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Research Note

SEASONAL PADDY PRICE DIFFERENCES IN BANGLADESH

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I. INTRODUCTION

Prices of foodgrains rains usually follow a seasonal pattern, falling immediately *after harvest due to abundant supply, rising thereafter until the next harvest.* If prices are determined competitively at harvest and in other months then the seasonal price difference will cover only storage costs including normal profits. A few studies on seasonal price fluctuations in developing countries support the proposition that seasonal price differences exceed storage costs (Hays and McCoy, 1978; Huq and Greeley, 1980) while others do not (Mellor, 1966, p. 334; Timmer et al., 1983, p. 174; Chowdhury, 1987). The relevant literature on Bangladesh suggests that foodgrain markets are highly competitive, efficient and seasonal price spreads are not excessively high (Farruk, 1972; Islam et al., 1985; Chowdhury, 1987). However these studies are based on aggregate average price without sub-dividing the country into homogeneous groups according to prices. In Bangladesh, paddy is grown in three crop seasons namely Aman, Boro and Aus. All areas do.not grow rice equally in all three seasons. Due to transportation problem the aggregate average price at the lean months especially at harvest may be upward biased. If two areas have different crop specialisation then the price difference between the areas is not only the transportation and handling cost. In the harvest month price also differs due to delay in the market arrival from the producing to the other area. Due tQ_this reason the price in the deficit area may be much higher than the surplus producing area in the harvest month. Therefore, the average price of the two areas at harvest time may be much higher than the price expected

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without transportation problem. So, to estimate unbiased seasonal spread, areas should be grouped according to price pattern or cropping pattern.

The objective of this study is therefore to examine the monthly paddy price differences in Bangladesh by sub-dividing areas into homogeneous groups according to cropping pattern.

This paper is organised as follows. Section II describes the methods and data. Section III describes briefly the characteristics of the village groups. Results are discussed in sections IV and V. The paper concludes with section VI.

II. METHODS AND DATA

The extent of seasonal paddy price difference is examined following the methodology described by Farruk (1972), and Hays and McCoy (1978). At any time after harvest the cumulative storage costs plus harvest price can be termed the expected price. This is the minimum price desired by those storing grains. Storage costs embody interest charges on working capital, storage losses, variable costs and normal profits (Timmer et al., p. 174). The expected price will always increase with the duration of storage. Let the expected price per unit of grains in a region at the t'th month be denoted by EP_t. It can be calculated as:

$$EP_t = P_0 + \Sigma_{i=1} SC_i$$

where, P_0 is the harvest price per unit of grains and SC is the monthly storage cost involved in storing a unit of grains.

The difference between the actual and expected price per unit of grain storage in the t'th month indicates the excess profit or loss in that month from grain storage. Farruk (1972), and Hays and McCoy (1978) called this difference the net seasonal rise in price and expressed it as a percentage of expected price. This percentage difference is actually an index measuring monthly price spread in the market in terms of proportionate supper-normal profit or loss from grain storage. So it would be appropriate to call this term to be the seasonal profit index (SPI) which is given as:

$SPI_t = ((P_t - EP_t)/EP_t)100$, where SPI_t is the seasonal profit index in the t'th month, P_t is the actual price in month t. SPI varies between months which is briefly interpreted as follows:

(i) If $SPI_t = 0$ then the storage of grains gives normal profit in month t. In this situation the marginal cost of storing grains is equal to its marginal revenue.

(ii) If $SPI_t > 0$ then super-normal profits are earned from the storage in month t.

(iii) If $SPI_t < 0$ then grain storage results in losses in month t.

In the short term, for instance within a paddy season, the maximum absolute value of this index (max.SPI) can be used to measure the degree of seasonal price spread in the market.

The data base used is a subset of sample from a nation-wide survey carried out at household level from October-November, 1982 to September-October, 1983. The survey was done by a collaborative research team from the Bangladesh Rice Research Institute (BRRI), the Agricultural Marketing Directorate, and the United State Agency for International Development. A computer tape of the data was obtained from the International Rice Research Institute via BRRI. The sample consisted of 80 villages and 2000 households. Akter (1989a) sub-grouped the sample villages into 5 groups using cluster analysis. The subset of the sample used for this study consists of two village groups. One group is called C1 in this paper which consists of 19 villages and 474 households and the other is called C2 consisting of 15 villages and 368 households. Among the villages in C1, 4 were from Bogra district, 6 were from Rangpur district, 6 were from Mymensingh, Rajshahi and Dinajpur districts (2 from each district) and the remaining 3 were from Pabna, Jessore and Faridpur districts (1 from each district). Among the villages in C2, 9 were from Dhaka, Comilla and Sylhet districts (3 from each district), 4 were from Tangail and Kurigram districts (2 from each district) and the remaining 2 were from Mymensingh and Faridpur districts (1 from each district).

III. CHARACTERISTICS OF THE VILLAGE GROUPS

Monthly sales, purchases along with their prices are recorded by selected enumerators who visited the households at the end of each month. The recorded characteristic features of the village groups C1 and C2 are shown in Table 1. The villages in C1 are favourable for growing 2 or more rice crops in a year, in particular Aman and Aus as indicated by the cropping pattern and yield.

These villages are surplus rice growing areas in all rice seasons. The villages in C2 are favourable for growing Boro but not for other crops. These villages are annually surplus from Boro production.

Monthly paddy price pattern in Figure 1 indicates weak spatial integration between village groups at the same time. The weakness of the study here is that the price difference over transportation cost was not calculated due to lack of data. However, regional price difference would nearly be the same in each month if transportation cost was the only factor responsible for that difference. Instead, a big difference was observed in some months relative to some other months. Moreover, our interest is not to examine the spatial variation but to examine the seasonal variation. The figure indicates that the average price of the two regions reaches the highest in the month of March-April. But, the highest peak price in C2 occurs two months earlier. If analysis is done separately, it will definitely help to identify some interesting reasons for this early peak. Moreover, the seasonal paddy price difference will be lower if estimated from the average monthly price of these two regions.

Table 1. Characteristics of Selected Village Groups, Bangladesh, 1982-83.

Characteristics		Village groups	
		C1	C2
Paddy growers: (%)	100	100	
Aman-			
	growers	100	79
	non-growers	0	21
	total	100	100
Local Boro-			
	growers	14	43
	non-growers	86	57
	total	100	100
Modern Boro-			
	growers	26	83
	non-growers	10	63
	total	100	100
Aus-			
	growers	90	37
	non-growers	74	17
	total	100	100

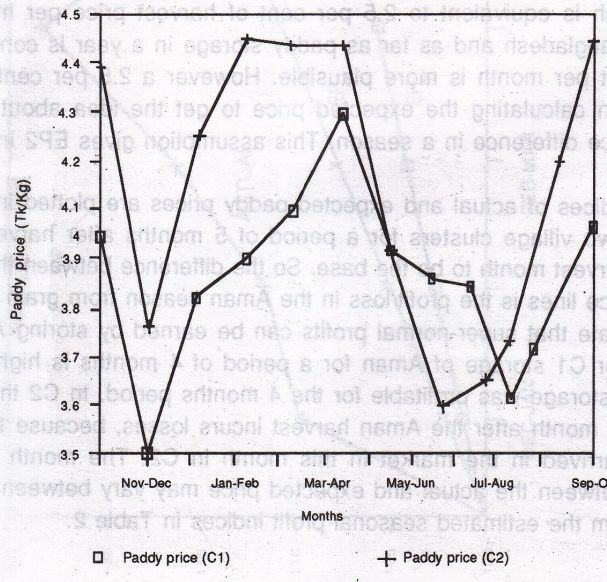
Table 1 Continued

Characteristics	Village groups			
	C1		C2	
Cropping pattern: (Acres/household)				
Aman	3.19	(0.16)	1.35	(0.10)
Local Boro	0.24	(0.04)	0.91	(0.13)
Modern Boro	0.31	(0.03)	1.21	(0.08)
Aus	2.58	(0.27)	0.42	(0.07)
Paddy yield: (t/ha)	2.02	(0.04)	2.77	(0.06)
Aman	2.17	(0.04)	1.84	(0.11)
Local Boro	1.70	(0.10)	2.44	(0.06)
Modern Boro	3.26	(0.21)	4.54	(0.09)
Aus	1.56	(0.05)	1.25	(0.14)
Paddy consumption:				
(kg/man-unit*)	486	(6.7)	398	(6.7)
Paddy marketable surplus:				
(kg/man-unit)	211	(16.7)	148	(17.2)

Figures in parentheses are standard errors. t/ha = Metric ton per hectare.

* Conversion factors, adult male = 1 man-unit
adult female = .8 man-unit
children = .5 man- unit.

Figure-1. Monthly Paddy Price.



IV. SEASONAL PRICE DIFFERENCES

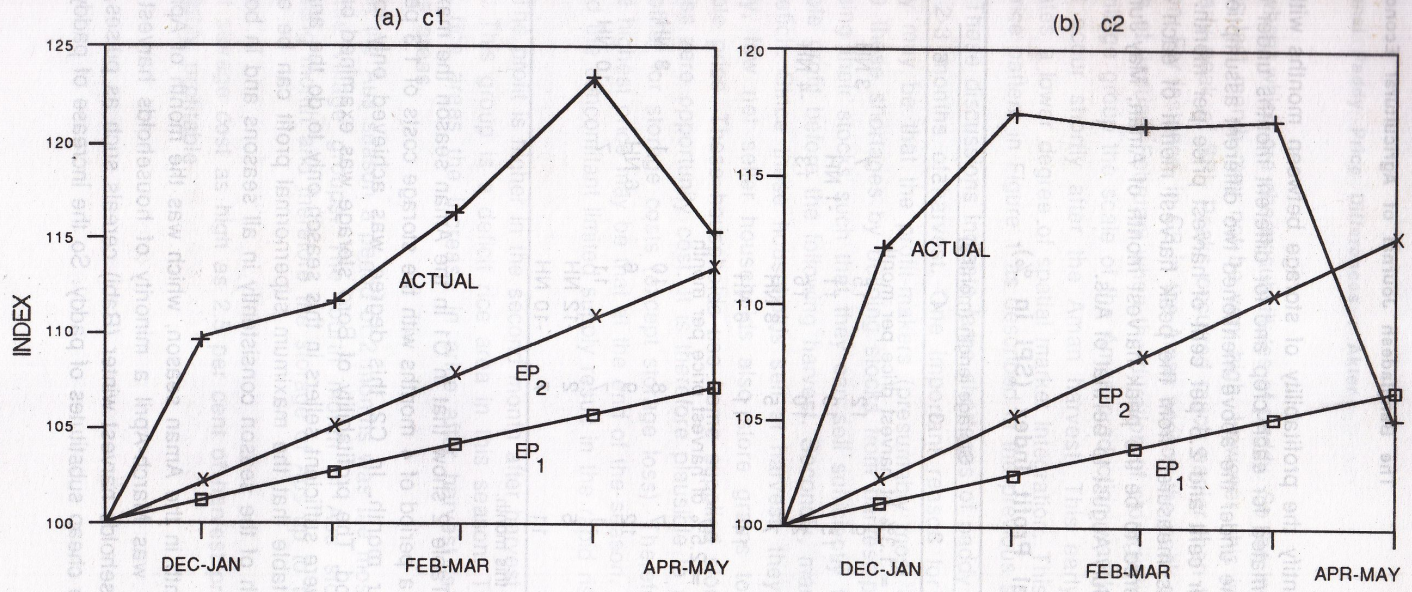
The expected price (EPt), for Aman paddy was calculated taking Nov-Dec as the base month and assuming storage costs to be 1.3 per cent and 2.5 per cent of harvest price per month. These two alternative assumptions, in absense of data on actual storage costs, are based on the following reasoning:

(i) Assuming that storage loss occurs at the same rate each month, storage loss was calculated to be 0.5 per cent per month from our survey data. Storage loss was estimated by Huq and Greeley (1980) at 2.04 per cent of quantity stored in a 4 months period in Bangladesh. With the same assumptian that storage loss increases proportionately with the increase in stor4ge months, this implies a storage loss of 0.5 per cent per month. Opportunity costs of storing grains are calculated by using the 10 per cent annual interest rate which is equivalent to 0.8 per cent per month. So total storage cost. is equal to 1.3 per cent per month. This assumption gives EP1 in Figure 2.

(ii) In the literature, 20 to 30 per cent seasonal differences are often considered reasonable for normal trading profits from intra-yqar storage (Timmer et al., 1983; Chowdhury, 1987). It is assumed that a maximum price difference tn a year need not exceed 30 per cent to cover the normal profit of storage which is equivalent to 2.5 per cent of harvest price per month. In the context of Bangladesh and as far as paddy storage in a year is concerned a 1.3 per cent cost per month is more plausible. However a 2.5 per cent cost is also considered in calculating the expected price to get the idea about a maximum desirable price difference in a season. This assumption gives EP2 in Figure 2.

The indices of actual and expected paddy prices are plotted in Figure 2 (a and b) for two village clusters for a period of 5 months after harvest assuming the Aman harvest month to be the base. So the difference between the actual and expected price lines is the profit/loss in the Aman season from grain storage. The figures indicate that super-normal profits can be earned by storing Aman grains. In the cluster C_1 storage of Aman for a period of.4 months is highly profitable, while in C_2 storage was profitable for the 4 months period. In C_2 the storage up to the fourth month after the. Aman harvest incurs losses, because the next crop local Boro arrived in the market in this month in C_2. The month of maximum difference between the actual and expected price may vary between clusters and is known from the estimated seasonal profit indices in Table 2.

Figure 2. Monthly Actual and Expected Paddy Price Indices in the Aman Season.



In order to quantify the profitability of storage between months within a season, SPI was estimated for each crop and for different months under each season. This was done under the above mentioned two different assumptions of storage costs, 1.3 per cent and 2.5 per cent of harvest price per month. The length of storage was measured from the peak harvest month of each crop. Nov-Dec was considered to be the peak harvest month of Aman, May-June to be that of Boro and July-August to be that of Aus.

Table 2. Seasonal Profit Index (SPI in %).

		Storage length (months)					
		1	2	3	4	5	6
Assuming storage cost = 1.3% of harvest price per month							
Aman:	C1	9	9	12	15	7	3 NH
	C2	10	15	13	11	-1 NH	
Boro:	C2	0	2	10	16	13	-4 NH
Aus:	C1	4	7	5	-8 NH		
	C2	8	14	11	-6 NH		
Assuming storage cost = 2.5% of harvest price per month							
Aman:	C1	7	7	8	10	1	-3 NH
	C2	9	12	9	6	-6 NH	
Boro:	C2	-1	-1	7	11	7	-10 NH
Aus:	C1	3	5	2	-12 NH		
	C2	7	11	7	-10 NH		

NH means new harvest in this month.

The results in Table 2 show that in C1 in the Aman season the max. SPI was 15 per cent for a period of 4 months with the storage costs of 1.3 per cent of harvest price per month. In C2 this degree was achieved only for two months storage period. The profitability of Boro storage was examined only for C2, because there were sufficient sellers in this season only to do the analysis. It is clear from the table that the maximum supernormal profit can be earned before the last month of the season consistently in all seasons and in both the village groups.

At the last month in the Aman season, which was the month of April-May except C2 where it was March-April a minority of households harvest early Boro and some households harvest winter (Rabi) cereals such as pulses, millet and wheat which are cheap substitutes of paddy. So the increase of paddy price

and wheat which are cheap substitutes of paddy. So the increase of paddy price at this last month may not be very high. However, this is not the only reason for early peak of SPI. Peaks occurred much earlier than the last month of the season. For instance, in C2 in the Aman season the peak of SPI occurred in the month of January-February when the duration of storage was only 2 months. In this village group the scale of the Aman production was low. So big shortages might occur shortly after the Aman harvest. This early peak in this area indicates a lower degree of spatial market integration. This is also indicated by the price pattern in Figure 1 as described in the previous section.

These discussions indicate large shortages of paddy supply in the market after 2-3 months of harvest. One important reason for these shortages of supply may be that the profit-makers (presumably most of them are traders) create these shortages by building stocks from harvest purchases. They start releasing their stocks such that they can sell sufficiently to make a maximum possible profit before the following harvest. Secondly, many net buyers are in big deficit. Since these households sell at harvest, they need to buy soon. Thirdly, few net seller households also store grains to obtain the highest possible price. These households use home supplied storage materials which possess zero opportunity cost. It is therefore plausible to assume that they do not bother for storage costs (except storage loss). Therefore their expectation for the highest price may be that at the end of the season. So the demand goes up and the concomitant limited supply result in the rapid rise in price.

The profit is higher in the second month after harvest in the Aman season in C_2. This group is a deficit rice area in this season. This indicates that in deficit rice areas the increase in price after harvest is faster than that in surplus areas.

In the Aus season, a period of 2 months was the most profitable length in both the village groups. The fourth month of Aus storage is the Aman harvesting month and therefore the storage of Aus up to this month results in losses.

If storage cost as high as 2.5 per cent of harvest price the storage was still highly profitable.

V. DO PRODUCERS OBTAIN RETURNS TO STORAGE ?

Unfortunately, returns from storage do not accrue to many farming households because most of their sales occur at harvest. This is especially true of net buyers who sell most of their gross sales at harvest as shown in Table 3. Not only these net buyers sell more in the low price harvest month but also receive lower price than net sellers.

The reason for the occurrence of most sales at harvest is not that storage is really problematic or unprofitable, since the previous section shows that returns to storage is high. The story is that at harvest households need a certain amount of cash to repay previous production and consumption loans and to pay casual labour for harvesting the crop. Due to the scarcity in the credit market, the possibility of getting credit to meet cash needs at this time instead of selling grains is very limited. This results in abundant supplies (tied supplies). So, distress sales occur at harvest due to imperfections in the credit market.

Tabel 3. Household Paddy Sales (% of Total Sales in the Season).

Crops	Households	C1		C2	
		Harvest	Non-harvest	Harvest	Non-harvest
Aman	Net sellers	29	71	28	72
	Net buyers	70	30	55	45
Boro	Net sellers	38	62	24	76
	Net buyers	88	22	46	54
Aus	Net sellers	34	66	29	71
	Net buyers	69	31	-	-

Households were net sellers who sold more than they purchased in a paddy season and otherwise they were net buyers.

Producers who enter into the market as buyers some time after the harvest suffer from this seasonal pattern because they purchase mostly at the end of the season and pay higher average buying prices than the average selling

prices for the whole-season. From the monthly share of annual purchases in Table 4 it is clear that households purchase grains mostly in the February-May period (3 to 5 months period after the Aman crop harvested) and SeptemberNovember period (2 to 3 months after the Aus crop harvested) when prices are high and storage is highly profitable.

Most extensive purchases occur in the month of October-November, immediately before the harvesting of the biggest crop, Aman, in C1. In C2 where Boro is an important crop, the February-April period is the time of extensive purchasing. Net buyers' monthly share is high in a number of high price months. Net sellers are also buying mostly at the peak price months. However, the average quantity purchased by net buyers was much higher than by net sellers and net buyers paid higher average buying price than net sellers as mentioned earlier. So net buyers are more disadvantaged than net sellers. This purchasing pattern and the evidence of the selling pattern obviously indicate that households are affected by the seasonality of prices from both selling and buying grains and that this may reduce their net income and their purchasing power substantially. If both net sellers and net buyers could sell and purchase at an annual average price or a moderately increasing price their income would be higher (Akter, 1989b).

It is hypothesised that since net buyers are marketing at a greater disadvantage in the current season, their income is lower in this season and therefore they will tend to have lower yields of paddy in the next season, because they cannot afford the same level of inputs as other households due to their low income from paddy marketing.

This hypothesis is examined as follows:

Firstly, the net buyers in the Aman season who were selling at harvest and also growing Boro are identified. The Boro yield of these households is compared with the Boro yield of the Aman season net sellers who were growing Boro.

Secondly, households which were net buyers in the Boro season and were selling at the Boro harvest time and in addition were growing Aus are identified. The Aus yield of this group is compared with the Aus yield of net sellers in the Boro season who were growing Aus.

Table 4. Monthly Share (%) of Annual Gross Purchases.

Months	C1		C2	
	S	B	S	B
Oct-Nov	26	17	17	15
Nov-Dec	2	1	2	2
Dec-Jan	1	1	3	6
Jan-Feb	2	4	5	9
Feb-March	5	7	24	17
March-April	14	12	27	15
April-May	9	14	11	7
May-June	8	11	4	5
June-July	4	9	0	3
July-Aug	9	9	1	4
Aug-Sept	7	6	2	7
Sept-Oct	13	10	4	9
Total	100	100	100	100

S stands for net sellers and B for net buyers.

Table 5. Results of Test on the Differences of Yield Between Net Sellers and Net Buyers.

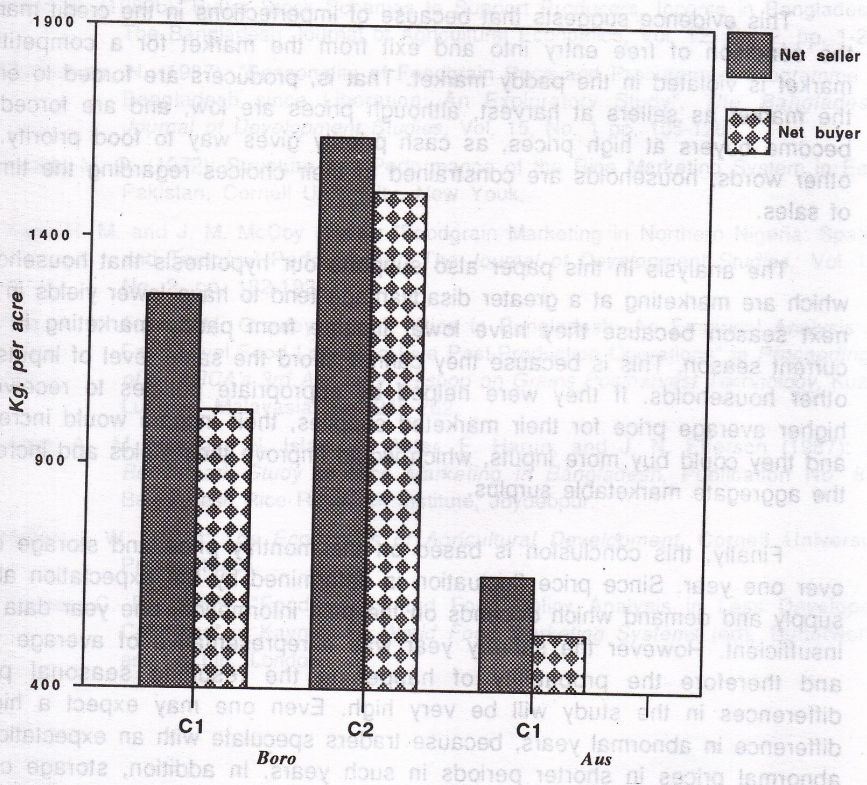
Crop Season	Observed t ratios			
	C1		C2	
Boro	2.00*	(89)	1.68*	(104)
Aus	1.82*	(90)	-	

* Significant at 5 per cent.
Figures in parentheses are degrees of freedom.

The yields of these groups are shown in Figure 3. The Figure shows the productivity of net sellers is much higher than that of net buyers in both the Boro and Aus seasons and is significantly higher at 5 per cent as suggested by the one-tail t-tests (Table 5).

So this evidence suggests that since net buyers marketing at a more disadvantage in the current season they earn less income and therefore they produce less in the next season.

Figure 3. Yield of Aus and Boro Crops.



VI. CONCLUSIONS

The study shows that seasonal price fluctuations are sufficiently large to offset storage costs in all paddy seasons within the year in Bangladesh. With a high storage cost of 2.5 per cent of harvest price a month, the amount of profits earned varied from 6 to 10 per cent for a 4 months period of storage in the Aman season. Only one month of storage can provide a profit of 7 to 9 per cent which is quite high. Storage is also profitable in the Aus season. Producer households hardly get these profits because most of them sell early in the season and buy back later in the season.

This evidence suggests that because of imperfections in the credit market the condition of free entry into and exit from the market for a competitive market is violated in the paddy market. That is, producers are forced to enter the market as sellers at harvest, although prices are low, and are forced to become buyers at high prices, as cash priority gives way to food priority. In other words, households are constrained in their choices regarding the timing of sales.

The analysis in this paper also supports our hypothesis that households which are marketing at a greater disadvantage tend to have lower yields in the next season because they have lower income from paddy marketing in the current season. This is because they cannot afford the same level of inputs as other households. If they were helped by appropriate policies to receive a higher average price for their marketed supplies, their income would increase and they could buy more inputs, which would improve their yields and increase the aggregate marketable surplus.

Finally, this conclusion is based on the monthly price and storage data over one year. Since price fluctuation is determined by the expectation about supply and demand which depends on the past information, one year data are insufficient. However the survery year was a representative of average year and therefore the probability of happening the resulting seasonal price differences in the study will be very high. Even one may expect a higher difference in abnormal years, because traders speculate with an expectation of abnormal prices in shorter periods in such years. In addition, storage costs based on some assumptions instead of actual data may be considered a limitation of the study. However, an attempt was made to use plausible

limitation of the study. However, an attempt was made to use plausible assumptions. It is expected that if storage cost is calculated using collected data on all of its items such as loading, unloading, packaging, storage loss and interest on capital, it will not exceed the storage costs used for this study.

REFERENCES

Akter, S. (1989a): A Quantitative Analysis of Marketable Surplus of Paddy and Food Policy in Bangladesh, A Ph. D Thesis, Wye College, the University of London.

Akter, S. (1989b): "Buffer Stock Schemes to Support Producers, Income in Bangladesh„ The Bangladesh Journal of Agricultural Economics, Vol. 12, No. 2, pp. 1-23.

Chowdhury, N. (1987): "Seasonality of Foodgrain Price and Procurement Programme in Bangladesh since Liberation: An Exploratory Study", *The Bangladesh Journal of Development Studies,* Vol. 15, No. 1 pp. 105-128.

Farruk, M. O. (1972): Structure and Performance of the Rice Marketing System in East Pakistan, Cornell University, New Youk.

Hays, H. M. and J. M. McCoy (1978): "Foodgrain Marketing in Northern Nigeria: Spatial and Temporal Performance", *The Journal of Development Studies,* Vol. 14, No. 2, pp. 182-192.

Huq, A. K. F. and M. Greeley (1980): "Rice in Bangladesh: An Empirical Analysis of Farm-Level Food Losses in Five Post-Production Operations" in *Proceedings of SEARCA's 3rd Annual Workshop on Grains Postharvest Technology,* Kuala Lumpur, Malayasia, pp. 245-262.

Islam, A., M. Hossain, N. Islam, S. Akter, E. Harun, and J. N. Efferson (1987): *A Benchmark Study of Rice Marketing in Bangladesh,* Publication No. 87, Bangladesh Rice Research Institute, Joydebpur.

Mellor, J. W. (1966): *The Economics of Agricultural Development,* Cornell University Press, Ithaca.

Timmer, C. P. (1986): "Food Prices and Food Policy Analysis in Less Developed Countries" in Kaynak, E. *World Food Marketing Systems* (ed), Butterworth and Co. Ltd., London.