Giffen Behavior for Rice Consumption in Rural Bangladesh

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Abstract: Rice is the staple food in Bangladesh. Thus, the price of rice is an important economic factor in Bangladesh especially for poor people. In Bangladesh, during the price hike of 2008-09, rice price increased by 40% on an average across the country. Interestingly, the consumption of rice in some rural parts of Bangladesh also increased during that period. Thus, the focus of this paper is to examine the practical evidence of this positive relationship between the consumption of rice and increasing price which is addressed as Giffen behavior (inverse of normal behavior) for rice consumption in Bangladesh. By analyzing secondary data obtained from some specific rural parts namely Patharghata (Barguna), Chaddagham (Comilla), Sadar (Jamalpur), Kaligang (Jhenaidaha), Sreemangal (Moulvibazar) and Sadar (Naogaon) of Bangladesh, we have found a new insight in this context. We find that the price elasticity of staple food for the poor people depends significantly and nonlinearly on the severity of their poverty. In order to have an effective design of welfare for the poor people, we need to understand this heterogeneity of their consumption behavior.

Keywords: Rice, Price, Bangladesh, Giffen behavior, Elasticity
JEL Classification: D01, D12, I30, O12

1. Introduction

Alfred Marshall first established the concept of Giffen good in the 1895 edition of his Principles of Economics. He pointed out that a poor consumer facing a price rise in a staple food, has to cut back the consumption of the protein or fancy food to increase the consumption of the staple item. Being contrary to the law of demand Giffen good has always raised curiosity, but real life examples are hard to find. Studies by Stigler (1947) and Koenker (1977) refute bread and wheat as Giffen good during Marshall's time in Britain. Rosen (1999) has also argued against potatoes as being a Giffen good during the Irish famine of 1845-1849(Paul A. Samuelson 1964). Therefore the lack of verified examples has raised numerous concerns about the pedagogical role of the existence of any Giffen good.

Boland (1977) pointed out that not only the theory is unable to rule out Giffen behavior, it is also unable to explain why it is not observed. He emphasized that under certain (albeit uncommon) conditions, Giffen behavior should exist. If it has not been observed, it is either because the appropriate conditions have not been satisfied, or the appropriate data have not been available to measure it. Among others, Dougan (1982) have argued that markets with upward sloping demand curves are inherently unstable and unlikely to be observed. Nachbar (1998) have showed in a general equilibrium framework that observing the equilibrium price and quantity of a good move in the same direction in response to a supply shock implies that the commodity is normal, not inferior, and thus not Giffen at all. Haagsma (2012) has discussed the historical roots of the possibility of the literature of Giffen paradox and investigated the explanations of a positively slopping demand curve in his paper.

Real life examples of Giffen good remained limited but Jensen and Miller (2008) found Giffen behavior in a field experiment conducted in two provinces of China. They used the term "Giffen behavior" rather than "Giffen good" because their argument was, Giffen property is one that holds for particular consumers in a particular situation and depends on among other things, like prices of the commodities and wealth. Thus, Giffen is a property of the consumers' behavior and not the good. In their experiment they subsidized prices of two staple goods- rice in Hunan province and wheat in Gansu province, China. They found strong evidence of Giffen behavior in Hunan for rice consumption and weaker evidence in Gansu. But they could not document such behavior at the market level as it was a field experiment in an artificial environment. The author also suggested that given certain conditions, Giffen behavior may be widespread in the developing world. However, Minagawa (2011) has found that a per unit charge raises the relative price of the low quality good and yet increases the (relative) demand of the good in case of gasoline. Kubler et al. (2013) has also found that the risk free asset can be an inferior good as well as a Giffen good by relaxing the assumption of risk free asset for members of the widely popular HARA (hyperbolic absolute risk aversion). This gives us the motivation to find out a real market based empirical evidence of Giffen behavior in case of Bangladesh. And to the best of our knowledge, this is the first precise, real-world empirical evidence about the consumption behavior of poor people due to price hike in Bangladesh.

Several studies have conducted to assess the impact of food price increase on the living standard and the food consumption pattern of poor people in Bangladesh. Centre for Policy Dialogue (a well reputed research organization in Bangladesh) showed that an additional 8.5% of households have actually fallen below the poverty line and changed their food consumption habit because of the high inflation especially in food price (CPD 2008). Unnayan Shamunnay (2008), (a research organization in Bangladesh) conducted a survey on four low-income working groups in Dhaka city to capture their consumption pattern changes due to price hike. The survey comprised of 50 households under each of the categories of petty traders, readymade garments workers, rickshaw pullers and day labors in different areas of Dhaka city. The survey results show that despite the rise in price, some households (most poor and vulnerable) increased their consumption of rice. However, it remains a doubt whether the causal relationship between price changes and consumption behavior was due to endogenous variation or not. Unnayan Shamunnay (2008) explained that the simultaneous increase in the relative prices of non-rice food items with respect to the price of rice is a possible reason for this behavior among those households.

2. Theoretical Framework

The possibility of Giffen behavior in Bangladesh has been motivated by an argument similar to Marshall's. We will argue that the need to maintain subsistence consumption is the significant factor leading to Giffen behavior. Although much of what follows in this section has previously appeared elsewhere, we believe that this analysis provides a useful synthesis on theoretical approach to the Giffen phenomenon. Consider a poor household whose income is below the $1.25 a day a person threshold. It has a simple food consumption bundle: coarse rice and pulses, where rice is the staple and pulse is considered as a fancy food. The staple food provides high level of calorie at low cost. The fancy food improves the taste of the consumption as well as providing protein, but the price of the fancy food is higher than the staple. And rice compromises a large portion of the household's budget.

Now, holding all other factors (that can affect the consumption pattern of rice) constant, if the price of rice increases and the price of the fancy food remain unchanged, there can be three possible outcomes and we can show this behavior through the following 3 diagrams.

Hypothesis-1: Demand for staple food falls and demand for fancy food may also fall.

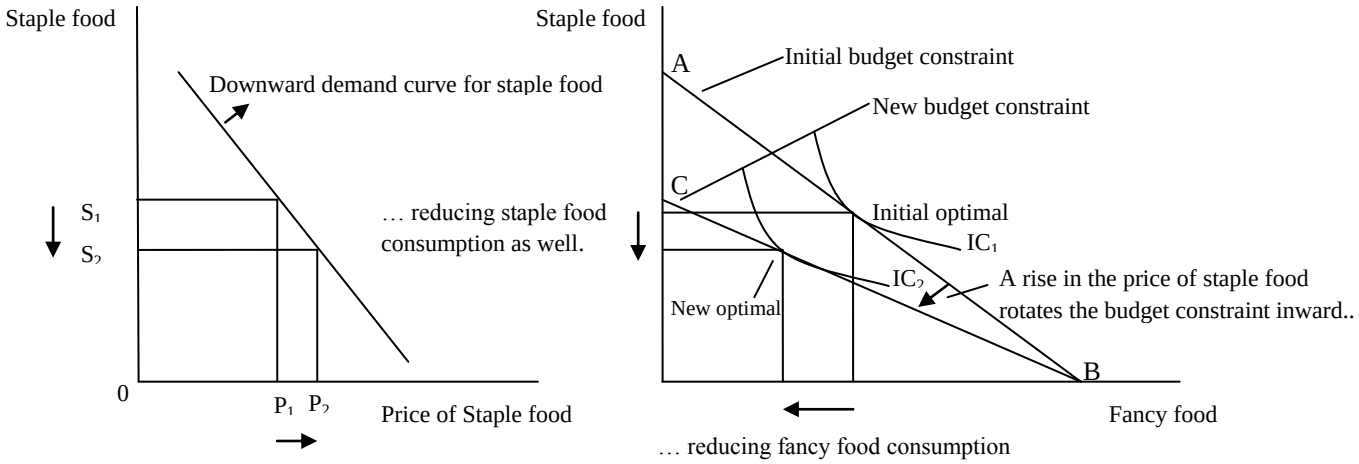

Figure 1: The possibility of the poor consumer's optimal choice pattern-1

As a coping strategy, the poor household has to reduce the consumption of fancy food as well as the consumption of the staple food. They stay hungry and their calorie intake falls. This shows a negative price elasticity of demand for rice.

Hypothesis-2: Demand for staple food remains unchanged but demand for fancy food falls.

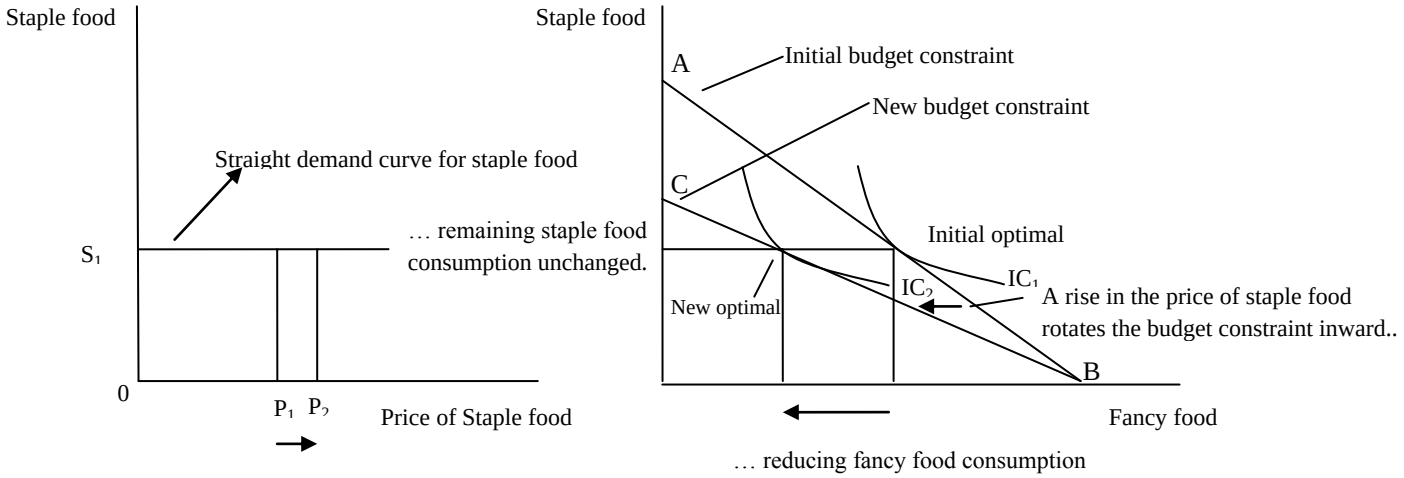

Figure 2: The possibility of the poor consumer's optimal choice pattern-2

In this case, household is not so poor that it has to reduce the consumption of staple food; rather it reduces the consumption of fancy food to accommodate its budget. Here the price elasticity of demand is zero and the consumer faces a straight demand for staple food.

Hypothesis-3: Demand for staple food increases and demand for fancy food falls.

There can be a third possible case, where the consumption of staple food increases and the consumption of fancy food declines. When demand of a good moves in the same direction with its price ceteris paribus, then is called a Giffen good. We are referring this behavior as Giffen behavior rather than terming rice as a Giffen good because we are assuming, this behavior occurs at a specific income level people and not by every consumer at the market.

A poor household will consume a lot of the staple food to get enough calories to meet the basic need and use whatever money is left over to purchase the fancy food. If the price of the staple food increases, the household can no longer afford the original bundle of foods. In this case if the household increases its consumption of the fancy food, it will fall below the required calorie intake. Therefore the household has to reduce the consumption of the fancy food but to relieve hunger; it increases the consumption of staple food. In this case we will find a positive price elasticity of demand for staple food, i.e. Giffen phenomenon.

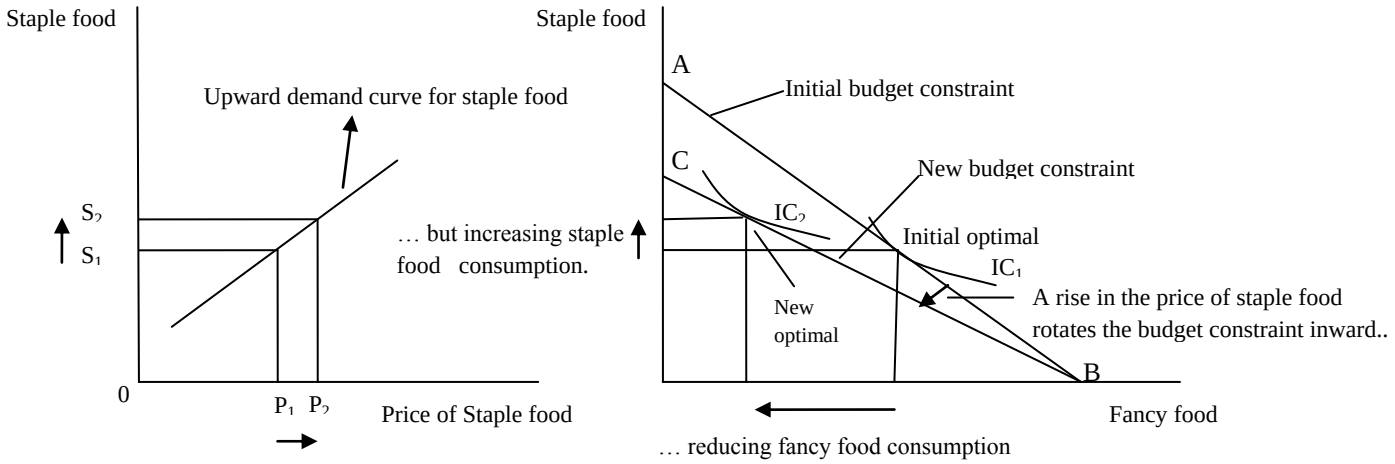

Figure 3: The possibility of the poor consumer's optimal choice pattern-3

2.1 Data and Methodology

The focus of this paper is to explore the response of poor and vulnerable households living in rural areas, especially poorer parts of Bangladesh with the increase in price of food (rice and non-rice) between 2006 and 2008 (the highest price hike period in Bangladesh). The primary source of our data was Nutritional Surveillance Project (NSP-2006) survey conducted by Helen Keller International and Institute of Public Health Nutrition-HKI/IPHN (an international research

organization on health and nutrition). To conduct the survey, they ranked the upazillas by their mean weight for height Z score. From each of the six divisions, the upazillas with the lower mean scores were selected as the primary survey sites. Within each upazilla, they conducted a panel survey in fifteen villages with a total household of 1500. The upazillas that were covered in the survey were Patharghata (Barguna), Chaddagham (Comilla), Sadar (Jamalpur), Kaligang (Jhenaidaha), Sreemangal (Moulvibazar) and Sadar (Naogaon). A sub-sample of NSP-2006 was revisited in 2008. However, to avoid the seasonality impact, the survey in 2008 was undertaken during the same time of the year as HKI survey had been conducted in 2006.

The study then carries out an extensive quantitative and qualitative analysis on collected data. To identify significant predictors of rice consumption in the study area multiple regression model has been conducted using STATA. Statistical significance was tested using paired T-tests; F-test and P-value tests (P value of ≤ 0.05 was considered as the cut-off for statistical significance). R-squared and Adjusted R-squared were used to test the proportion of the total sample variation in the dependent variable (% change in rice consumption) which is explained by the predictor independent variables.

2.2 Preliminary Results

Findings from the survey are summarized and presented on the following tables:

Table-1: Average per capita daily rice consumption by district (in kg)

Year	Barguna	Comilla	Jamalpur	Jhenaidaha	Moulvibazar	Naogaon
2006	0.39	0.28	0.41	0.39	0.34	0.38
2008	0.45	0.32	0.42	0.44	0.45	0.44
% Δ	14.29	13.33	2.41	12.05	27.85	14.63

Source: based on BRAC-2010 report calculated by the Authors

Per capita rice consumption has substantially increased across all household between 2006 and 2008. A possible reason of this could be, since rice is the cheapest source of energy and the price of all major food items increased, households had to substitute other foods with more rice.

Table-2: Average share of rice in total food expenditure (%)

Year	Barguna	Comilla	Jamalpur	Jhenaidaha	Moulvibazar	Naogaon
2006	57	34	51	48	42	43
2008	61	35	62	47	51	56
% Δ	6.78	2.9	19.47	-2.10	19.35	26.26

Source: based on BRAC-2010 report calculated by the Authors

Rice share in total food expenditure has increased in this period but there is a significant variation across regions. In Jamalpur, by far the poorest cluster in the sample, the amount of rice consumption has not increased, while the share of rice in total food expenditure has increased by 19.47%. This indicates that on average these households have reduced non-rice consumption but was not able to meet up that reduction with the additional consumption of rice. The share of rice

to total expenditure in 2008 was also the highest in Jamalpur among the six districts. Such finding is compatible with the second possible hypothesis of our theoretical model.

Table-3: Price of rice per kg (in Tk.)

Year	Barguna	Comilla	Jamalpur	Jhenaidaha	Moulvibazar	Naogaon
2006	23	20	19.87	20	28.28	20
2008	26	28	29.35	29	29.75	26
% Δ	12.24	33.33	38.52	36.73	5.07	26.09

Source: based on BBS-2010 survey calculated by the Authors

Table-4: Price of non-rice per kg (in Tk.)

Year	Barguna	Comilla	Jamalpur	Jhenaidaha	Moulvibazar	Naogaon
2006	104.2	92.5	93.6	80.7	99.3	94.6
2008	110.6	119	124.6	105	127.2	115
% Δ	5.9	25.06	28.4	26.16	24.7	19.5

Source: based on BBS-2010 survey calculated by the Authors

Tables 3 and 4 represent the price of rice and non-rice item (non rice item includes the price of khesari (lentil), potato, banaba/dozen, egg (hen/ dozen), fish (rui/kg), poultry/ kg, and beef /kg.)per kg in TK. It can be seen from these tables that both items price has been significantly increased across all districts.

Now, in order to have an idea about the net effect of food price (i.e. rice and non-rice price) hikes on consumption pattern among these household, we also need to consider the data of nominal and real income adjustment between these two periods in the entire surveyed district. However, the data has been collected from a panel survey by HKI/IPHN (examining the same households over the two surveyed period) and they have not found any changes in the basic demographic status of the sampled households as their family sizes and headship remain unchanged. In the absence of detailed income/expenditure data, they formed a wealth index in 2006 as a proxy variable to measure the socio-economic status of these households. The wealth index included 10 indicators viz. Number of adult males in the household, size of the house, main material of the walls, having electricity connection, type of latrine used, ownership of cows, occupation of the main earner is day labor, log of amount of cultivable land owned, log of amount of homestead land owned and education of the female.

Using the wealth index, no significant change was observed among the households socio-economic profile in these two periods. Therefore, we have considered the data on household's agricultural and non-agricultural wage rates of 2006 and 2008 to measure their change in income over these two periods and results are presented in Tables 5 – 8.

Table-5: Average Agricultural nominal income measured in Tk.

Year	Barguna	Comilla	Jamalpur	Jhenaidaha	Moulvibazar	Naogaon
2006	92	116	132	68	55	88
2008	140	178	176	101	71	141
% Δ	41.38	42.18	28.57	39.05	25.4	46.29

Source: based on BRAC-2010 report calculated by the Authors

Table-6: Average Non-agricultural nominal income measured in Tk.

Year	Barguna	Comilla	Jamalpur	Jhenaidaha	Moulvibazar	Naogaon
2006	99	170	116	107	114	90
2008	151	218	158	147	147	134
% Δ	41.6	24.74	30.66	31.5	25.29	39.29

Source: based on BRAC-2010 report calculated by the Authors

Table-7: Average Agricultural real income measured in quantity of rice (kg)

Year	Barguna	Comilla	Jamalpur	Jhenaidaha	Moulvibazar	Naogaon
2006	4	5.8	6.64	3.4	1.94	4.4
2008	5.38	6.36	5.99	3.48	2.39	5.42
% Δ	29.42	9.21	-10.28	-6.21	20.78	20.77

Source: based on BRAC-2010 report calculated by the Authors

Table-8: Average Non-agricultural real income measured in quantity of rice (kg)

Year	Barguna	Comilla	Jamalpur	Jhenaidaha	Moulvibazar	Naogaon
2006	4.3	8.5	5.84	5.35	4.03	4.5
2008	5.8	7.78	5.38	5.07	4.94	5.15
% Δ	29.84	-8.85	-8.19	-5.37	20.31	13.49

Source: based on BRAC-2010 report calculated by the Authors

Agricultural real income is calculated in kg of rice. Since poor households spend a majority of their income on rice, we estimated the rice equivalent of money income as dividing the nominal agricultural income (the average from all districts) by corresponding period's retail price of coarse rice. The non-agricultural real income is also calculated in a similar way. From these tables (5-8) above we found that, average agricultural real income measured by amount of rice increases by 10% and average non-agricultural income measured by amount of rice increases by 6.87% only whereas average agricultural nominal income increase by 32.14% and average non-agricultural nominal income increase by 32.18% during the two periods in the surveyed districts. This indicates that the rate of the nominal income increase is lower than the rate of the rice price increase.

2.3 Regression Estimation Strategy

The households in our sample are poor and almost exclusively consume coarse rice. We computed all the changes in these two periods as arc-percentage-changes:

$$\{X_t\text{-}X_{t-1}/(X_t+X_{t-1}/2)\}*100 \quad (1)$$

The percentage change formulation normalizes for factors such as household size; composition and activity level allow us to interpret the coefficients as elasticity's.

For each upazilla we calculated the change of every variable between the year 2006 (before the price hike) and 2008 (after the price hike). After that we attempt to construct a regression model for rice consumption in the sample areas of Bangladesh. The considered regression models are:

$$\log(rice\_cons_i) = \alpha + \beta_1 \log(rice\_price_{i)} + \beta_2 \log(n\_rice\_price_{i)} + \beta_3 \log(agri\_nm\_y_{i)} + \beta_4 \log(n\_agri\_nm\_y_{i)} + \varepsilon i \quad (2)$$

and

$$\log(rice\_cons_i) = \alpha + \beta_1 \log(rice\_price_{i)} + \beta_2 \log(n\_rice\_price_{i)} + \beta_3 \log(agri\_y_{i)} + \beta_4 \log(n\_agri\_y_{i)} + \varepsilon i \} \quad (3)$$

where, i= 1……n; n = 1500

Here β_1.β_6 are the coefficients or multipliers that describe the size of the effect the independent variables are having on our dependent variable, and α is the value of the dependent variable predicted to have when all the independent variables are equal to zero.

2.3.1 Regression Results

Table-9: Rice consumption response to the price variation with nominal income
(in percentage change)

Coefficients	Estimate	Std. Error.	t-value	Pr(>|t|)	[95% Conf. Interval]	
log(rice_price)	-.744	.028	-26.14	0.00	-.801	-.688
log(n_rice_price)	.553	.064	8.54	0.00	.425	.681
log(agri_nm_y)	.456	.041	11.08	0.00	.374	.537
log(n_agri_nm_y)	-.245	.057	-4.26	0.00	-.359	-.131
Intercept	11.95	3.09	3.86	0.00	5.81	18.09

*Number of observations = 1500 ; R-squared = 0.592; Adj R-squared = 0.586

Table-10: Rice consumption response to the price variation with real income
(in percentage change)

Coefficients	Estimate	Std. Error.	t-value	Pr(>|t|)	[95% Conf. Interval]	
log(rice_price)	-.474	.048	-9.69	0.00	-.571	-.377
log(n_rice_price)	.625	.059	10.55	0.00	.508	.743
log(agri_y)	.495	.036	13.62	0.00	.423	.567
log(n_agri_y)	-.198	.051	-3.83	0.00	-.301	-.095
Intercept	7.975	2.79	2.85	0.005	2.43	13.51

** Number of observations = 1500; R-squared = 0.603; Adj R-squared = 0.584

The tables 9 and 10 represent the log-log regression results which include rice consumption as dependent variable and price of rice, price of non-rice, agricultural nominal and real income, non-agricultural nominal and real income as independent variables. The estimated regression results are:

$$\log(\widehat{rice\_cons}) = 11.95 - .744\log(rice\_price) + .553\log(n\_rice\_price) + .456\log(agri\_nm\_y) - .245\log(n\_agri\_nm\_y) \quad (4)$$

And

$$\log(\widehat{rice\_cons}) = 7.97 - .474\log(rice\_price) + .625\log(n\_rice\_price) + .495\log(agri\_y) - .198\log(n\_agri\_y) \quad (5)$$

In order to interpret the regression coefficient's estimates correctly, Gauss-Markov assumptions need to be held constant. Our coefficient's estimates are statistically significant with very small standard errors showing less variation and relatively large absolute value of the t-statistic. The variance inflating factors (VIFs) of these coefficients ranges from 2.5 to 4.6 which generally seen as indicative of the absence of severe multi co-linearity or simultaneity. We are also able to hold all other independent variables constant in the regression results while interpreting the expected impact on rice consumption by an independent variable.

Looking at the regression results presented in Tables 9 and 10, we find that consumption of rice is expected to decrease by 0.744 percent and 0.474 percent as price of rice is increased by 1 percent. This follows the law of demand and we are observing a normal behavior. However, rice consumption is expected to increase by 0.456 percent and 0.495 percent when agricultural nominal income and real income is increased by 1 percent. So for the people of agricultural profession (the marginal land owner or subsistence producer in our sample) law of demand holds and rice becomes a normal good. On the other hand, rice consumption is expected to decrease by 0.245 percent and 0.198 percent as non-agricultural nominal income and real income is increased by 1 percent. So for non-agricultural profession (mainly the day labor) rice becomes an inferior good (negative relationship with income). We know that all Giffen good is an inferior good. Therefore if we were able to separate the rice consumption of the non-agriculture group from that of the agriculture group then maybe we would have found a Giffen behavior for these classes of people. However we didn't do it as the primary survey conducted by Helen Keller International and Institute of Public Health Nutrition (HKI/IPHN) was not done separating these two groups.

In both regressions, consumption of rice is expected to increase by 0.553 percent and 0.625 percent as price of non-rice is increased by 1 percent. Therefore there is a significant causal positive relationship between these two variables. This finding also indicates a possible Giffen behavior among these households as they are increasing the consumption of rice to accommodate the higher rice price and non-rice price subject to their subsistence concerns. Thus, we can conclude that these models explain the percentage change in rice consumption pattern in the selective areas in a better way.

4. Conclusion

In this paper, we examine the practical evidence of the positive relationship between the consumption of rice and increasing price which is addressed as Giffen behavior in the real world context of Bangladesh. We found well-built, clear evidence about poor households' dealings with the price hike among six districts (Barguna, Comilla, Jamalpur, Jhenaidaha, Moulvibazar, and Naogaon) in Bangladesh. This result has important policy implications as food price is very sensitive for the poor people in Bangladesh. The most noticeable one is the pattern of substitution away from nutritious foods to less nutritious but calorie-rich food rice, and the results suggest that programs designed to improve nutrition may have little impact for this subsistence class of consumer.

Bangladeshi policymakers are often concerned that households highly dependent on staple goods may experience nutrition declines when the prices of those goods increase and a number of programs such as various safety net measures, fair price cards, rationing, Open Market System (OMS) operations are designed to protect against this very possibility. Our results suggest that a certain portion of these highly dependent households are able to shield their staple consumption against such price changes quite well. Therefore critically identifying the households which are highly dependent on staple is important to implement those programs more effectively.

Endnotes

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