ACREAGE RESPONSE FOR POTATO IN BANGLADESH

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ABSTRACT

This study was undertaken to examine the acreage response to various economic and non-economic factors of potato in Bangladesh.. The results show that the macro level results differed markedly from the micro level results. For the country as a whole the last year's acreage played a dominant role whereas all the district results except Dhaka show that last year's harvesting price was an important variable in acreage response function. The variation of gross profit and rainfall had little or no impact on potato acreage allocation.

I. INTRODUCTION

The major problem of agriculture revolves around supply functions and relationship of product output with factor input. These provide a framework for adjusting production and resource employment to promote economic development. This is especially true for Bangladesh where planning has been accepted as a tool of economic development. Improved knowledge on the potential future supply structure is needed for the appraisal of problems and potentialities in area development.

Accurate knowledge of supply is essential not only for formulating suitable sets of policies but also for better guidance and decision making to individual farmers. Estimation of supply responses will help farmers in adjusting their production to projected prices with a view to maximize their profit. This study, therefore, was undertaken to examine acreage response to various economic and non-economic factors and thereby to estimate the supply elasticities of potato in Bangladesh.

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II. DESIGN OF THE STUDY

Specification of the Model

The basic model used was the Nerlovian "adjustment lagged model", i.e.

$$A^*_t = Bo + B_1P_{t-1} + B_2CVP_{t-1} + B_3R_t + U_t$$

$$A_t - A_{t-1} = r(A^*_t - A_{t-1}),\ 0<r<1$$

where,

A^*_t = the planned or desired acreage

A_t and A_{t-1} = actual acreage in time t and t−1

P_{t-1} = the post harvesting price in time t−1

CVP_{t-1} = coefficient of variation of gross profit of the three preceding period

R_t = total rainfall in the pre-sowing period

r = coefficient of adjustment

U_t = residual.

The reduced form of the equation is

$$A_1 = b_o + b_1P_{t-1} + b_2CVP_{t-1} + b_3R_t + b_4A_{t-1} + V_t$$

where, $b_o = rB_o$, $b_1 = rB_1$, $b_2 = rB_2$, $b_3 = rB_3$

$b_4 = 1-r$, $V_t = rU_t$

However, the traditional static model of the following form was used in order to compare it with Nerlovain dynamic model:

$$A_t = b_o + b_1P_{t-1} + b_2CVP_{t-1} + b_3R_t + U_t$$

Five important potato growing districts of Bangladesh namely Dhaka, Comilla, Rajshahi, Rangpur and Bogra were selected for this study. Regression was run for each

selected districts as well as for the country as a whole. Both linear and logarithmic functions were tried and finally logarithmic function was selected because it yielded better result than linear one. Time series data of the period 1962-63 to 1981-82 for Bangladesh as a whole and the period 1965-66 to 1981-82 for districts were used for this study.

The analysis was further carried to work out short-run and long-run supply elasticities with respect to price.

Specification of Variables

In this study, the dependent variable was acreage planted and not output. The acreage planted was used as a proxy of planned output. This may be justified by the fact that the farmers have greater control over acreage than that on the yield or output.

Three months (January to March) average post-harvest wholesale price of potato was taken in this model because most of the farmers in Bangladesh dispose of their products just after harvest. Total rainfall in the pre-sowing months (September to December) was considered as a proxy for weather. Risk element was incorporated in the supply response equation by including coefficient of variation of gross profitability (CVP_{t-1}) of potato over the three preceding years. The independent variables were tested for multicollinearity through zero order correlation. Also to test the first order linear autocorrelation, Durbin-Watson statistic (d) was calculated.

III. RESULTS AND DISCUSSION

The estimated potato acreage response functions are presented in Tables 1 and 2 whereas Table 3 shows the short-run and long-run elasticities obtained from different functions. The results of the regression analysis for the districts as well as for the country as a whole are discussed below.

Country Results

In case of Nerlovian model last year potato acreage was found to be significant whereas lagged potato price was positive but non-significant. When last year acreage was dropped from the equation in case of traditional model, price variable came out significant and all other variables bore the desired sign but the value of $\bar{R}^2$ reduced considerably. The low value of Durbin-Watson (d) statistics in traditional model indicates that the possibility of serial correlation can not be ruled out. On the basis of $\bar{R}^2$ and 'd' value Nerlovian model has an edge over the traditonal one.

TABLE 1 ESTIMATED POTATO ACREAGE RESPONSE FUNCTIONS FOR THE EASTERN DISTRICTS AND THE COUNTRY AS A WHOLE

Nation/District	Type of model	Constant (in log form)	Potato Acreage (A_{t-1})	Potato Price (P_{t-1})	C.V. of Gross Profit (CVP_{t-1})	Rainfall (R_t)	$\bar{R}^2$	Estimated value of 'd' statistics
Bangladesh	Nerlovian	0.1892	0.9014* (0.1876)	0.0016 (0.0615)	0.0473 (0.0523)	-0.0046 (0.0845)	0.8049*	1.9554 (NSC)
	Traditional	2.0307	—	0.2466* (0.0532)	-0.1160 (0.0614)	0.0334 (0.1298)	0.5046*	0.9594 (Incon.)
Dhaka	Nerlovian	0.6531	0.5992* (0.1096)	0.0425 (0.080)	0.1744 (0.1135)	-0.2246 (0.1162)	0.8520*	2.1596 (NSC)
	Traditional	1.2838	—	0.3163* (0.1188)	0.3129 (0.2106)	-0.4579* (0.2058)	0.4635*	0.9509 (Incon.)
Comilla	Nerlovian	0.7541	0.2209 (0.1518)	0.1976* (0.0758)	-0.0530 (0.0605)	-0.0837 (0.0485)	0.6728* —	2.1472 (NSC)
	Traditional	1.0026	—	0.2776* (0.0547)	-0.0931 (0.0566)	0.0651 (0.0491)	0.6394*	1.9114 (NSC)

*Significant at 5 per cent level.

Figures in the parentheses are standard errors

NSC = No serial correlation.

Incon. = Test inconclusive.

TABLE 2 ESTIMATED POTATO ACREAGE RESPONSE FUNCTIONS FOR THE NORTHERN DISTRICTS OF BANGLADESH

District	Type of Model	Constant (in log form)	Potato Acreage (A_{t-1})	Potato Price (P_{t-1})	C.V. of Gross Profit (CVP_{t-1})	Rainfall (R_t)	$\bar{R}^2$	Estimated value of 'd' statistics
Rajshahi	Nerlovian	1.1688	0.0724 (0.2132)	0.0999* (0.0325)	-0.0170 (0.0264)	-0.0572 (0.0403)	0.6098*	1.6932 (NSC)
	Traditional	1.2608	—	0.1080* (0.0213)	-0.0202 (0.0237)	-0.0615 (0.0367)	0.6411*	1.6681 (NSC)
Rangpur	Nerlovian	0.7807	0.2162 (0.1994)	0.1568* (0.0429)	0.0168 (0.0282)	0.0212 (0.0326)	0.8565*	2.0522 (NSC)
	Traditional	1.0296	—	0.1966* (0.0222)	0.0061 (0.0266)	0.0175 (0.0326)	0.8541*	1.6367 (NSC)
Bogra	Nerlovian	1.1031	0.0472 (0.3134)	0.1783* (0.0658)	-0.0171 (0.0473)	-0.0473 (0.0819)	0.5440*	2.3461 (NSC)
	Traditional	1.1513	—	0.1860* (0.0396)	-0.0211 (0.0376)	-0.0406 (0.0656)	0.5846*	2.2585 (NSC)

*Significant at 5 per cent level.

NSC=No serial correlation.

Figures in parentheses are standard errors.

TABLE 3. ELASTICITIES WITH RESPECT TO PRICE FOR THE SELECTED DISTRICTS AND THE COUNTRY AS A WHOLE

Nation/District	Type of model	Coefficient of adjustment (r)	Short run elasticity	Long run elasticity
Bangladesh	Nerlovian	0.0996	0.0016	0.0164
	Traditional	–	0.2466	–
Dhaka	Nerlovian	0.4008	0.0425	0.1060
	Traditional	–	0.3163	–
Comilla	Nerlovian	0.7791	0.1976	0.2536
	Traditional	–	0.2776	–
Rajshahi	Nerlovian	0.9276	0.0999	0.1077
	Traditional	–	0.1080	–
Rangpur	Nerlovian	0.7838	0.1568	0.2000
	Traditional	–	0.1966	–
Bogra	Nerlovian	0.9528	0.1783	0.1871
	Traditional	–	0.1860	–

When regression was run with only lagged acreage as independent variable, the value of $\bar{R}^2$ was estimated to be 0.79 i.e. 79 per cent of the variation in current acreage of potato was determined by the last year acreage. This indicates that the lagged acreage in Nerlovian model acted as a dominant variable, which attempted to explain most of the variation in dependent variable leaving little to be explained by other variables. Thus it is evident that the potato growers in Bangladesh take into consideration the last year acreage along with last year harvesting price for making potato acreage allocation decision.

The results show that variation of gross profit and rainfall had little or no impact on potato acreage allocation. Rainfall has no impact on acreage determination as farmers grow potato with assured irrigation facilities.

The short-run and long-run price elasticities in case of Nerlovian model were 0.0016 and 0.0164 respectively while for traditional model short-run price elasticity was 0.2466. In case of Nerlovian model the long-run elasticity was much higher than short-run elas-

ticity. This was due to low coefficient of adjustment. Further, the short-run elasticities for traditional model were much higher than those for Nerlovian model. The results imply that the potato farmers in Bangladesh take much time to adjust their acreage to the change in economic factors.

District Results

Like Bangladesh, lagged acreage acted as a dominant variable in case of Dhaka district where the coefficient of price variable turned out to be significant because of exclusion of lagged acreage variable in case of traditional model. In all other districts, the last year harvesting price coefficient for both traditional and Nerlovian model were found to be positive and significant, whereas the lagged acreage coefficients were positive but non-significant.

In all but Dhaka and Rangpur districts, the profit risk variable bore the desired sign but in no case the risk variable was found to be significant. In most of the cases the rainfall variable was negative and non-significant.

Exclusion of lagged acreage variable (in case of traditional model) resulted in low value of 'd' statistics in all the cases. But the same was not true for $\bar{R}^2$, which was higher for Nerlovian model in case of eastern districts only. In case of Northern districts except Rangpur the traditional model had higher value of $\bar{R}^2$. On the basis of $\bar{R}^2$ and 'd' statistics traditional model yielded better results in case of Comilla, Rajshahi and Bogra districts. In rest of the cases the Nerlovian model has an edge over the traditional one. Therefore, the result shows that in all but Dhaka district only the lagged harvesting price has been influencing the farmer's decision to allocate land under potato. Whereas, in Dhaka district apart from price, lagged acreage has been influencing the farmer's potato acreage allocation decision.

The short-run and long-run elasticities for Nerlovian model ranged from 0.0425 and 0.106 for Dhaka district to 0.1976 and 0.2536 for Comilla district. On the other hand, in case of traditional model the short-run elasticities ranged from 0.108 for Rajshahi district to 0.3163 for Dhaka district. In all the cases the short-run elasticities for traditional model was higher than those for Nerlovian one. In Northern districts the short run and long-run elasticities differ slightly due to nigh value of the coefficient of adjustment. This indicates that the farmers of the Northern districts have very promptly adjusted their potato acreage in accordance with the change in economic environment and thereby implies that the farmers in this region were more responsive to the change in price.

IV. CONCLUSION

From the foregoing results it is evident that the aggregate or country results differed markedly from the district results. For the country as a whole the last year acreage played a dominant role whereas all district results except Dhaka show that last year harvesting price was an important variable in acreage response function. At the national level, lagged acreage was found to be a dominant variable probably due to the pooling of aggregate acreage data. At the national level, the aggregate data are adjusted in the light of the previous year acreage (Pray 1980). Therefore, caution must be taken to suggest a policy on the basis of aggregate or macro level results.

In Dhaka district, the farmers generally keep their produce in the cold storage during the harvesting period because of better cold storage facilities in this district. One study (Elias and Islam 1982, p. 43) shows that in Dhaka district 19 per cent of potato produce were sold at the time of harvest while in Bogra district 90 per cent were sold during that period. Consequently, in Dhaka district the harvesting price had little impact on farmer's acreage allocation decision.

On the contrary, lagged harvesting price was an important variable in acreage response function for the northern districts. The reason is that the farmers in that region sell their products just after harvest due to paucity of cold storage. That is why, farmers in the northern districts were more responsive to the change in harvesting price. The results show that the farmers did not take into consideration the variation of profit in the preceding years for making a decision about the allocation of acreage to this crop. The weather (rainfall) by and large did not have any impact on acreage allocation under this crop.

Lastly, on the basis of the result obtained in the present study, it is difficult to draw any conclusion on the superiority of Nerlovian model over the traditional one. The result of this study lend support to the result obtained by R.D. Singh *et al* (1974).

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