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Research Note

**ANALYSING INTRA-YEAR PRICE VARIATIONS AND PRICE
FLEXIBILITY OF SELECTED CROPS FOR LOCAL LEVEL
PLANNING IN BANGLADESH**

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ABSTRACT

Realizing the significance of crop production, this paper has attempted to determine own-price flexibilities and cross-price flexibilities of selected crops viz. Boro paddy, wheat, lentil and potato, and estimate monthly price variations for local level planning. In estimating own-price fluctuation of selected crops, price flexibility coefficients have turned out significant, except lentil. Among these crops, quantity of Boro paddy was highly responded to its price. Cross-price flexibilities of Boro paddy with Aman and wheat were found negative, meaning that these crops are substitute. It implied that, increase in the quantity of one reduces the price of another. Positive flexibilities were also found in Boro with potato, wheat with potato and lentil with potato, which means two crops were competing in production for using the same resources. Three years average price variations depict that prices of the selected crops fluctuated from month to month especially before harvest period. It was also found that price pattern of crop may not be same in all markets except potato markets. By knowing the local price variations farmers may take appropriate selling and storing decisions, which may help them to get higher price from the market.

I. INTRODUCTION

Sharp changes in agricultural prices have serious effects on the entire economy. The role which the price mechanism is expected to perform does not materialize in a highly unstable price situation. So, price stabilization has a significant importance to the whole economy. Unstable prices have political consequences and responsible for periodic food scarcity, which may result in starvation and serious malnutrition (Ahmed 1989). As both the land and financial resources are limited to the farmers, they always suffer in indecision and risk. If it is possible to inform them about the future trend of market prices of respective crops before production, the scarce resources would be allocated in an optimal way. The generated information of this study may help both farmer and government to take appropriate decisions on the right time. In this context, price flexibility concept has high magnitudes as current supply of agricultural products is very important in determining market prices and the profitability of the crops produced. Then government can also determines procurement prices

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of rice just after harvest season and removing the risk of falling prices. It is also necessary to know, how the price of crop is affected not only by its own supply but also other crops supply. Then government can take stabilization programmes for the economy considering not only a particular crop but also group of crops based on their price volatilities.

This study is an attempt to provide price trend information for local level planning such as a guideline about which varieties to produce in the early or late season or in off-seasonal months or storing and releasing stored products etc. on the basis of price trends of selected crops. It also helps the farmer to getting highest price by indicating the best selling period of crops in respective areas. The following are the specific objectives of the study:

1. To determine price flexibilities and cross-price flexibilities of selected crops.
2. To estimate monthly price variations of selected crops.

Following introduction, methodology is discussed in section II. Results obtained and their interpretations are presented in the section III. Last section contains a brief summary and policy recommendation.

II. METHODOLOGY OF THE STUDY

For this study, leading crops such as paddy, wheat, lentil and potato have been selected according to their ascendancy in agriculture in terms of production and area coverage. These crops together occupy largest cultivated area (83.19 percent) out of total cultivated area in Bangladesh (BBS, 2008 p.33). As Boro covers the major part in case of production among different rice varieties, only Boro has been selected in the study. According to the BBS, Boro production was 56.67 percent of total rice production in 2008-09.

Harvest prices of selected crops (from 1981-82 to 2009-10) have been taken into consideration for the reason that wholesale and retail prices may not reflect what the farmers actually receive, because they are set at a considerably higher level (covering cost of storage, transportation and risk). Moreover, bulk of the agricultural produces is marketed during the harvest or immediately post harvest period. So, harvest prices are the most relevant prices for the producer. Beside this, domestic production *as a proxy of quantity supply* is more pertinent in harvest period price determination rather than quantity available by the external trade. And the quantity export of studied crops was very negligible amount (in some cases there was no export, such as wheat and lentil) that may not have the influence in harvest price of that crop. For that reason we considered harvest prices of the respective crops, and only domestic production have been taken into account instead of considering both import and export for estimating price flexibility. In case of using wholesale price in assessing price flexibility, external trade should be considered. Nominal prices were transformed into real prices by using agricultural raw-material prices indices for the corresponding period. For calculating monthly prices of selected crops four weeks prices available in DAM weekly price bulletin, were averaged.

The study makes an extensive use of secondary data on prices and quantity available of selected crops in Bangladesh for the period of 30 years from 1981-82 to 2009-10 (as the latest data available). Agricultural sector prior to eighties was highly subsidized by the Government.

Withdrawal of subsidies and handing over fertilizer and irrigation equipment marketing to private sector started from the eighties. In the case of examining recent price variation, last three years (from 2007-08 to 2009-10) data were used. This is because normally agricultural crops accomplish a price cycle within three years (Alam 2005).

For each crop, three leading districts have been selected for analysis. As the research was solely based on secondary data, these data were obtained from various publications of Ministry of Finance, Ministry of Planning and Government of the People's Republic of Bangladesh (i.e., Statistical Yearbook of Bangladesh, Yearbook of Agricultural Statistics, Bangladesh Economic Review etc.), FAO statistical report, various books, journals, newspapers and internet. Furthermore, district wise market prices of different crops were collected from the weekly wholesale price bulletin of Department of Agricultural Marketing (DAM) for the period 2007-08 to 2009-10.

Analytical Techniques

The flexibility coefficient gives the percentage change in price associated with a one percent change in quantity, other factors remaining constant. Thus, the price flexibility coefficient implies that price is a function of the quantity available of the particular crop (Tomek and Robinson 1972 pp.51-52). In this study price flexibilities of the selected crops were estimated by the following equation:

$$\ln P_{it} = \ln a + b \ln Q_{it} + U_t \dots\dots\dots(1)$$

Where, P_{it} = Price of crop i in year t

Q_{it} = Production of crop i in year t

b = own-price flexibility coefficient

\ln = Natural logarithm value of the variable

U_t = error term

The cross flexibility [i.e., $P_{ij} = f(Q_{it}, Q_{jt})$] of i with respect to j is the percentage change in the price of commodity i in response to a one percent change in the quantity of commodity j, other factors remaining constant (Tomek and Robinson 1972 pp.53-54).

Cross flexibility was measured by the following formula:

$$\ln P_{it} = \ln a_0 + b_1 \ln Q_{it} + b_2 \ln Q_{jt} + U_t \dots\dots\dots(2)$$

Where,

P_{it} = Price of crop i in year t

Q_{it} = Production of crop i in year t (to be used to measure flexibility of P_i)

Q_{jt} = Production of crop j (substitute or complementary of i) in year t

U_t = error term

\ln = Natural logarithm value of the variable

The cross flexibility based on the quantity variable of the substitute is expected to be negative. This is in contrast to cross elasticities for substitutes which usually are positive. For making the local level planning of the selected crops simple average method was used to find out the monthly price variation.

III. RESULTS AND DISCUSSION

The price flexibility concept is particularly important for agricultural products. The biological nature of the production process results in many crops being produced annually or only at regular time intervals. Further some of these commodities are perishable or semi-perishable; they cannot be stored for long periods. For such commodities, the quantity available for consumption is largely fixed by the size of production and the entire commodity must be consumed within a period of months after harvest. Again within the time period, the level of production cannot be changed. Hence, the situation is one of a fixed supply and a given level of demand for a specific time period. Agricultural product price is affected not only by its own supply but also other products supply. So cross price flexibility is also important to measure among competing and substitute products.

Own-Price Flexibility of Selected Crops

The level of supply is the main factor determining average price for the agricultural products. Variations of prices within the year have very little influence on the size of production in that year (Tomek and Robinson 1972 p.52).

In the present study, among the selected crops Boro paddy, wheat and potato have significant flexibility coefficients. For lentil current production has little impact on current prices (price flexibility coefficient is only 0.08). That means the price of this crop is influenced by many other factors other than own production. Practically lentil price is determined largely by the import price of this crop. Lentil is imported in a high volume in each year. Thus lentil supply (excluding import) has little impact (insignificant) on its price determination. Domestic price of lentil is highly determined by international price and import amount of lentil.

Until now, local production has little impact on price volatility of lentil. Boro supply (production) reduces current year's Boro price at a significant level. From Table 1, it can be mentioned that one hundred percent increases in Boro paddy production reduces Boro paddy price 78 percent in the same production season. This price flexibility indicates how Boro price changes with the change of Boro supply in a year. Then, it is possible to make Boro price more or less stable by supplying its appropriate amount of this. Here, stable price means the price which is helpful and affordable for both producer and consumer.

Table 1: Price flexibilities and cross price flexibilities* of selected crops for the period of 1981-82 to 2005-06 (Price was deflated by using Agricultural raw material price index)

Dependent Variable (Price)	Constant	Explanatory Variables (Quantity)						R ²
		Boro Paddy	Aman Paddy	Wheat	Lentil	Potato	Tomato	
Boro Paddy	26.74	-0.78 ^{hs} (-6.03)	-0.51 ^c (-2.04)	-0.26 ^s (-2.51)		0.19 ^s (2.17)		0.73
Wheat	13.46	-0.58 ^{hs} (-4.35)		-0.27 ^s (-2.41)		0.39 ^{hs} (4.18)		0.56
Lentil	5.85				-0.08 (-0.95)	0.14 ^s (2.26)		0.21
Potato	-2.11					-0.33 ^c (-1.99)	1.10 ^s (2.20)	0.18

* $\ln P_{it} = \ln a_0 + b_1 \ln Q_{it} + b_2 \ln Q_{jt} + \dots + U_t$

Figures in the parenthesis shows t- statistic

hs, s, and c indicate highly significant, significant and critically significant at 1 percent (2.81), 5 percent (2.07) and 10 percent (1.71) level of significance, respectively (with 22 degrees of freedom).

In case of wheat, own price flexibility is -0.27 (Table 1), which implies that if the production (supply) of wheat increases one hundred percent, wheat price in that period will sink 27 percent. The flexibility coefficient is low and significant, indicating low impact on prices by domestic production. It might be concluded that, though Bangladesh is highly deficit in wheat production, but its domestic production also has a significant (comparatively low) effect on its domestic price determination. Own price flexibility coefficient of potato is also critically significant and the value of the coefficient is -0.33. These indicate that wheat and potato provide an inflexible price feature (conversely, price response elasticity will be elastic).

Cross-Price Flexibility of Selected Crops

This study considers Aman and tomato production to find out cross price effect among them, as we know inclusion of potential variables increase the validity of the cross price effect. The main reason behind inclusion of tomato supply in this study is its competing nature with potato and it is also another important vegetable in Bangladesh. Aman has a substitute effect with Boro production. Price of Boro reduces 51 percent if supply of Aman increases one hundred percent (Table 1). A larger supply of Aman results in a lower price for Aman, which in turn results in a decline in demand for the Boro. The lower demand implies a reduction in price of Boro. That means, Aman is a close substitute of Boro which is quite likely as rice. Wheat also has a substitute effect with Boro. If wheat production increases one hundred percent, Boro price will drop 26 percent. This is plausible as increased availability of wheat declines the demand for Boro and vice versa. Thus wheat is a closest substitute of Boro. If potato supply goes up, Boro price will also increase (as flexibility coefficient is 0.19). Rising potato production means cheaper prices for potato. That increased production of potato also might have come from increased area allocation of Boro land to potato cultivation. Which result is relatively smaller supply of Boro, and ultimately induces higher price of Boro.

From Table 1, it is also revealed that cross price flexibility of potato with wheat, potato with lentil and tomato with potato has shown positive flexibility relationship. These positive relations indicate that, these crops are competing in case of resource utilisation. As cultivated area is limited, thus increase in one crop area may reduce area under other crop. In case of potato and wheat, increase of potato production by one hundred percent also boosted wheat prices by 39 percent. This is because increased area under potato cultivation will reduce wheat area, which decrease total production of wheat and finally tends to enhance wheat price. Other positive relations (potato with lentil and tomato with potato) may be explained by the same way. These inter crops relationships have to be taken into consideration by the policy planners when they want to increase production or stabilization of prices of any single crop. Any policy formulation must carefully be assessed in terms of impacts on substitute or competing crops.

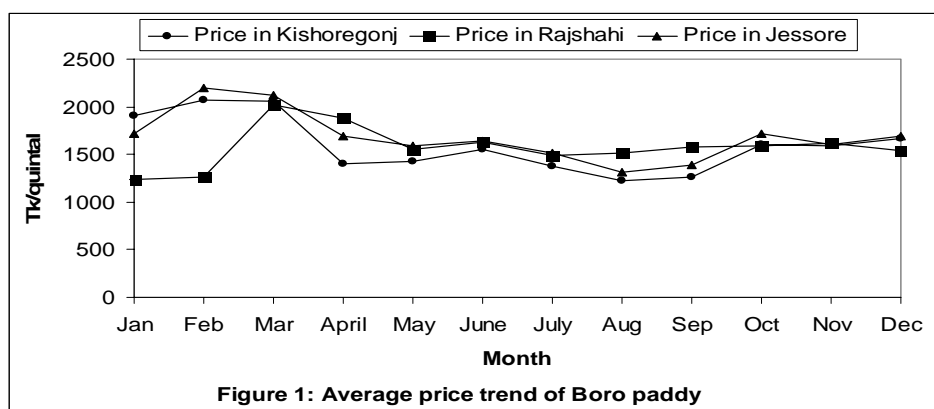
Use of Seasonal Price Variation for Local Level Planning

Seasonal price variations occur due to change in demand, change in supply, cost of storing products and so on. Prices do not remain same throughout the production season. If produces are available in the off-season, prices do not remain the same in each month of the off-season period. If monthly prices can be forecasted based on last three to five years, then there is

scope to spread the seasonality of production activities, or choosing varieties to produce in the off-seasonal months or storing and releasing stored produces can be planned accordingly. Local level market prices must be used for planning local level productions and storage (Alam 2005).

In this study a useful planning is done for selected districts to show how a local level planning may be made by using past price variations. As this is average price variation, the prices may not fluctuate extremely within the planning months. Supply of the crops is mainly responsible for price movement surrounding by the year. Thus, farmers would be more benefited if they supply the crop in the peak price period rather than in harvest period and get the price benefit. So these types of local level planning are indispensable for them to reap the benefits of price movement.

Average monthly price variations of Boro paddy in three selected districts are presented in figure 1. Prices of Boro paddy in Kishoregonj remain flat during April to December. Prices start rising from January and reach peak position in March. Thus, the best selling period of Boro in Kishoregonj is February – March and worst selling period is August – September. Farmers will get the highest price if they store Boro until the best selling period and then sell it in the market. But storing involves different types of cost such as infrastructural cost, storage loss, opportunity cost of tied capital etc. For policy making purpose these cost features must be considered. In Jessore, price variations are more or less same as Kishoregonj, though prices remain higher in Jessore throughout the year. Figure 1 also indicates the best selling months for Boro in Rajshahi are March – April.



Storage loss of Boro in Rajshahi was found 6.02 percent in 2009 (Ripa 2009), which is also greater than Kishoregonj (4.22 percent) and Jessore (4.03 percent). If price in March - April is more than the storage and other cost, then it will be better decision for the farmers to store the paddy until peak price rather harvest season selling. By considering all of these costs storing decision should be made. It is evident that the Kishoregonj prices of Boro remain relatively lower throughout the year than both Rajshahi and Jessore. From May to December, Boro price remain more or less stable and most fluctuating months are January to April i.e., pre-harvest months.

In Faridpur, wheat price was highest in December – January, and lowest and mostly stable in April to June. The best selling period in Dinajpur is November – December, where it is February in Rajshahi, just before the arrival of wheat in the market.

Figure 2 also indicates that after harvest season (March to mid April) wheat price gradually increases. This is because Bangladesh has deficit in wheat production that means demand is always higher than supply. So, storing and releasing wheat in appropriate time will be helpful for the farmers but price volatility and trend pattern is almost similar in all markets (this is sign of

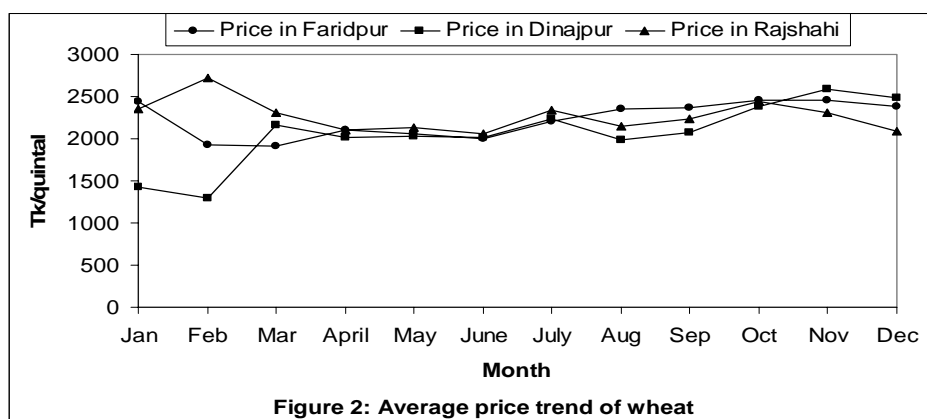


Figure 2: Average price trend of wheat

price integration). It is also an important indication from the figure that, peak price in one market may not ensure peak price to other location particularly, January to March (growing season). This may be due to variations in harvesting times and availability of wheat in different locations.

Three years price variations also depict that, wheat prices go gradually higher after harvesting months. So, it would be always preferable if farmers can sell their produces during the post harvest months.

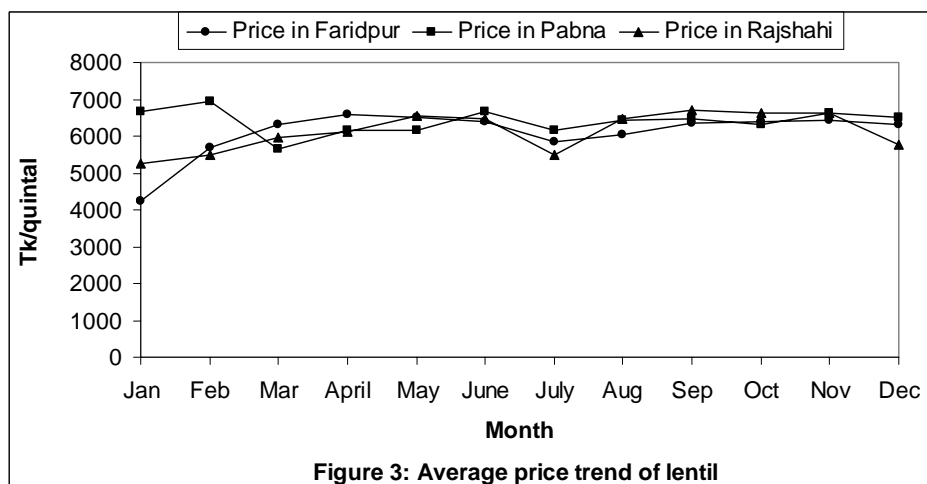


Figure 3: Average price trend of lentil

Price of lentil in Faridpur is lowest in January and then increases (figure 3). Thus, it is not wise decision to sell lentil in January. The best selling period is April to June. Similar price pattern is also found in Rajshahi. This indicates storing lentil for longer period is not beneficial for the farmers because lentil supply is determined in the market by amount imported throughout the year. So, local supply of lentil has little impact on its price trend. Thus, it is necessary to increase lentil production through increasing technological efficiency in production practices. Other than January to March, prices of lentil behave in similar fashion in all markets.

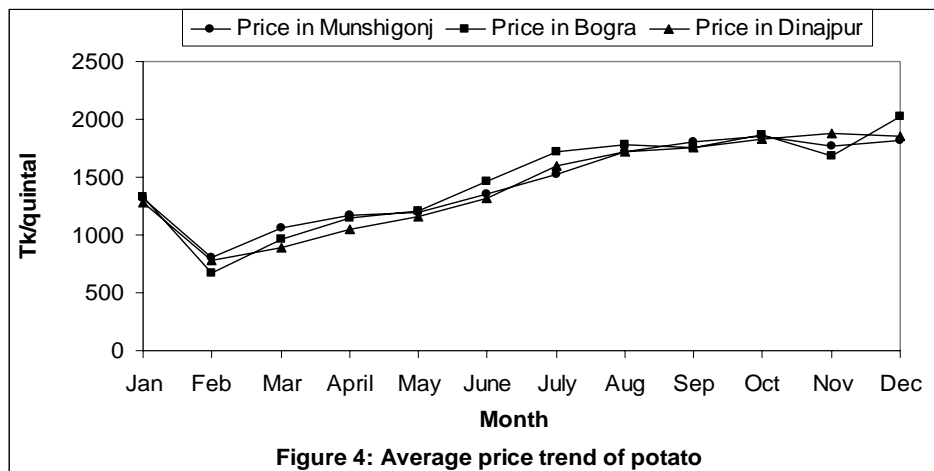


Figure 4: Average price trend of potato

Potato arrives in markets from mid January to March and peak harvests are available in February. In all the selected markets (Munshigonj, Bogra and Dinajpur), lowest price prevails in February and then prices gradually increases throughout the year (Figure 4). In Bogra price of potato slightly decrease in November. That means price of potato remains highest before harvest period. Thus, storing and selling of potato over the year is a best decision for farmers, of course, if storage cost is lower than the price they receive. Early harvest of potato (in January) would also give farmers best prices. Worst selling month for potato is February. Early varieties may be invented and encouraged to the farmers for cultivation. It is revealed that, from March, prices move upward in a similar fashion in all markets and apparently prices remain more or less stable throughout the year than any other crops. Higher storage facilities for potato contributed to price stability.

Thus it is observed that, peak and trough prices months vary by crops and that should be taken account by the farmers for planning to sell their produce.

IV. CONCLUSIONS AND POLICY IMPLICATIONS

The present study revealed that own-price flexibilities for selected crops have turned out significant except lentil. Supply of Aman has significant effect on Boro price as Aman is a highly substitute of Boro which is quite likely as a rice. Wheat was found as substitute of Boro, as most of the people now prefer to consume wheat than rice. Cross price flexibility of

Boro with potato, wheat with potato, and tomato with potato has shown positive. These positive relations indicate that, these crops are competing in case of resource utilization. From this study it was found that prices fluctuated from month to month especially before harvest period. Price trends of selected crops in selected markets indicate that, price pattern of crops may not be similar in all markets except potato markets, as selected potato markets followed similar price pattern.

Stabilization of prices, particularly of major food grain, is a serious concern of most developing countries like Bangladesh. Agricultural price stabilisation means reduction in price fluctuations and regulations of price movements within a certain range. Demand is more predictable than prices and production. Thus, Supply shocks and overflow are becoming more important than demand shift as a source of price variability of agricultural produces. The government has to take action on the supply side considering price flexibility effects to make price more stable. Any policy formulation must carefully be assessed in terms of impacts on substitute or competing crops. So, price support or subsidy programme for any crop must be judiciously taken. Price of a single crop may not always same within a year. It varies monthly, weekly even daily. Supply of the crop is mainly responsible for price movement through the year. Farmers are massively affected by this price volatility. By knowing the best selling period, farmers would be more benefited if they supply the crop in the peak price month rather than the harvest period and reap the price benefit. As the price pattern of crops may not similar in all the markets, thus, local level market price must be used for taking their decision on production, sales and storage. If there is no adverse weather fluctuation or shock, there is a strong possibility that, price trend of a crop follow the previous year's trend. In this sense, price trend estimation based on last three years, is important for farmers to get the price benefit from the market. For doing this, DAM can produce graphs and crop prices trends every year and supply to Extension Officers for consultation to farmers. For every Upazila, identification of price trends by the extension officers and making arrangement for demonstration may help farmers immensely for planning their production and sales.

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