Chapter VIII

REGRESSION PRODUCTION FUNCTIONS

8.1 INTRODUCTION

We have analysed in the previous chapter the per acre output and inputs data by different farm size groups. We have found that the tiny farms (farms holding upto 2 acres of net cultivable lands) fare better both in respect of crops and milk output from milch cows.

This chapter provides us with an opportunity of discussing productivity of inputs using regression functions. It is necessary that the investigator takes meticulous care to keep all non-sampling errors at minimum. Accordingly the crop accounts have been almost free of any sampling errors. But the villagers in some cases have failed to give separate accounts of ordinary grass, high yielding grass, concentrates, hay and free grazing on public places. Since these could not be separated by some milk farmers they all have been lumped under one category, namely, fodder. Another point we would like to mention is that even though milk is the main output from animals, there are byproducts which have values. These byproducts are cowdung and offspring. But since total milk produced is far more valuable than cowdung and offspring, the regression output function from cows includes only the value of milk (Rs.) but excludes cowdung and offspring.

Similarly, byproducts have been excluded from crop outputs defined for the purpose of regression crop output function. The loss of output as a result of not including the byproducts has been even less in the case of crop output. For better results we have only considered total output as sum of all crop outputs.

We must not fail to stress that it has not been an easy task to survey six hundred households and a great deal of pains have been taken to visit and

revisit the respondents of the district which is the farthest from the state capital and one of the far away stations from the University of North Bengal, the temporary home of her supervisor.

We analyse the productivities of inputs of crops in the second section of this chapter. The third section is given to the discussion of productivities of inputs of milk from HYV cows. The productivities of inputs of milk from Deshi cows are discussed in the fourth section. A short summary of the findings of the chapter is given in the last section.

8.2 CROP FUNCTIONS : PRODUCTIVITIES OF INPUTS OF CROPS

Table 8.2.1
Regression Total Output Function
Dependent Variable = Total Output
(Sum of all crops) (Main Outputs not including byproducts)
Linear Regression
No. of Regressors : 8

Mnemonic Names	Co-efficients	T with d.f. = 16
TOUM	950.18	2.2282
DECIN	1.68	2.5002
SEED	1.12	1.7184
INOF	- 0.15	- 0.22084
ORMA	- 0.11	- 0.21438
INSE	3.17	2.2426
IRIN	3.67	3.0546
HOLA	- 0.72	- 0.53752
HILA	1.66	1.2850

$R^2 = 0.81$

We have used in the first instance eight regressors for the total output function. They are (1) depreciation (DECIN), (2) seeds (SEEDS), (3) inorganic fertilisers (INOF), (4) organic manures (ORMA), (5) insecticides

(INSE), (6) irrigation (IRIN), (7) home labour (HOLA) and (8) hired labour (HILA). The dependent variable is total output (TOUM).

Table 8.2.2
Regression Total Output Function
Log-Linear Regression
No. of Regressors : 8

Mnemonic Names	Co-efficients	T with d.f. = 16
TOUM	4.55	6.1383
DECIN	0.11	2.1010
SEED	0.21	2.2813
INOF	0.04	+ 0.3919
ORMA	- 0.09	- 1.0035
INSE	0.005	0.7635
IRIN	0.32	4.1269
HOLA	- 0.09	- 1.1165
HILA	0.13	1.2953

$R^2 = 0.81$

Of the two results, from linear and log linear forms, as expressed in tables from 8.2.1 to 8.2.3, marginal products obtained from the linear form are more reasonable. We must, however add that functions fitted by both forms are held by us as significant. We follow that practice which holds the function as significant if at least one of the co-efficients is significant.

Table 8.2.3

Marginal products in terms of table 8.2.2

Variable	Marginal Product
DECIN	1.27
SEED	1.50
INOF	0.32
ORMA	- 0.61
INSE	0.23
IRIN	5.08
HOLA	- 1.49
HILA	1.58

Table 8.2.1 shows that hired labour as a whole is more productive than home labour. In fact, there has been an excess use of home labour. As a result home labour shows negative marginal product. Apart from hired labour, implements, seeds, insecticides and irrigation records profitable productivities. Of the productivities of inputs irrigation shows the highest. This is consistent with the fact that the area is benefited by low level of irrigation.

By reducing the number of independent variables to seven from eight, there occurs a loss in explanation. The number of inputs profitably used decline from five to three. This incidentally points to some defect of the crazy methods of mathematics.

So we stick to the eight regressor analysis of the linear form of regression in this context.

Table 8.2.4

Regression total output function
Linear Regression
No. of Regressors : 7

Mnemonic Names of Variables	Co-efficient	T with d.f. = 17
TOUM	1048.1	2.479
DECIN	1.7469	2.5943
SEED	0.8919	1.4292
INOF	- 0.47	- 0.68
ORMA	- 0.0626	- 0.12078
INSE	3.0622	2.1546
IRIN	3.5549	2.9426
ALAB	0.5549	0.63252

$R^2 = 0.79$

ALAB = Home Labour and Hired Labour taken together.

Table 8.2.5

Regression of total output function
Log-linear regression

No. of Regressors : 7

Variable	Co-efficient	T with d.f. = 17
TOUM	4.9326	6.3640
DECIN	0.12073	2.2732
SEED	0.16036	1.8288
INOF	0.055193	0.57563
ORMA	- 0.10814	- 1.1882
INSE	0.00359	0.58495
IRIN	0.32533	3.9781
ALAB	0.01015	0.09257

$R^2 = 0.79$

Table 8.2.6

Marginal Products of variables corresponding to table 8.2.5

Variable	Marginal Product (Rs.)
DECIN	1.40
SEED	1.15
INOF	0.45
ORMA	- 0.74
INSE	0.17
IRIN	5.17
ALAB	0.07

8.3 PRODUCTIVITIES OF INPUTS OF MILK FROM HYV COWS

Here we fit simple regression functions both in linear and log-linear forms. Productivity of implements is high in both forms. The functions in both forms are highly significant. The results are presented in tables 8.3.1 to 8.3.3.

The results of fodder are not that encouraging. They are presented in tables 8.3.4 to 8.3.6. Of the two forms here the result from the linear form is better, though the function is significant in both forms.

Medicines for treatment of HYV cows have been used most productively. The results in the two forms – linear and log-linear are significant and presented in tables 8.3.7 to 8.3.9.

Table 8.3.1
HYV Milk Function
(Simple Linear Regression)
Regressor : DECI

Variable	Co-efficient	T with d.f. = 23
MIHI	2392.5	2.5868
DECI	14.956	7.8160

$R^2 = 0.73$

MIHI = Milk from HYV cows

DECI = Depreciation

Table 8.3.2
HYV Milk Function
(Simple Log-Linear Regression)
Regressor : DECI

Variable	Co-efficient	T with d.f. = 23
MIHI	4.5541	8.0186
DECI	0.74708	8.1092

$R^2 = 0.74$

Table 8.3.3
Marginal Product
Corresponding to table 8.3.2

Variable	Marginal Product (Rs.)
DECI	14.40

Table 8.3.4
HYV Milk Function
(Simple Linear Regression)
Regressor : FODE

Variable	Co-efficient	T with d.f. = 23
MIHI	3357.1	5.5150
FODE	0.96772	10.3222

$R^2 = 0.8$

FODE = Fodder

Table 8.3.5
HYV Milk Function
(Simple Log-Linear Regression)
Regressor : FODE

Variable	Co-efficient	T with d.f. = 23
MIHI	4.1286	7.5496
FODE	0.57481	9.1998

$R^2 = 0.79$

Table 8.3.6
Marginal Product
Corresponding to table 8.3.5

Variable	Marginal Product (Rs.)
FODE	0.86

Table 8.3.7
HYV Milk Function
(Linear Regression)
Regressor : MEDI

Variable	Co-efficient	T with d.f. = 23
MIHI	5739.6	15.936
MEDI	7.4993	10.976

$R^2 = 0.84$

MEDI = Medicines

Table 8.3.8
HYV Milk Function
(Log-linear Regression)
Regressor : MEDI

Variable	Co-efficient	T with d.f. = 23
MIHI	6.5681	29.600
MEDI	0.41782	11.68

$R^2 = 0.86$

Table 8.3.9
Marginal Product
Corresponding to table 8.3.8

Variable	Marginal Product (Rs.)
MEDI	7.84

8.4 PRODUCTIVITIES OF INPUTS OF MILK FROM DESHI (TRADITIONAL) COWS

Here also we use simple regression functions. Implements show good productivity. Though the fitted functions are significant both in linear and log linear forms, R^2 is low. The results are given in tables 8.4.1 to 8.4.3.

The results of fodder are presented in tables 8.4.4 to 8.4.6. The goodness of fitting is not very low. In the log linear form the marginal product is found to be quite good. In both linear and log linear forms the functions are significant.

so on the whole inputs have been productively used for raising milk from Deshi cows.

Table 8.4.1
Deshi Milk Output Function
Simple Regression (Linear)
Regressor : DECI

Variable	Co-efficient	T with d.f. = 23
MISI	1571.2	8.4883
DECI	1.2095	2.0093

$R^2 = 0.15$

MISI = Milk from Deshi Cows

DECI = Depreciation

Table 8.4.2
Deshi Milk Output Function
Simple Regression (Log-linear)
Regressor : DECI

Variable	Co-efficient	T with d.f. = 23
MISI	6.0763	9.1697
DECI	0.26139	2.2161

$R^2 = 0.18$

Table 8.4.3
Marginal Product
Corresponding to table 8.4.2

Variable	Marginal Product (Rs.)
DECI	1.75

Table 8.4.4
Deshi Milk Output Function
Simple Regression (Linear)
Regressor : FODE

Variable	Co-efficient	T with d.f. = 23
MISI	917.85	5.1902
FODE	0.86277	5.8546

$R^2 = 0.60$

FODE = Fodder

Table 8.4.5
Deshi Milk Output Function
Simple Regression (Log-linear)
Regressor : FODE

Variable	Co-efficient	T with d.f. = 23
MIHI	3.7749	6.5015
FODE	0.5368	6.4945

$R^2 = 0.65$

Table 8.4.6
Marginal Product
Corresponding to table 8.4.5

Variable	Marginal Product (Rs.)
FODE	3.59

8.5 SUMMARY OF THE FINDINGS OF THE CHAPTER

Using multiple regression with eight regressors we find that most inputs were used productively. We used multiple regression for measuring productivities of inputs for raising milk from HYV cows. Implements and medical treatment of animals have been used productively.

We used simple regression for the purpose of measuring the productivities of inputs for raising milk from Deshi cows. Both implements and fodder are found to have been used productively.

Although methodologically regression results have the capacity to say only about the historical process and strictly they cannot be extrapolated backward and forward, yet the intrinsic capacity of inputs to bring more revenue than their costs cannot be conceptually ignored for future also.

8.6 USE OF THE INPUT PRODUCTIVITIES

The intrinsic productivities of these inputs will be of use, along with new elements we shall introduce later in the dissertation, for designing expansion of activities and hence demand and demand determined newer technologies and processes.