aus, Aman, Boro, Wheat and total food grain (Aus + Aman + Boro + wheat) respectively.

The production function (6) contains five independent variables which are irrigation, human labour, animal labour, seed and fertilizer. Insecticide was not included in the production function because the data related to this input were not sufficient and available. Each of the irrigation, human labour, animal labour, seed and fertilizer demand functions contains three independent variables which are lag price of output, own price and amount of institutional credit. Both production and input demand functions were specified in log linear form which provided elasticities directly.

IV. IMPACT OF INSTITUTIONAL CREDIT ON FOOD GRAIN PRODUCTION

Aus Paddy Model

The results of the Aus paddy model are presented in Table 1. In production function all the parameters have consistent signs except quantity of fertilizer used. This variable has inconsistent sign because it indicates negative relationship with Aus paddy production. However, it is insignificant. Generally production increases as quantity of fertilizer increase. The sign of irrigated area is consistent and significant. The elasticity of Aus production with respect to irrigation is 0.1932. The rest of the variables are insignificant. The fitness of the model is good as indicated by R2. More than 97 per cent of the total variation are explained by the five variables used in explaining Aus paddy production.

In the irrigation demand function, all the independent variables have consistent signs but the signs of lag price and institutional credit are significant. The elasticities of irrigation demand with respect to lag price and institutional credit are 0.1940 and 0.1647 respectively. The value of R^2 = 0.81 indicates that the fitness of the model is quite good.

All the independent variables in human labour demand function possess consistent signs but only the sign of the price of human labour is significant. The price elasticity of demand for human labour is -0.7806. This indicates that if wage increases by 10 per cent demand for labour falls by 7.8 per cent. The fitness of the model is good as indicated by R^2.

All the arguments in animal labour demand function have consistent signs. The coefficients of lag price, institutional credit and price of animal labour are all significant. The elasticities of animal labour demand with respect to lag price, own price and institutional credit are 0.2206, -1.1852 and 0.1031 respectively. All the three explanatory variables displayed proper effect on the demand function for animal labour. The value of R^2 indicates that the fitness of the model is good.

In the seed/ seedling demand function, all the estimated parameters have consistent signs. The coefficient of institutional credit and seed/ seedling are 0.1109 and -0.6267 respectively. Both these two are significant. The explanatory power of the model is about 76 per cent as indicated by R^2. The included independent variables in the fertilizer function are consistent but all of them are insignificant.

Table 1. Results of the Estimated Aus Paddy Model

Arguments and R^2	Functions	Intercept	Irrig. Ln Ia	H. Lab. Ln L_a	A. Lab. Ln Z_a	Seed. Ln S_a	Fert. Ln F_a	Lag price Ln PY_{a-1}	Credit Ln C_a	Irrg. Cost Ln PI_a	Price of H. Lab. Ln PL_a	Price of A. Lab. Ln PZ_a	Price of seed. Ln PS_a	R^2
Production Fundtion : Ln Y_a	3.3375	0.1932* (2.520)	0.1012 (0.216)	0.2191 (0.622)	0.4653 (1.128)	-0.0902 (-1.553)	-	-	-	-	-	-	-	0.9704
Irrigation Demand Function : Ln I_a	2.3606	-	-	-	-	-	0.1940* (0.2229)	0.1647* (3.181)	-0.0114 (-0.178)	-	-	-	-	0.8106
Human labour Demand Function : Ln L_a	6.3974	-	-	-	-	-	0.2370 (1.398)	0.0345 (0.852)		- 0.7806* (-4.272)	-	-	0.7871	
Animal Labour Demand Function : Ln Z_a	6.0913	-	-	-	-	-	0.2206** (1.700)	0.1031* (2.448)	-	-	-1.1852* (-5.110)	-	-	0.8542
Seed/seedling Demand Function : Ln S_a	5.4013	-	-	-	-	-	0.0665 (0.496)	0.1109* (2.139)	-	-	-	-0.6267* (-3.380)	-	0.7596
Fertilizer Demand Function : Ln $F_<$	3.1183	-	-	-	-	-	0.2328 (1.134)	0.14 (1.492)	-	-	-	-	-0.1418 (-0.371)	0.4804

* Significant at 5 per cent level
** Significant at 10 per cent level
Figures within the parentheses indicate t-values

Aman Paddy Model

The results of the Aman paddy model are presented in Table 2. The table shows that all the estimates of the parameters of Aman production are consistent in terms of signs excepting irrigated area. The coefficient of the seed/ seedling and fertilizer are highly significant. The elasticities of production with respect to seed/ seedling and fertilizer are 0.9931 and 0.2121 respectively. The explanatory power of the model is 94.79 per cent as indicated by R^2.

Among the included explanatory variables in the irrigation demand function, the signs of lag price and institutional credit are consistent while that of the irrigation cost is inconsistent because it indicates positive relationship with irrigation demand. The coefficients of lag price and institutional credit are significant. The elasticities of irrigation demand with respect to lag price and institutional credit are 0.3847 and 0.168 respectively. The fitness of the model is good as indicated by R^2.

In the human labour demand function, the lag price and the institutional credit have consistent signs while the price of human labour contains inconsistent sign. Again, only the coefficient of institutional credit is significant. The elasticity of human labour demand with respect to institutional credit is 0.0739. The explanatory power of the model is 75.37 per cent.

All the arguments in the animal labour demand function have consistent signs but only the coefficients of institutional credit and the price of animal labour are significant. The elasticities of animal labour demand with respect to institutional credit and price of animal labour are 0.054 and -0.1853 respectively.

All the independent variables in the seed/ seedling demand function have inconsistent signs and are insignificant which indicates that these independent variables have no consistent impact on seed/ seedling demand for Aman production.

In the fertilizer demand function, the lag price and the institutional credit have consistent signs while the price of fertilizer has inconsistent sign. Only the coefficient of lag price is significant and the elasticity of fertilizer demand with respect to lag price is 0.4523.

Boro Paddy Model

The results of the Boro paddy model is presented in the Table 3. All the functions except fertilizer demand have good fitness as indicated by high R^2. The area under irrigation, animal labour and seed have consistent signs while the human labour and fertilizer have inconsistent signs. The coefficients of area under irrigation and seed/seedlings are significant while the coefficient of animal labour is highly significant

In the irrigation demand function, only the lag price has consistent sign while the cost of irrigation and institutional credit have inconsistent signs. The coefficients of cost of irrigation and institutional credit are highly significant while the coefficient of lag price is insignificant. The elasticities of irrigation demand with respect to cost of irrigation and institutional credit are 0.5156 and -0.1235 respectively.

Table 2. Results of the Estimated Aman Paddy Model

Arguments and R^2 Functions	Intercept	Irrig. Ln I_m	H. Lab. Ln L_m	A. Lab. Ln Z_m	Seed. Ln S_m	Fert Ln F_m	Lag price Ln PY_{m-1}	Credit Ln C_m	Irrg. Cost Ln PI_m	Price of H. Lab. Ln PL_m	Price of A. Lab. Ln PZ_m	Price of seed. Ln PS_m	Price of fert. Ln PF_m	R^2
Production Fundtion : Ln Y_m	-1.3186	0.0020 (-0.029)	0.2125 (1.581)	0.1881 (0.943)	0.9931* (3.493)	0.2321* (3.890)	-	-	-	-	-	-	0.9479	
Irrigation Demand Function : Ln I_m	0.831	-	-	-	-	-	0.3847* (2.181)	0.168* (2.697)	0.0148 (0.129)	-	-	-	-	0.759
Human labour Demand Function : Ln L_m	5.3018	-	-	-	-	-	0.1053 (0.957)	0.0739* (2.494)	-	-0.0478 (0.424)	-	-	-	0.7537
Animal Labour Demand FunctioN : Ln Z_m	5.6355	-	-	-	-	-	0.0239 (0.309)	-	0.054* (2.493)	-	0.1853* (-1.72)	-	-	0.3067
Seed/seedling Demand FunctioN : Ln S_m	6.8228	-	-	-	-	-	-0.0639 (-0.934)	-0.0267 (-1.309)	-	-	-	0.079 (1.098)	-	0.1258
Fertilizer Demand Function : Ln F_m	2.6631	-	-	-	-	-	0.4523** (1.879)	-	0.0212 (0.312)	-	-	-	-0.1655 (0.65)	0.7319

* Significant at 5 per cent level

** Significant at 10 per cent level

Figures within the parentheses indicate t-values

Table 3. Results of the Estimated Boro Paddy Model

Arguments and R^2 / Functions	Intercept	Irrig. Ln I_b	H.Lab. Ln L_b	A. Lab. Ln Z_b	Seed. Ln S_b	Fert. Ln F_b	Lag price Ln PY_{b-1}	Credit Ln C_b	Irrg. Cost Ln PI_b	Price of H. Lab. Ln PL_b	Price of A. Lab. Ln PZ_b	Price of seed. Ln PS_b	Price of fert. Ln PF_b	R^2
Production Fundtion : Ln Y_b	2.1248	0.5705* * (1.816)	-0.4448 (-0.993)	0.9036* (2.978)	0.2910* (2.231)	-0.1165 (-0.867)	-	-	-	-	-	-	-	0.9896
Irrigation Demand Function : Ln I_b	2.7667	-	-	-	-	-	0.1771 (0.815)	-0.1235* (-1.285)	0.5165* (3.560)	-	-	-	0.837	
Human labour Demand Function : Ln L_b	1.9823	-	-	-	-	-	0.2311 (1.117)	- 0.0843** (-1.858)	-	0.7673* (3.932)	-	-	-	0.9036
Animal Labour Demand Function : Ln Z_b	0.2209	-	-	-	-	-	0.2553 (1.221)	-0.0903 (-1.59)	-	-	0.8151* (3.449)	-	-	0.8913
Seed/seedling Demand Function : Ln S_b	0.6472	-	-	-	-	-	0.3314 (1.181)	0.0153 (0.208)	-	-	-	0.6627* (2.42)	-	0.9036
Fertilizer Dema..d Function : Ln F_b	-0.6472	-	-	-	-	-	0.762 (1.628)	-0.0292 (-0.243)	-	-	-	-	0.5465 (1.145)	0.7272

* Significant at 5 per cent level

** Significant at 10 per cent level

Figures within the parentheses indicate t-values

Among the three arguments in human labour demand function, the sign of lag price is consistent and the signs of price of human labour and institutional credit are inconsistent. The coefficient of the price of human labour is highly significant. The coefficient of the institutional credit is significant also but the coefficient of lag price is insignificant. The elasticities of human labour demand with respect to price of human labour and institutional credit are 0.7673 and -0.0843 respectively.

Excepting lag price, other independent variables in animal labour demand function have inconsistent signs. The coefficient of the price of animal labour is highly significant while that of the lag price and institutional credit are insignificant. The elasticity of animal labour demand with respect to its price is 0.8151.

Excepting price of seed/ seedling, other two arguments in seed/ seedling demand function have consistent signs but only the coefficient of price of seed/ seedling is significant. The elasticity of seed/ seedling demand with respect to its price is 0.6627.

In the fertilizer demand function, the lag price has consistent sign while the price of fertilizer and institutional credit have inconsistent signs. The coefficients of the independent variables are insignificant.

Wheat Model

The results of the wheat model are presented in Table 4. All the functions have good fitness judged by high R2. In the wheat production function, excepting seed and fertilizer, other independent variables have consistent signs. The coefficient of seed is significant and the coefficients of irrigated area, human labour and animal labour are highly significant. The elasticities of wheat production with respect to irrigated area, human labour, animal labour and seed are 0.4298, 0.7555, 0.8758 and -0.7610 respectively.

Among the independent variables in irrigation demand function, the signs of lag price and the cost of irrigation are inconsistent while the sign of institutional credit is quite consistent. Again, only the coefficient of institutional credit is highly significant. The elasticity of irrigation demand with respect to institutional credit is 0.4878.

All the independent variables in human labour demand function have consistent signs. The coefficient of institutional credit is highly significant while the coefficients of lag price and price of human labour are insignificant. The elasticity of human labour demand with respect to institutional credit is 0.4743.

All the arguments in animal labour demand function have consistent signs. The coefficients of lag price and price of animal labour are insignificant while the coefficient of institutional credit is highly significant. The elasticity of animal labour demand with respect to institutional credit is 0.46.

Table 4. Results of the Estimated Wheat Model

Arguments and R^2 / Functions	Intercept	Irrig. Ln I_w	H. Lab. Ln L_w	A. Lab. Ln Z_w	Seed. Ln S_w	Fert. Ln F_w	Lag price Ln PY_{w-1}	Credit Ln C_w	Irrg. Cost Ln PI_w	Price of H. Lab. Ln PL_w	Price of A. Lab. Ln PZ_w	Price of seed. Ln PS_w	Price of fert. Ln PF_w	R^2
Production Fundtion: Ln Y_w	2.5575	0.4298* (5.095)	0.7555* (2.772)	0.8758* (3.556)	- 0.7610* (-2.384)	-0.1343 (-0.864)	-	-	-	-	-	-	-	0.9945
Irrigation Demand Function : Ln I_w	1.9315	-	-	-	-	-	-0.1196 (-0.39)	0.4878* (4.177)	0.4027 (1.276)	-	-	-	0.8209	
Human labour Demand Function : Ln L_w	0.5587	-	-	-	-	-	0.2543 (1.025)	0.4743* (7.115)	-	- 0.0779 (-0.316)	-	-	-	0.8985
Animal Labour Demand Function : Ln Z_w	0.4257	-	-	-	-	-	0.1909 (0.758)	0.46* (6.215)	-	-	-0.2027 (-0.744)	-	-	0.9869
Seed/seedling Demand Function : Ln S_w	0.8342	-	-	-	-	-	0.2287 (1.036)	0.4232* (4.809)	-	-	-	-0.031 (-0.102)	-	0.8484
Fertilizer Demand Function : Ln F_w	2.2097	-	-	-	-	-	0.0673 (0.309)	0.407* (5.028)	-	-	-	-	0.4791** (1.825)	0.8979

* Significant at 5 per cent level

** Significant at 10 per cent level

Figures within the parentheses indicate t-values

All the independent variables in seed demand function have consistent signs. The coefficient of institutional credit is highly significant while it is insignificant for the lag price and price of seed. The elasticity of seed demand with respect to institutional credit is 0.4232.

In the fertilizer demand function, the lag price and institutional credit have consistent signs while the price of fertilizer has inconsistent sign. The coefficient of price of fertilizer is significant while the coefficient of institutional credit is highly significant. The elasticities of fertilizer demand with respect to its price and institutional credit are 0.4791 and 0.407 respectively.

Total Food grain Model

The results of the total food grain model are presented in Table 5. Except area and animal labour demand functions all the functions have good fit as indicated by high R2. In the total food grain production function, excepting human labour all the variables have consistent signs. The coefficients of area under irrigation, seed and fertilizer are significant while the rest of the coefficients are insignificant. The elasticities of total food grain production with respect to area under irrigation, seed and fertilizer are 0.1641, 0.7938 and 0.1720 respectively.

Excepting lag price other two variables have inconsistent signs in irrigation demand function. All the coefficients of the arguments are insignificant indicating that they have no impact on irrigation.

All the arguments in human labour demand function have consistent signs. The coefficient of lag price is significant and the coefficient of institutional credit is highly significant. But the coefficient of the price of human labour is insignificant. The elasticities of human labour demand with respect to lag price and institutional credit are 0.1408 and 0.049 respectively.

All the explanatory variables in animal labour demand function have consistent signs. The coefficient of lag price is significant while the coefficients of institutional credit and price of animal labour is highly significant. The elasticities of animal labour demand with respect to lag price, price of animal labour and institutional credit are 0.0889, -0.1806 and 0.0419 respectively.

Excepting price of seed/ seedling, other two variables in seed/ seedling demand function have consistent signs. All the coefficients of the explanatory variables are insignificant.

Among the arguments in fertilizer demand function, excepting price of fertilizer, other variables have consistent signs. The coefficients of the lag price and institutional credit are insignificant while the coefficient of price of fertilizer is significant. The elasticity of fertilizer demand with respect to its price is 0.4513.

Table 5. Results of the Estimated Total Food grain Model

Arguments and R^2 / Functions	Intercept	Irrig. Ln I_t	H. Lab. Ln L_t	A. Lab. Ln Z_t	Seed. Ln S_t	Fert. Ln F_t	Lag price Ln PY_{t-1}	Credit Ln C_t	Irrg. Cost Ln PI_t	Price of H. Lab. Ln PL_t	Price of A. Lab. Ln PZ_t	Price of seed. Ln PS_t	Price of fert. Ln PF_t	R^2
Production Fundtion: Ln Y_t	0.3569	0.1641** (1.808)	-0.0037 (-0.021)	0.2166(0 .835)	0.7938* (1.763)	0.1720* (2.451)	0.9881							
Irrigation Demand Function : Ln I_t	2.2532	-	-	-	-	-	0.3839 (1.287)	-0.0136 (-0.182)	3.3133 (1.459)	-	-	-	-	0.7726
Human labour Demand Function : Ln L_t	5.9653	-	-	-	-	-	0.1408* (2.265)	0.049* (3.507)	-	-0.008 (-0.133)	-	-	-	0.8671
Animal Labour Demand Function : Ln Z_t	5.7195	-	-	-	-	0.0889** (1.877)	0.0419* (3.484)	-	-	-0.1806* (-2.848)	-	-	0.4654	
Seed/seedling Demand Function : Ln S_t	6.3633	-	-	-	-	-	0.042 (1.307)	0.0123 (1.357)	-	-	-	0.0426 (1.241)	-	0.8823
Fertilizer Demand Function : Ln F_t	3.8928	-	-	-	0.3419 (1.59)	0.0228 (0.392)	-	-	-	0.4513** (1.716)	0.8773			

* Significant at 5 per cent level

** Significant at 10 per cent level

Figures within the parentheses indicate t-values

Elasticities of Input Demands with respect to credit

The elasticities of input demands with respect to institutional credit are summarised in Table 6. These results are highly important. Elasticities of demand for irrigated area with respect to credit are statistically significant for all crop models excepting total food grain model. But it has consistent signs for Aus paddy, Aman paddy and wheat models and inconsistent signs for Boro paddy and total food grain models. Among the consistent signs, the elasticity of the demand for irrigated area is the highest for wheat model and the lowest for Aus paddy model. Again, among the inconsistent signs, the elasticity of the demand for irrigated area is the highest for Boro paddy model and the lowest for total food grain model.

Table 6. Elasticities of Input Demands with respect to credit

Crop Model	Irrigated Area	Human Labour	Animal Labour	Seed/ seedling	Fertilizer
Aus paddy	*0.1647	0.0345	*0.1031	*0.1109	0.1400
Aman paddy	*0.1680	*0.0739	*0.054	-0.0267	0.0212
Boro paddy	-*0.1235	-**0.0843	-0.0903	0.0153	-0.0292
Wheat	-*0.4878	*0.4743	*0.4600	*0.4232	*0.4070
Total food grain	-0.0136	*0.0490	*0.0419	0.0123	0.0228

* Significant at 5 per cent level, ** Significant at 10 per cent level

Elasticities of demand for human labour with respect to credit are statistically significant for all crops excepting Aus paddy and have consistent signs for all crop model excepting Boro paddy model. In 80% of the cases credit showed positive contribution. Among the consistent signs, the elasticity of human labour is the highest for wheat model and the lowest for Aus paddy model.

Elasticities of animal labour demand are statistically significant and have consistent signs for all crop models excepting Boro paddy model. Among the consistent signs, the elasticity of the demand for animal labour is the highest for wheat model and the lowest for total food grain model.

The coefficient of seed/ seedling is statistically significant for Aus paddy and wheat models. Also, it has consistent signs for Aus paddy, Boro paddy, wheat and total food grain model while it has inconsistent sign for Aman paddy model. Among the consistent signs, the elasticity of the demand for seed/ seedling is the highest for wheat model and the lowest for total food grain model.

The coefficient of fertilizer is significant for wheat model only and it has consistent signs for all crop models excepting Boro paddy model. Among the consistent signs, the elasticity of the demand for fertilizer is the highest for wheat model and the lowest for Aman paddy model.

It is to be mentioned that in majority cases, the demand for inputs are positively influenced by credit which support the hypothesis this credit affects directly the input demand.

The magnitudes of these elasticities indicate that the impact of institutional credit is the highest for wheat production.

Elasticities of Production with respect to Credit

Having obtained the estimates of the parameters of the models, the estimated equations were differentiated partially with respect to credit and elasticities of production with respect to credit were calculated by taking the sum total of the product of elasticities of output with respect to input used other than credit and elasticities of input demand with respect to credit used in the production. Therefore, estimated individual equation is not of prime consideration, rather what is most important is the total effect obtained for the production function and the input demand functions. Thus, the individual parameters of the different equations produced earlier have little relevance for this specific purpose.

The elasticities of production with respect to institutional credit are furnished in Table 7. The magnitude of elasticity is the highest in case of wheat production while it is negative in case of Boro paddy production. Wheat production increases by 6.00 per cent with a 10 per cent increase in institutional credit. Aus, Aman, and total food grain production increase by 1.00 per cent, 0.03 per cent, and 0.20 per cent respectively with a 10 per cent increase in institutional credit. These results are more or less close to real world situation. Because crop production is not only related to institutional credit, it also depends highly on environmental condition. Natural calamities like flood, drought, cyclones, hailstorm etc. affect the paddy season seriously. Therefore, acting impact of institutional credit on paddy production would probably be much higher than what has been revealed here. This is apparent that the environmental condition remains largely stable in wheat season and the impact of institutional credit on wheat production as found here is the highest.

Table 7. Elasticities of Food grain Production with respect to Institutional Credit.

Crop Model	Elasticity of production
Aus paddy	0.100
Aman paddy	0.003
Boro paddy	-0.110
Wheat	0.600
Total food grain	0.020

It is, therefore, established that credit affects the demand for inputs and production of crop is affected by credit via input demand. The foregoing discussion reveals that credit has a positive impact on the production of food grain. The poor magnitude of elasticities of production with respect to credit may be explained by a number of factors. Firstly, many of the coefficients of fertilizer displayed inconsistent signs which is not strange for developing country like Bangladesh. Given the socio-economic conditions of Bangladesh, non-availability of fertilizer at right time and at right prices, the use of unbalanced quantity and types, it is not unlikely to have inconsistent signs.

Secondly, the time series data used in the present study have been derived from a number of sources the reliability of which can often be questioned. Different sources sometimes provide different figures the use of which produces different estimates. Another important problem is the misuse of credit money made by the farmers. Unless the credit is used in buying the required inputs credit will ultimately have no impact. Moreover, because of non-availability and paucity of some important information, some assumptions had to be made which might not be close to the actual situation. This might have resulted in the specification errors. Another important fact which could not be taken into consideration is the quantum of non-institutional credit used in the production of all these crops. The fact that the poor farmers have very little access to credit institutions which constraints the availability of fund for buying necessary modern inputs. Moreover, the institutional sources hardly provides 25 to 30 per cent of the credit need of the farmers. The big portion of the unsatisfied credit need is filled in by the non-institutional sources. Unfortunately, the use of only institutional credit in crop production and the ignorance of the use of non-institutional credit has largely under estimated the magnitude of the impact of credit. The actual contribution of credit to crop production could be properly estimated if the study could make use of another set of primary data collected over cross section of farmers. This could not be done because of the limitation of time and fund. Thus, this appears as an important limitation for estimating the impact of credit on food grain production.

Lastly, the functional specification that has been used may not be the true production function and input demand function. The authors believe that the present study is an improvement over the existing studies and scope for further improvement is left with the future researchers. What the results imply is that credit influences production and the way it has been estimated seems to be better than the idea of using credit as a direct argument in the production function and getting its estimates.

V. CONCLUSION AND RECOMMENDATION

It can be concluded from the study that credit is an important catalyst for crop production. It affects the crop production via input demand. The input demand is positively affected by credit. Elasticity of production with respect to credit is positive for all the food grains production under study.

It can be recommended that there is no denying the fact that credit does not affect crop production no matter whether it does so directly or via input demand. In order to improve productivity of crops, adequate care should be taken to reduce the pilferage of credit from the proposed purposes for which it is taken. The study provides empirical evidence that credit positively influences the demand for inputs required to produce food grain. Credit does not directly influence crop production but it does so via satisfying input demands of the farmers. In order to improve the impact of credit on food grain production adequate care should be taken to reduce the diversion of credit use from crop production.

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