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***MARKETED SURPLUS FUNCTION FOR POTATO IN
SELECTED AREAS OF BANGLADESH***

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ABSTRACT

The study is an attempt to examine the variation in distribution pattern and factors influencing the marketed surplus of potato in two selected areas of Bangladesh. It shows that on an average 89 percent of potatoes are sold, of which 71 percent during harvest time and 18 per cent in the latter period. Small farmers sell relatively higher portion of their produce in the harvest time, compared to other groups of farmers. Except in few places, over-all marketed surplus of potato in the country has increased over the years.

Production and marketed surplus of potato move in the same direction. Marketed surplus in absolute term is directly related to farm size but it is not true for the marketed surplus in percentage term. Cash income is not significantly influencing the marketed surplus. Land under potato is the most important factor determining the marketed surplus of potato.

I. INTRODUCTION

The role of marketed surplus of agricultural Commodities in the economic development of a low-income country like Bangladesh can not be overemphasized. It facilitates capital formation by supplying basic wage goods, provides raw material, liquid capital and foreign exchange to the non-agricultural sector. It also reduces the need for importing foodstuffs and thus relieves pressure on balance of payments.

In the recent past, higher production of potato due to introduction of modern technologies has increased the marketed surplus of potato in Bangladesh. But, the existing

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market infrastructure has failed to handle this huge marketed surplus of potato. This is creating a wide temporal and spatial variation in potato prices, as a result, an element of uncertainty is being introduced which is affecting both producers and consumers.

Thus, there is a great need for an efficient marketing system in order to sustaining and accelerating potato production and thereby promoting agricultural growth in our country. But, any type of market improvement programme and policy must be based on understanding the pattern of marketed surplus of different groups of farm over time and space. For accelerating the marketed surplus of potatoes, different variables which affect the marketed surplus, should be known. Keeping in view the above problem, this study is designed to examine variation in distribution pattern of marketed surplus and factors influencing the marketed surplus of potato in two selected areas of Bangladesh.

II. SOURCES OF DATA

The study was conducted in Tongibari and Bogra sadar upazillas under Munshigonj and Bogra district respectively. One union was chosen from each of the above upazillas on the basis of highest potato production.

The potato farmers were divided into three groups or strata viz., small (<1.0 hectare), medium (1.0 - 2.0 hectares), and large (>2.0 hectares) and a proportionate random sample was drawn from each stratum to make the total sample size 100 for each union. The selected 200 farmers were then interviewed with predesigned questionnaire during 1985-86.

III. MARKETED SURPLUS

Marketed surplus has been used in two ways. Gross marketed surplus has been defined as the actual quantity sold by the farmers either for cash or on barter. On the other hand, net marketed surplus has been defined as the gross marketed surplus minus the "buy back." Since very small amount of potatoes are purchased by farmers during lean period, the gross and net marketed surplus of potatoes are by and large same for all groups of farmer in Bangladesh.

Marketed surplus (gross) and other uses of potatoes are shown in table 1 and 2. On the average, marketed surplus is 89 percent of the total production against about 91 percent in Tongibari and 83.63 percent in Bogra. Farmers sell nearly 71 percent of their produce during harvest time and 18 percent in the latter period. Other major uses of potato are seed and home consumption which account for 8.69 and about 2 percent respectively. The farmers of Bogra keep relatively high percentage of potatoes for seed and home consumption against the farmers of Tongibari.

TABLE 1. MARKETED SURPLUS AND OTHER USES OF POTATOES IN DIFFERENT AREAS.

Place	Percentage of total production					
	Seed	Consumption	Other disposal	Sale during harvest	Sale after harvest	Marketed surplus
Tongibari	7.74	1.23	0.29	69.05	21.69	90.74
Bogra	11.58	4.07	0.72	76.30	7.33	83.63
All area	8.69	1.93	0.39	70.84	18.15	88.99

TABLE 2. MARKETED SURPLUS AND OTHER USES OF POTATOES BY SIZE GROUP OF FARMERS.

Farm Size	Percentage of total production					
	Seed	Consumption	Other disposal	Sale during harvest	Sale after harvest	Marketed surplus
Small	9.82	3.21	0.45	72.92	13.60	86.52
Medium	8.22	1.59	0.41	69.78	20.00	89.78
Large	8.56	1.45	0.33	70.99	18.67	89.66

The marketed surplus is lowest (86.5%) for small farmers because they keep higher percentage of their produce for seed and consumption purposes in comparison to medium and large farmers. Furthermore, small farmers sell higher portion of their produce during the harvest time against other groups of farmer.

IV. CHANGE IN MARKETED SURPLUS OVER THE YEARS

Attempt has been made to measure the change in marketed surplus and other uses of potatoes over the years on the basis of the earlier studies (Elias et. al. 1982 and 1984) which were also conducted in the same area. Table 3 shows the area-wise marketed surplus (gross) and other uses of potatoes in different years.

TABLE 3. MARKETED SURPLUS AND OTHER USES OF POTATOES IN DIFFERENT YEARS.

Source and year	Percentage of total production					
	Tongibari			Bogra		
	Consumption	Seed	Marketed surplus	Consumption	Seed	Marketed surplus
Elias et. al. (1980/81)	6.2	10.4	83.4	3.8	1.9	94.4
Elias et. al. (1982/83)	3.0	11.0	85.0	6.0	3.0	90.0
Present study (1985/86)	1.2	7.7	90.7	4.1	11.6	83.6

In Tongibari, marketed surplus has increased from 83.4 percent in 1980-81 to 90.7 percent in 1985-86 mainly due to decrease in percentage of consumption and seed. This indicates that production of potato in Tongibari increases at a faster rate than consumption and seed. In contrast, marketed surplus of Bogra farmers has decreased from 94.3 to 83.6 percent during the same period. This is so because more quantities of potatoes are being kept for seed by Bogra farmers than before. This reveals that use of own seed has increased over the years in Bogra.

Bangladesh Bureau of Statistics (1986, p. 168) has estimated the percentage of potato available for non-farm population which can be used as a proxy for the marketed surplus of potato in Bangladesh during 1976/77 to 1984/85. Compound growth rate as estimated from this data shows that percentage of potato available for non-farm population has increased at the rate of 9.52 percent per annum during this period (Table 4). Higher production has increased the marketed surplus during this period. Available production

TABLE 4. PROPORTION OF POTATO AVAILABLE FOR NON-FARM POPULATION.

Year	1976/77	77/78	78/79	79/80	80/81	81/82	82/83	83/84	84/85
% of potato available for nonfarm population	17.1	25.6	27.9	27.9	32.1	37.1	39.2	39.5	38.5
Compound growth rate : 9.62%									

Source : Bangladesh Bureau of Statistics, 1986, p. 168.

data (BBS) shows that between 1976/77 to 1984/85 potato production has gone up by about 6 percent per annum¹. Thus, the study reveals that the over-all marketed surplus of potato has increased over the years in Bangladesh.

V. RELATIONSHIP BETWEEN MARKETED SURPLUS AND OTHER FACTORS

In this section, three main issues will be examined : (i) the nature of relationship between marketed surplus and output, (ii) the nature of relationship between farm size and marketed surplus and (iii) the effect of change in cash income on marketed surplus. Correspondingly, three hypotheses are proposed : (i) the marketed surplus is positively related to output, (ii) the marketed surplus increases with increase in farm size and (iii) *ceteris paribus*, the marketed surplus is negatively related to cash income of farm household.

Output and Marketed Surplus

To examine the empirical relationship between the production and the marketed surplus (net), a number of hypothetical models, namely, linear, quadratic, Cobb-Douglas and square root functions were fitted to each size group as well as for aggregate. The final choice of the model was made on the basis of the two criteria ; (a) the value of R^2 and the significance of regression co-efficients and (b) ability of the function to

provide economically meaningful results. It was found that linear function satisfied all the criteria over other types of functions and thus the same was selected for each size group as well as for the aggregate.

The results of the linear regression for different size groups and the aggregate farms are given in Table 5. In all the cases, R^2 is very high and regression co-efficients are found significant at 1 percent level which indicate that the total marketed surplus increases with the increase in production⁹.

The values of the individual intercepts are found to be negative in all the size groups. This indicates that there is a minimum retention level of production by farmers below which there will be no sale at all. In all the cases, the elasticities of marketed surplus with respect to production are found to be around 1 which implies that one percent increase in production augments the marketed surplus also by one percent.

TABLE 5. ESTIMATED LINEAR FUNCTIONS FOR DIFFERENT SIZE GROUP

Size group	Intercept	Production of potato (b Co-efficient)	Minimum retention (kg)	Elasticity of marketed surplus with respect to production
Small	-8.73	0.8969* (0.0097) $R^2=0.9889$	363.29	1.0538
Medium	-22.22	0.9262* (0.0055) $R^2=0.9972$	895.43	1.0520
Large	-49.77	0.9303* (0.0331) $R^2=0.9741$	1996.80	1.0619
All	-14.69	0.9098* (0.0067) $R^2=0.9892$	602.80	1.0430

Parenthesis are standard error.

*Significant at 1% level

The relationship between output and marketed surplus is likely to be affected by size of family. Therefore, it is necessary to introduce family size as an explanatory variable for testing the relationship between output and marketed surplus. However, introduction of this variable is likely to give rise to multicollinearity problem as the two variables are related to each other. Net marketed surplus and level of output have therefore been standardised by dividing each by family size (adult unit). The result of the regression equation between marketed surplus per capita and output per capita are presented below:

$$\text{Tongibari} \quad : \quad Y = -0.7309 + 0.9029 * X \quad R^2 = 0.9692 \\ \quad \quad \quad \quad \quad \quad \quad \quad (0.0162)$$

$$\text{Bogra} \quad : \quad Y = -0.7900 + 0.8945 * X \quad R^2 = 0.9840 \\ \quad \quad \quad \quad \quad \quad \quad \quad (0.0115)$$

Where Y = Per capita marketed surplus in quintal.

X = Per capita production in quintal

*Significant at 1% level.

The above equations seem to be very good fit with high R^2 and with regression coefficients being significant at 1 percent level. This implies that per capita marketed surplus is also positively related to the per capita production of potato.

Farm Size and Marketed Surplus

In order to examine the relationship between farm size and marketed surplus, various types of equations were fitted with per capita marketed surplus and total cultivated area. In all the cases, the linear form was found to be best fit. The fitted equations are given below:

$$\text{Tongibari} \quad : \quad Y = 12.7472 + 14.5057 * X \quad R^2 = 0.5882 \\ \quad \quad \quad \quad \quad \quad \quad \quad (1.2261)$$

$$\text{Bogra} \quad : \quad Y = 4.9718 + 4.5195 * X \quad R^2 = 0.2951 \\ \quad \quad \quad \quad \quad \quad \quad \quad (0.7056)$$

Where,

Y = Per capita marketed surplus in quintal

X = Total cultivated land in hectare.

*Significant at 1% level,

The above equations show that farm size is significantly influencing that per capita marketed surplus of potato in both the areas indicating that marketed surplus (absolute) increases with the increase in farm size. When percentage of output marketed are regressed on size of farm, the regression co-efficients come out to be non-significant in both the areas⁴. The study thus reveals that although marketed surplus in absolute term is positively related to the farm size but it is not true for the marketed surplus in percentage form.

Cash Income and Marketed Surplus

In this case, the hypothesis is that an increase in cash income would result in a smaller marketed surplus. Two factors such as level of output and family size are not same for all farm. Therefore, these two factors must be taken into consideration for determining the relationship between cash income and marketed surplus. The hypothesis may be reformulated as : A farm having the same level of output and same family size vis-à-vis another, but having a higher level of cash income, would market less than the other. In a multiple regression equation, per capita output and cash income are regressed on per capita marketed surplus for both the areas and the results are shown below :

$$\text{Tongibari : } Y = -0.7443 + 0.9028^*X_1 + 0.0005 X_2 \quad R^2=0.9692$$

(0.0169) (0.0224)

$$\text{Bogra : } Y = 0.7319 + 0.9035^*X_1 - 0.0029 X_2 \quad R^2=0.9842$$

(0.0139)[†] (0.0025)

Where, Y = Per capita marketed surplus in quintal

X₁ = Per capita production in quintal

X₂ = Per capita cash income other than potato in '00 taka.

*Significant at 1% level.

The results show that the co-efficient of cash income is negative in one case and positive for another but in all the cases they are not statistically significant. This indicates that as cash-flow to the farm household increase, the marketed surplus does not decrease⁵.

VI. DETERMINANTS OF MARKETED SURPLUS

The marketed surplus of potatoes at farm level is likely to be influenced by various factors such as area under potato, price, family size, distance from the market etc. In

order to identify these factors and assess their relative importance multiple linear equations (all area) were fitted and the results are given in Table 6.

The fitted equation I shows that the selected independent variables have explained 92 percent of the total variation in marketed surplus. Land under potato, distance from the market and family size are found to be statistically significant. Land is directly related whereas family size and distance from the market are inversely related to the marketed surplus. Coefficient of land shows that with the increase of potato area by one hectare, the marketed surplus would be increased by 264 quintals. Subsequently the regression analysis was done after dropping the non-significant variables (Equation II in Table 6). Due to dropping of non-significant variables, all the coefficients decrease slightly but are significant at the same level, R^2 also decreases slightly.

TABLE 6. ESTIMATED LINEAR FUNCTION SHOWING DIFFERENT FACTORS INFLUENCING THE MARKETED SURPLUS OF POTATO.

Variables	Equation I	Equation II
Constant	40.0508	17.303
Land under potato (hectare)	264.0991** (7.5356)	261.0404** (7.3460)
Distance from the market (km)	-4.7094** (1.1020)	-4.6243 ** (1.0983)
Family size (adult unit)	-4.2279* (1.8394)	-3.8203* (1.8180)
Av. price received (Tk./qnt.)	-0.0962 (0.0590)	— —
Indebtedness of family (Tk.)	0.1583 (0.1923)	—
R^2	0.9181	0.9177

**Significant at 1% level.

*Significant at 5% level.

Thus, the study reveals that area under potato is the most important factor that determines the marketed surplus of potato. Family size and distance from the market are also influencing the marketed surplus inversely although only 2 percent of the produce are consumed and nearly one-third of the surplus are sold in the village⁶.

VII. SUMMARY AND CONCLUSION

In the study area, on an average, 89 percent of potatoes are sold, of which 71 percent are sold during harvest and 18 percent in the latter period. Small farmers sell relatively higher portion of their produce during harvest against medium and large farmers. Poverty, little access to cold storage facility, need for repayment of loan may compell the small farmers to sell the lion's share of their produce just after harvest. The over-all marketed surplus of potato in the country has increased over the years except in few places, for instance, Bogra where surpluses have decreased due to increase in the use of own seed.

Production and marketed surplus of potato move very much in sympathy with each other. One percent increase in production augments the marketed surplus by also one percent. Therefore, any policy to raise the production of potato would require development of market infrastructure since all the additional production would have to be marketed by the farmers.

The relationship between farm size and marketed surplus shows that marketed surplus in absolute form is directly related to the farm size but it is not true for the marketed surplus as a percentage of the total production. Cash income from other than potato is not significantly influencing the marketed surplus which indicates that as 'cash-flow' to the farm household increase, the marketed surplus does not decrease.

Land under potato is the most important factor determining the marketed surplus of potato. Cultivation of potato in one additional hectare of land would raise the marketed surplus by 264 quintals. Other factors negatively influencing the marketed surplus of potato are family size and distance from the market

NOTES

1. Estimated by Author himself.
2. This also confirm the results obtained in earlier studies (Sharma & Gupta, 1970; Bhargava & Rustogi, 1972).
3. Raquibuzzaman (1966) showed that 93 percent of the variation in the marketed surplus of paddy in Bangladesh was explained by production and family size.

4. The results of such fit are presented below :

$$\text{Tongibari} : Y = 85.5722 + 1.6277 X \quad R^2 = 0.0371 \\ (0.8375)$$

$$\text{Bogra} : Y = 77.7554 + 1.3916 X \quad R^2 = 0.0193 \\ (1.0036)$$

Where,

Y = Percentage of output marketed.

X = Total cultivated area in hectare.

5. Rahman (1980) obtained the similar result for paddy in Bangladesh.
6. Quasem (1987) in his study showed that the factors such as production, price, cultivated land and income were positively influencing the marketed surplus of paddy in Bangladesh.

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