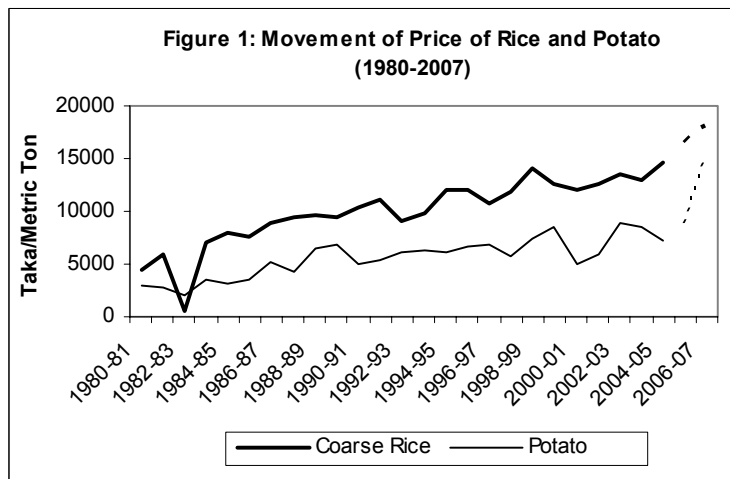


## POTATOES for RICE: A PREAMBLE

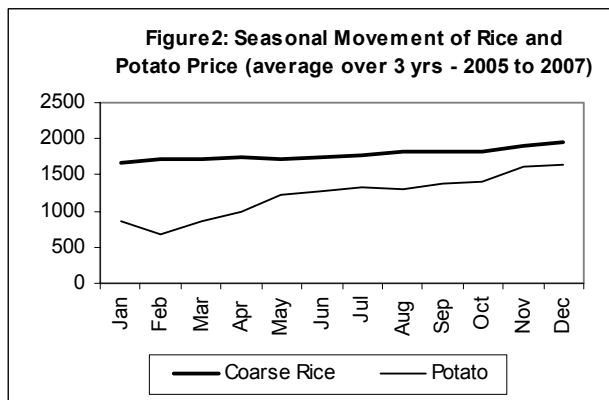
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In the face of domestic and worldwide shortage of food production, food prices in Bangladesh have risen rapidly and beyond the affordability of the commons. Rice price increase is what has affected them the most, since it has posed a high threat to the food security of the people, particularly the poor. Wheat has long served as the substitute of rice for the people in Bangladesh but in the background of recent price rise of both rice and wheat at the same time, one might be tempted to look for other substitutes for rice, especially for the poor people whose real income is under serious pressure due to the price hike. Potatoes have traditionally been considered as a vegetable and rice as a cereal. But with rich starch and other nutritional contents, comparatively lower price and cooked in different forms potato may well serve as a substitute for rice.

Historically (1971-2006) rice has dominated the production of foodgrains (rice, wheat, maize) with a massive average share of 94% and potato has dominated production of vegetables with an average share of about 66% (Agricultural Statistics). As is depicted in Figure 1, the prices of potato and coarse rice (widely consumed by poor people) seem to be correlated, moving together along the period of 1980-81 to 2006-07. Figure 2 reflects



Source: The figures for the prices up to 2004-05 were obtained from Agricultural Statistics and provides national average while the dashed parts represent figures obtained from Department of Agricultural Marketing, covering a few urban markets.



Source: Department of Agricultural Marketing

the fluctuation of potato price against a pretty stable rice price over different months of a year. This is expected as rice price is dominated by world rice price which generally shows little seasonal variation. In contrast, potato consumption is mostly met out of domestic production and so its price is expected to fluctuate over different seasons and may at times pose problems for poor.

Both the agricultural commodities (rice and potato) are very important as far as the economy of the country is concerned and any new dynamics in between these two will have substantial implications for policy making and the economy as a whole. This paper looks at the empirics at micro level as to whether potatoes are actually considered as a substitute for rice by lower income group. We use simple econometric tools on a simple model; the purpose of the paper remains to initiate discussion and further research in this area.

A log transformed demand function at household level, derivable from a Cobb-Douglas consumption function is used for the study. In log linear form it stands as:

$$\text{Ln}(Q_p) = \alpha + \beta_1 \text{Ln}(P_r) + \beta_2 \text{Ln}(P_p) + \beta_3(Y) + \beta_4 \text{Ln}(\text{HHS}) + \epsilon$$

Where,  $Q_p$  = Quantity of potato consumed per capita

$P_r$  = Price of rice

$P_p$  = Price of potato

$Y$  = Per capita income of households

$\text{HHS}$  = Adult equivalent household size calculated as  $\text{HHS} = 0 (M_{\text{age}<2\text{yrs}}) + 0.5 (M_{2\leq\text{age}<10}) + 1 (M_{10\leq\text{age}})$  where  $M$  is the number of household members in the given age range.

Three sets of cross sectional data are used for the analysis, BIDS-PKSF<sup>1</sup> Round 1 household survey data, BIDS-PKSF Round 3 household survey data and HIES<sup>2</sup> 2000. These data sets cover the period of 1997-98, 1999-2000 and 2000 respectively and thus we can also have a look at the relationship over the three years. The two rounds of BIDS-PKSF surveys covered matched sample of households. While HIES 2000 data covers the whole country, BIDS-PKSF data were largely rural. Potato consumption data in Round 3 are available for only 6 regions namely Panchagar, Kurigram, Shahjadpur, Netrokona, Chittagong and Bogura and so we confine our analysis on households in these 6 regions only, as far as BIDS-PKSF data (of both rounds) is concerned. HIES 2000 data cover 7440 households, 5040 of them being rural and 2400<sup>3</sup> of them being urban. BIDS-PKSF data of Round 1 cover 1344 households while that of Round 3 cover 1368<sup>4</sup> households. While calculating household size in BIDS-PKSF data, only those members are counted who staid in the household for 90 or more days in the last six months (counted from the day when the survey was carried out). This is necessary to ensure that the members had substantial shares in the household consumption.

We run simple OLS regression on the above model; at first on all households of each data set and then on four different income groups (of each data set) based on income quartiles.  $\beta_1$ , the own price elasticity of potato is expected to be negative while  $\beta_2$ , the cross elasticity of potato with rice takes a positive value if potato is indeed a substitute for rice.  $B_3$  takes a positive value if potato is treated as a normal good and negative if it is an inferior good. We do not have any prior notion as to what sign  $B_4$  is supposed to take.

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<sup>1</sup> BIDS: Bangladesh Institute of Development Studies; PKSF: Palli Karma Shahayak Foundation

<sup>2</sup> HIES: Household Income and Expenditure Survey

<sup>3</sup> 3 observations were excluded for invalid data

<sup>4</sup> Even though BIDS-PKSF had matched samples, higher figure in Round 3 reflect splitting of some households surveyed in Round 1.

The regression results for the three data sets- at aggregate level and four income groups in each data set are tabulated below.

**Table 1: Regression Results at Aggregate Level**

Period	Constant	P <sub>r</sub>	P <sub>p</sub>	Y	HHS	R <sup>2</sup>
1997-98 (BIDS-PKSF: R1)	4.91 (9.00)	-1.35 (-7.05)	-1.08 (-14.43)	0.06 (2.35)	0.53 (8.88)	0.22
1999-2000 (BIDS-PKSF: R3)	-2.27 (-4.00)	0.57 (2.40)	0.05 (0.28)	0.04 (1.93)	-0.60 (-11.32)	0.22
2000 (HIES 2000)	-1.09 (-8.68)	0.63 (13.55)	-1.25 (-37.85)	0.25 (15.58)	-0.30 (-16.40)	0.24

Figures in parenthesis are *t* values; estimates for which  $|t| > 1.96$  is considered as significant.

As expected price elasticity of demand of potato is found to be negative wherever the coefficients are found significant. The coefficient is marginally positive but statistically insignificant in 1999-2000 data. Cross price elasticity of potato with rice, on the other hand shows an interesting picture. Rice and potato seem to be complementary goods in the first set of 1997-98 data, with a negative cross elasticity, but becomes supplementary in the next two periods, with positive cross elasticities. A closer look into different income groups will enable us to assess if rice-potato relation varies across income groups.

**Table 2: Regression Results for Four Income Quartiles**

Period	Income Quartile	Constant	P <sub>r</sub>	P <sub>p</sub>	Y	HHS	R <sup>2</sup>
1997-1998 (BIDS-PKSF: R1)	I	7.34 (5.53)	-1.88 (-4.36)	-1.19 (-6.19)	-0.05 (-0.75)	0.46 (3.08)	0.20
	II	6.60 (2.90)	-2.18 (-7.42)	-1.02 (-9.12)	0.12 (0.55)	0.46 (1.88)	0.36
	III	3.46 (0.86)	-1.39 (-2.90)	-1.19 (-6.71)	0.22 (0.59)	0.71 (1.78)	0.18
	IV	1.06 (0.79)	-0.37 (-1.07)	-0.96 (-7.42)	0.15 (1.49)	0.69 (5.31)	0.20
1999-2000 (BIDS-PKSF: R3)	I	-2.06 (-2.07)	0.74 (2.06)	0.07 (0.26)	-0.03 (-0.83)	-0.73 (-6.68)	0.25
	II	3.42 (1.18)	0.90 (1.32)	-0.45 (-1.72)	-0.49 (-1.84)	-1.24 (-4.68)	0.33
	III	-0.87 (-0.34)	-0.08 (-0.19)	0.70 (2.13)	-0.10 (-0.44)	-0.63 (-2.76)	0.18
	IV	-1.30 (-0.63)	0.15 (0.22)	-0.27 (-0.52)	0.13 (0.84)	-0.64 (-3.55)	0.18
2000 (HIES 2000)	I	-4.38 (-8.01)	1.11 (8.63)	-1.50 (-21.12)	0.71 (7.59)	-0.27 (-6.12)	0.26
	II	-0.48 (-0.44)	0.68 (7.03)	-1.32 (-19.40)	0.18 (0.99)	-0.39 (-9.64)	0.23
	III	-1.26 (-1.56)	0.53 (6.71)	-1.20 (-19.94)	0.33 (2.51)	-0.31 (-9.58)	0.22
	IV	1.59 (5.53)	0.23 (3.15)	-0.98 (-16.32)	-0.08 (-2.46)	-0.22 (-7.90)	0.15

Figures in parenthesis are *t* values; estimates for which  $|t| > 1.96$  is considered as significant.

In the first period, price elasticity of potato is found significantly negative in all income groups. People in the highest income group has the lowest elasticity. Cross price elasticity is negative in all income quartiles (though not significant in the richest quartile), reflecting the complementarity of potato with rice. The cross elasticity decreases with higher income, as one would expect. However, the second poorest group shows the highest elasticity.

Moving on to the next period, we find that own price elasticity estimate loses its significance in three of the four income groups. But it takes a positive value where it is found significant. On the other hand, we find cross elasticity of potato with rice take a positive value in the poorest quartile now, signifying the introduction of substitutability of potato for rice. However, this substitutability is seen in only the lowest income group and not in others where the coefficient is found insignificant.

Finally, when we move to the HIES data of 2000, we find own price elasticity of potato negatively significant in all income quartiles and also consistently decreasing with higher income. The cross elasticity of potato is found positively significant in all income quartiles, reflecting strong substitutability of potato for rice. The coefficient value increases with lower income, as expected. Marginally negative and significant coefficient for income per capita in the richest quartile indicates that potato is treated as an inferior good by this group.

At this point, it is worth looking deeper into the HIES data since it establishes a clear substitution of rice and potato. As mentioned earlier, HIES data covers both urban and rural households and so we now run separate regressions on total urban and rural households and then on four income quartiles from each group.

**Table 3: Regression Results on Rural and Urban Households of HIES2000**

Region	Income Quartile	Constant	P <sub>r</sub>	P <sub>p</sub>	Y	HHS	R <sup>2</sup>
Urban	-	0.80 (4.01)	0.04 (0.54)	-0.93 (-17.17)	0.10 (4.82)	-0.28 (-10.08)	0.15
Rural	-	-2.02 (-11.54)	0.79 (13.12)	-1.36 (-33.59)	0.39 (16.24)	-0.31 (-13.42)	0.28
Urban	I	1.14 (1.56)	-0.20 (-1.05)	-1.09 (-9.66)	0.22 (1.97)	-0.37 (-5.80)	0.19
	II	-0.81 (-0.61)	0.02 (0.17)	-1.01 (-9.89)	0.39 (1.80)	-0.24 (-4.04)	0.17
	III	1.30 (1.19)	0.10 (0.79)	-0.60 (-5.55)	-0.13 (-0.81)	-0.16 (-3.06)	0.05
	IV	2.75 (5.44)	-0.07 (-0.52)	-0.95 (-8.50)	-0.12 (-2.11)	-0.31 (-6.59)	0.17
Rural	I	-5.76 (-7.90)	1.10 (6.47)	-1.61 (-18.22)	1.01 (8.08)	-0.28 (-4.92)	0.28
	II	-3.66 (-2.41)	0.91 (7.60)	-1.45 (-17.82)	0.66 (2.54)	-0.33 (-6.70)	0.27
	III	-3.85 (-3.00)	0.70 (6.31)	-1.32 (-16.60)	0.73 (3.48)	-0.37 (-8.50)	0.25
	IV	0.02 (0.05)	0.57 (6.18)	-1.19 (-16.10)	0.09 (1.66)	-0.26 (-6.98)	0.21

Figures in parenthesis are *t* values; estimates for which  $|t| > 1.96$  is considered as significant.

From the above table we find that the substitutability of potato for rice is not found significant in the urban households but can be seen in the rural households, where one would expect the income to be low. This is also supported by the separate regressions run on income quartiles on urban and rural households, where we see that in all urban income groups the substitutability is found insignificant whereas in all rural households it is highly significant. The coefficient decreases in magnitude as we move to higher income groups, as well.

As we have found out, potatoes were initially treated as a complementary commodity to rice, as is also supported by historical practices among researches in the subject. But with time it seems to be turning into a substitute good, especially to the poor and in rural areas, possibly due to rising rice prices. This calls for a new dimension to policy making as far as providing food security to the poor is concerned. Production of potato and its price, very important for the country's economy anyway, will have to be stabilized for the sake of poor people's food security. This is particularly important when rice prices go up, since we have seen earlier that potato and rice prices tend to move together. There remains much scope for further research in this area. Further analysis should however make use of more rigorous econometric tools, account for other commodities (and their prices) and probe into consumption differences arising across regions as a result of production differences.