

Factors Affecting the Prices of Rice in Bangladesh from the Perspective of Growers and Sellers

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Abstract: Bangladesh is an agricultural country. Rice is the main food of our country. But day by day the price rate of rice is increasing dramatically. There might have many reasons behind this price hiking in Bangladesh. Using primary data, among fifteen components the present study extracted four principal factors by factor analysis method. Based on these results we concluded that some external factors like political crisis, natural calamities, lack of government patronization; price inflation factor like price hike of fuel-fertilizer and rice in international market; unavailability of ingredient factor like scarcity of seeds and fertilizers were identified as key determinants of price hike of rice. The results also revealed that lack of proper inventory management and strong supply chain that constitute factor of inventory control is one of the main reasons for this issue. The outcome of this research will indicate that huge emphasis must be given to the storage capacity. So in the moment of crisis, demand can be satisfied easily and price control can be made properly. Therefore, issues and relations underlying price fluctuations need to be properly investigated before formulating and implementing any policies.

Keywords: Price hike, Factor analysis, Likert-scale, Inventory control, Bullwhip effect.

Introduction

In Asia, more than 700 million people's staple food is rice. [1] During the recent economic recession, the farmers have been also affected to a great extent. Due to reducing the income of people globally, farmers generally will prefer to produce the food grains that require minimum investment. Even Philippine Government made a plan to produce 4% less rice in the 2010.

For Bangladesh, being the seventh most populated country in the world and having one of the highest concentrations of poverty, ensuring food security

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Factors Affecting the Prices of Rice in Bangladesh from the Perspective of Growers and Sellers

remains to be a critical challenge here. Rice is not only the staple food of Bangladesh but also the driving force of Bangladesh agriculture. Bangladesh is an agro-based country where more than 60% of our people directly or indirectly are dependent on agriculture and most of them live in extreme poverty. [2] In Bangladesh food security is mainly influenced by the availability and price situation of rice. Thus rice plays an important role in Bangladesh economy. Indeed, rice is the single most important staple food for Bangladesh which comprises about 97 per cent of the total food grains produced. Rice is not only the staple food of Bangladesh but also the driving force of Bangladesh agriculture. Rice also accounts for almost 73% of calories consumed in Bangladesh compared to 33% cent in India. [2]

According to the Household Income and Expenditure Survey (HIES) of 2010, the poor households spend about 39 per cent of their total expenditure for rice (BBS 2011).[2] Moreover 60 percent of the total agricultural labor force is employed in rice production, processing, marketing and distribution.[3] Although Bangladesh has achieved commendable success in production of rice, and is currently the fourth largest producer of rice worldwide (after China, India and Indonesia) but unfortunately now-a-days the price of rice is increasing here. [2] In Bangladesh prices of rice went to taka 45-50 per kg in 2013 up from taka 25-30 per kg in 2007. Global warming decreases in food production round the world. Poor countries like Bangladesh are hardest hit by this food security but there has not been an increase in the income. Our agriculture faces the challenges of stimulating and sustaining productivity and income growth in an ever declining land base. Due to demographic pressure and increase urbanization, cultivation area is declining at the rate of 1% per annum whereas population is growing at the rate of 1.6% per annum. As a result government faces colossal problem to satisfy their domestic demands. [1] To overcome the problem we have to realize the need to increase storage capacity building and controlling inventory for rice and other food grains.

Like other developing countries, Bangladesh has a large proportion of low income households. Hence, higher rice price has the potential to significantly affect household welfare in Bangladesh. Furthermore, as a net importer of food grains, Bangladesh depends on imported rice for fulfilling its domestic demand. The country also depends on the harvest for its food security. This makes Bangladesh vulnerable to rice price shocks, originating either from international or from domestic sources. [4]

Researchers think, in Bangladesh rice price is highly increased for several reasons. Since independence in 1971, Bangladesh has faced a number of human-caused and natural calamities that have threatened the food security of poor and marginalized people. These calamities include a famine in 1974, floods in 1987 and 1988, a cyclone in 1991, a flood in 1998, and a cyclone in 2007.[3] On the political front, Bangladesh was run by an unelected and undemocratic "civil" caretaker government, backed by the military, which remained in power until the end of 2008 and undertook several steps to occur price hikes. [5] Moreover during 2007 and 2008 global food price hikes resulted in a sharp rise

in staple food like prices in Bangladesh. Consequently a large number of households are falling below the poverty line. Food security in Bangladesh is strongly linked to the production, import, and price stability of rice. In spite of being a net rice-importing country, rice imports in Bangladesh have traditionally been erratic, depending on domestic production, which is often affected by natural calamities. Though the government decided to intensify internal procurement of food grains, in reality total procurement was much lower than targeted procurement. [5] This inactiveness of government patronization is also helpful for price hiking.

Due to the scarcity of strong supply chain, the price of rice is also increasing tremendously in our country. Besides, with the rapid growth of industrialization the cultivable land are eradicating day by day. Also due to the unavailability and excessive cost of seeds and fertilizers push the price of rice high.

Last but not least the lack of proper inventory management is responsible for this price inflation. Inventory consists of usable but idle resources. The resources may be of raw materials, WIP finished goods and machines, etc. Inventory is the list of items kept to the stock for future use to synchronize the inflow and outflow of goods in transaction. An inventory problem is said to exist if either the resources are subject to control or if there is at least one such cost that decreases as inventory increases. Only through the optimal decision regarding inventory control, organizations or individual can earn profit, goodwill, customer satisfaction and also can help to reduce the price of the rice in the domestic markets.

The paper is structured as follows: - Section 2 provides objective of this study and section 3 deals related work of the current research that is literature review. Section 4 contains methodology (data collection and analysis). Findings and conclusion- recommendations are placed in section 6 and 7 respectively.

1. Objectives of the Study

For current study, the objectives may be as under:

- a. To identify the key determinant of price hike of rice in Bangladesh.
- b. To examine the various external reasons like political, natural and government patronization, etc influencing the prices of rice.
- c. To examine the various internal reasons like cost of fuel and fertilizer, traditional methods of cultivation, availability of arable land, etc determining the rice prices.
- d. To implement appropriate name of different factors
- e. Moreover we intend to find out the importance of inventory control regarding the price issue of rice by keeping in mind by maintaining proper inventory individual, organization or even government can reduce the cost of commodity. And as a result consumer can get right thing at the right time at right price.

Factors Affecting the Prices of Rice in Bangladesh from the Perspective of Growers and Sellers

2. Literature Review

In Bangladesh, several empirical studies on price behavior, production and yield behavior of rice have been undertaken. Some of the studies may be entirely relevant to the present study and their findings, methodology of analysis and suggestions have a great influence on the current study. Most of the available studies of price hike of rice reportedly focus on cause and effect of a sharp rice price increase in Bangladesh. Although global grain prices have declined during 2009, domestic food prices in South Asian countries sharply increased in early 2010. For instance, rice prices have increased by 27 percent in Dhaka, Bangladesh between October 2009 and February 2010. On the other hand, rice prices in the international market have decreased by 6 percent between February and March 2010 due to increased supply from Vietnam and Thailand (World Bank, 2010). This divergence of domestic and international prices is somewhat surprising given the presumption that prices of tradable goods of small open economies are supposed to be set in between their respective export parity prices and import parity prices. [6]

A study about the impact of a large rice price increase on welfare and poverty in Bangladesh, exhibits an inter connection between high price of rice and poverty. The study has been revealed that if per capita income gap is considered as a measure of poverty, we find that poverty increases with a higher price of rice. [4]

In attempt to explore two types of temporal variations in rice prices (inter-year and intra-year) a time series analysis of price escalation of rice in Bangladesh has been conducted that measures the fluctuation pattern of rice prices over time. [3]

Though inventory control is very important for all types of commodity and a lot of works have to be done to control it but unfortunately it is not getting proper importance in the food grains and vegetable commodities. As a result huge losses are counted by the producers of that commodity and government faced colossal problem to satisfy the people's demands of food grains and vegetables etc. mentioned in his article that farmers count losses amount of one billion taka only due to the lack of proper inventory in Bangladesh especially in the district of Sirajgonj. [7]

It is mentioned in the Editorial of The Daily Jugantor, February 20, 2008 that necessary and sufficient cares are required to produce food grains in Bangladesh. In that editorial it is also stated that already 12000 types of rice has been lost only for the lack of proper care and obviously it has a negative impact on the price of rice. [8] According to The Daily Star, April 11, 2008 the world food situation is very serious. Food riots reported from many countries like Egypt, Cameroon, Haiti, Senegal etc. And that is because the world has 4-5 million tons (MT) of cereals stocks that can feed the global population only 8-12 weeks which might also have a positive contribution of increase the prices of rice. [9]

It is analyzed that price of rice have marked a sharp rise in wholesale and retail markets in Dinajpur in May-June 2013 that causes a concern to the people of low and middle income groups in our country. [10] The wholesalers and rice millers

have attributed the situations to frequent load shedding and the improper procurement drive and the retailers' alleged that rice prices have shot up due to huge stocks built up by some unscrupulous wholesalers instead of the government.

In a recent study, Minten et al. discuss the issue of agricultural marketing, price stabilization, value chain and international trade. The paper discusses various aspects of the food grain market in Bangladesh and mentions some of the reasons of price inflation of rice. [11]

Sabur and Elahi examined trend, annual and seasonal rice price fluctuations in Bangladesh. The study revealed that annual rice price fluctuation in the pre-liberation period and in the 80's was more stable than in the 70's. [12]

3. Methodology

4-1. Data collection

In order to achieve the specific objectives of the study, primary sources of data are used. The study undertakes both empirical and exploratory research approaches. Therefore, this study is an attempt to identify the major determinants of price hike of rice in Bangladesh by performing the quantitative statistical analysis using primary data and also determine how to solve the problem. Thus the perceptions of both growers and sellers from different districts of Bangladesh have been investigated. Using convenience sampling technique the study includes the total of 1119 respondents. Primary data were collected by administering a survey with direct interview approach. A structured questionnaire was used to get respondents opinion on different issues. For the study purpose, fifteen questions have been made and each question is a statement followed by a five point Likert-scale incorporating as follows:

SDA = Strongly Disagree (1)

DA = Disagree (2)

N = Neutral (3)

A = Agree (4)

SA = Strongly Agree (5)

4-2. Tools used for data analysis

Data purification and analysis was carried out through SPSS version 16. Factor analysis was performed to identify the major issues of price hiking of rice as well as specifying the most influential factors. Factor analysis is a multivariate method used for data reduction purposes. The basic idea of this technique is to represent a set of variables by a smaller number of variables. [13] The method is mainly designed for interval data, although it can also be used for ordinal data (e.g. scores assigned to Likert scales). The variables used in factor analysis

Factors Affecting the Prices of Rice in Bangladesh from the Perspective of Growers and Sellers

should be linearly related to each other. Obviously the variables must also be at least moderately correlated to each other; otherwise the number of factors will be almost the same as the number of original variables.

Consider the observable random variable \mathbf{X} with p components with mean μ and covariance matrix Σ . The factor model postulates that \mathbf{X} is linearly dependent upon the few unobservable random variables F_1, F_2, \dots, F_m , called common factors and p additional sources of variation $\varepsilon_1, \varepsilon_2, \dots, \varepsilon_p$, called specific factors.

The generalized factor analysis model can be expressed as,

$$\begin{aligned}
 X_1 - \mu_1 &= l_{11}F_1 + l_{12}F_2 + \dots + l_{1m}F_m + \varepsilon_1 \\
 X_2 - \mu_2 &= l_{21}F_1 + l_{22}F_2 + \dots + l_{2m}F_m + \varepsilon_2 \\
 X_p - \mu_p &= l_{p1}F_1 + l_{p2}F_2 + \dots + l_{pm}F_m + \varepsilon_p
 \end{aligned}$$

This equation system can be expressed as $\mathbf{X} - \mu = \mathbf{L} \mathbf{F} + \varepsilon$. Here the coefficient l_{ij} is the loading of i^{th} variable on j^{th} factor. Thus \mathbf{L} indicates the matrix of factor loadings. The i^{th} specific factor ε_i

is associated only with the i^{th} response X_i . The p deviations $X_1 - \mu_1, X_2 - \mu_2, \dots, X_p - \mu_p$

are expressed in terms of the $(p + m)$ unobservable random variables F_1, F_2, \dots, F_m and $\varepsilon_1, \varepsilon_2, \dots, \varepsilon_p$. After being derived from factor extraction, the orthogonal transformation of factor loadings has been performed that is called factor rotation. For this study purpose, varimax rotation has been conducted to identify the factors and specify these properly.

4. Data Analysis and Findings

Following table shows the frequencies of respondents under each question used for the study purpose. Fifteen questions were made related to fifteen different components that are responsible for excessive price hike of rice in Bangladesh.

Table 1: Frequency Table

Following questions have been used for the survey based on price hike of rice in Bangladesh.	SDA	DA	N	A	SA
Lack of proper inventory management is responsible for increasing the price of rice	24 (2.1%)	114 (10.2%)	124 (11.1%)	387 (34.6%)	470 (42%)
Political crisis is responsible for the inflation of price	32 (2.9%)	110 (9.8%)	108 (9.7%)	400 (35.7%)	469 (41.9%)
Natural calamities are responsible for the price hiking	42 (3.8%)	114 (10.2%)	115 (10.2%)	397 (35.5%)	451 (40.3%)
Lack of strong supply chain is one of the major facts of price increasing	19 (1.7%)	120 (10.7%)	174 (14.4%)	421 (37.6%)	385 (34.4%)
Due to rapid growth of industrialization, price is increasing	118 (10.5%)	303 (27.1%)	252 (22.5%)	294 (26.3%)	152 (13.6%)
Lack of government patronization is also helpful for price hiking	41 (3.7%)	142 (12.7%)	152 (13.5%)	417 (37.3%)	367 (32.6%)
Bizarre weather pattern is another reason for price hiking	35 (3.1%)	167 (14.9%)	227 (20.4%)	457 (40.8%)	233 (20.8%)
Increased cost of fuel and fertilizer push the price high	11 (1%)	37 (3.3%)	90 (8%)	352 (31.5%)	629 (56.2%)
Price hiking is an ultimate result of traditional cultivation method	76 (6.8%)	216 (19.3%)	240 (21.4%)	351 (31.4%)	236 (21.1%)
Reduction of plough land is responsible for price hiking	52 (4.6%)	115 (10.3%)	128 (11.5%)	381 (34%)	443 (39.6%)
Unavailability of	158	145	128	340	348

Factors Affecting the Prices of Rice in Bangladesh from the Perspective of Growers and Sellers

fertilizer at right time in right place is a reason of price hiking	(14.1%)	(13%)	(11.4%)	(30.4%)	(31.1%)
Shortage of sufficient electricity for irrigation is responsible for increasing price	41 (3.7%)	101 (9%)	144 (12.9%)	438 (39.1%)	395 (35.3%)
Price hiking in the international market is a cause of price increasing in the local market.	37 (3.3%)	89 (8%)	133 (11.8%)	340 (30.4%)	520 (46.5%)
Inadequacy of proper import forecasting is responsible for upper trend of price	48 (4.3%)	133 (11.9%)	193 (17.3%)	457 (40.8%)	288 (25.7%)
Unavailability of good seeds is responsible for high price	217 (19.4%)	243 (21.7%)	134 (12%)	347 (31%)	178 (15.9%)

Source: 1119 growers and sellers from various districts in Bangladesh.

The results show that, all of these factors have strong influence on the inflation of rice price in Bangladesh. The result exhibited that the consent of respondents varies from factor to factor. But in all cases majority of the respondents agreed that the stated issues are responsible for the upper trend of price because the percentage of agreement (agreed and strongly agreed respondents) are higher for each question. Among different reasons it has been found that lack of proper inventory management, political crisis, natural disasters, excessive cost of fuel and fertilizer, decrease of cultivable land, insufficient electricity for irrigation and price hiking in the international market have heavy impact on high price of rice in our country.

For current study, the resulting value of Kaiser-Meyer-Olkin measure of sampling adequacy is

over 0.7 (KMO = 0.778) and Bartlett's test of sphericity is significant (p-value < 0.05). Thus

factor analysis can be executed for these data.

Table 2: Total Explained Variances

Component	Initial Eigen values			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	λ	σ_1^2	σ_2^2	λ	σ_1^2	σ_2^2	λ	σ_1^2	σ_2^2
1	3.258	21.723	21.723	3.258	21.72	21.723	2.562	17.080	17.080

					3				
2	1.485	9.899	31.622	1.485	9.899	31.622	1.678	11.185	28.266
3	1.409	9.390	41.012	1.409	9.390	41.012	1.506	10.042	38.308
4	1.061	7.076	48.089	1.061	7.076	48.089	1.467	9.781	48.089
5	.959	6.396	54.484						
6	.879	5.861	60.345						
7	.854	5.694	66.039						
8	.825	5.497	71.536						
9	.739	4.926	76.462						
10	.692	4.613	81.076						
11	.649	4.328	85.404						
12	.604	4.029	89.433						
13	.563	3.751	93.184						
14	.530	3.533	96.717						
15	.493	3.283	100.000						

Here, λ = Eigen values

σ_i^2 = Percentage of variance

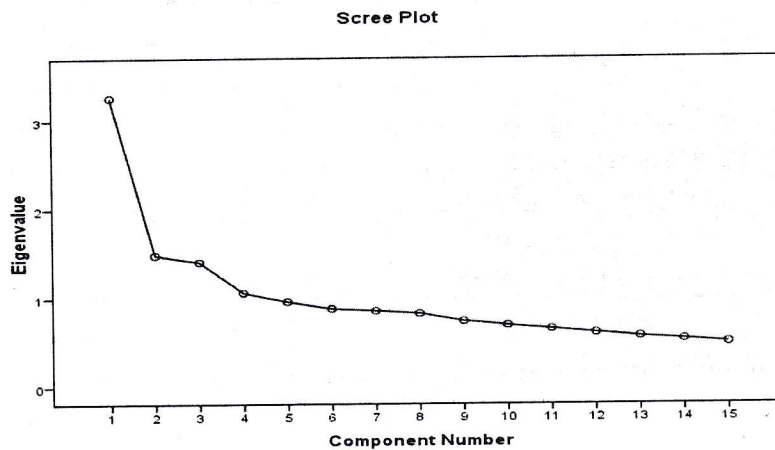
σ_i^2 = Cumulative percentage of variance

Above table lists the eigen values associated with each of 15 components before extraction, after extraction and after rotation. Eigen values associated with each component represent the variance explained by the particular component. These results also reveal the individual and cumulative percentage of variance explained by different components. For instance, individually first component explains the 21.723% of total variance; second component explains the 9.899% of total variance and these two components explain 31.622% of total variance together. From these results it is clear that the first four components explain a relatively large amount of variance whereas subsequent components explain only a small amount of variance. Thus these four components with eigen values greater than 1 have been extracted in the columns labeled 'Extraction Sums of Squared Loadings' except the discarded components which have eigen values less than 1. The final part of the table represents the results after rotation. Basically rotation has the effect of optimizing the factor structure and one consequence for these data is that the relative importance of the four components is equalized. Before rotation the first component accounted for considerably more variance (21.723%) than the remaining three (compared to 9.899%, 9.390% and 7.076% respectively), however in case of rotation it accounts for only 17.080% of variance (compared to 11.185%, 10.042% and 9.781%). Moreover among 15

Factors Affecting the Prices of Rice in Bangladesh from the Perspective of Growers and Sellers

components first four components explain almost 48% of total variability. So these four components are considered to be four factors that can be used for further analysis rather than taking all other components.

Figure 1: Scree plot of determining the main factors of price hike of rice in Bangladesh



Generally scree plot is a graph of the eigen values against all the components. It is useful for determining how many factors to retain. The point of interest is where the curve starts to flatten. It can be seen that the curve begins to flatten between factors 4 and 5 against eigen value 1. Also note that factor 5 has an eigen value less than 1, so only first four factors have been retained.

Table 3: Factor Loadings With and Without Rotation

	Estimated Factor Loadings				Rotated Estimated Factor Loadings			
	F ₁	F ₂	F ₃	F ₄	F ₁	F ₂	F ₃	F ₄
Lack of proper Inventory management								.754

Political Crisis					.633			
Natural Calamities	.551				.655			
lack of strong supply chain								.621
Rapid Industrialization								
Lack of government Patronization	.597				.645			
Bizarre Weather	.618				.640			
Fuel & Fertilizer Price Hike				- .519		.690		
Traditional Cultivation Method								
Reduction of plough land	.604				.596			
Unavailability of fertilizer at right time and price			.712					.817
Shortage of electricity								
Price rise in International market		.564				.627		
Lack of Import		.541				.517		
Unavailability of good seeds			.676					.798

The table shows the loadings of the 15 variables on the four factors extracted. The higher the absolute value of the loading, the more the factor contributes to the variable. The gap on the table represents loadings that are less than 0.5. Here all loadings less than 0.5 has been suppressed for reading the table easier.

Above table shows the result of factor loadings before and after rotation. These two solution methods produced a little bit different results. The idea of rotation is to reduce the number of factors on which the variables under investigation have

Factors Affecting the Prices of Rice in Bangladesh from the Perspective of Growers and Sellers

high loadings. Rotation actually change makes the interpretation of the analysis easier. Looking at the rotated factor loadings, it has been found that the political crisis, natural calamities, lack of government patronization and bizarre weather are substantially loaded on factor 1. Observing these factor loadings it is fairly clear that the first factor represents some conditions which are externally related to the current price hike of rice. So it might be called external factors. The second factor contrasts price hike of fuel & fertilizer and price hike of rice in international market. Thus factor 2 might be called a price inflation factor. Unavailability of fertilizer along with unavailability of good seeds has high loadings for factor 3. Thus these represent the lack of ingredient for better production of rice which results price inflation of rice in our country. This factor might be called ingredient factor. Lack of proper inventory management and strong supply chain are strongly loaded on factor 4. This might be termed as factor of inventory control.

5. Conclusion

The current study has explored several issues and has been found different factors (external factors, price inflation factor, ingredient factor, factor of inventory control) which have major impact on excessive price of rice in Bangladesh. Going forward, we cannot say anything about where price inflation will stand. But to alleviate this problem it is essential to take necessary steps immediately. Supply shocks may be mitigated abroad; there may be good yields locally and abroad. Increase production and productivity of land and laborers through technological advancement and infrastructure development. Start institutionalize mechanism by which the small farms can get incentive in farming e.g. lessening input costs, insurance for price volatility, support mechanism for natural disaster etc. The researchers focus on the idea that, food security should be a major concern for the Bangladesh Government, and some efforts by the Central Bank and the Government should be taken to implement policy actions in agriculture, aimed at attaining food sufficiency. We have so far identified that lack of inventory system has significant adverse affect on increasing price of rice but frequently it has been seen that most of this case the management which are responsible to maintain stock; suffers from 'Bullwhip Effect' which indicates even though there may have huge production of rice but due to lack of good supply chain and other system complexity, good amount of stock are not maintained; that represents a very poor management. Government can do something needful regarding to solve this so called 'Bullwhip Effect' and price of rice can make stable or even can be reduced remarkably. The current inflation of rice price in Bangladesh could not be explained solely on these four factors but according to these factors proper initiatives can be adopted to solve the existing problem. So, the concerned authorities should take into account all these factors when they formulate policies to check inflation. To maintain price stability, the government must work on both economic and non-economic factors that influence on the ongoing inflation of rice price.

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