

A Hedonic Pricing Model of Rice for Bhutan

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Abstract—Bhutanese consumer perception towards import and domestic rice was analyzed from a survey using market price and 11 different characteristics of rice. The paper, in addition developed a hedonic model of import and domestic rice consumed in Bhutan. The paper using Ordinary Least Squares (OLS) empirically finds that there exist some relationship between price paid by consumers and the characteristics of the rice. The study finds that Bhutanese prefer paying a premium for whiteness, less foreign materials, less broken rice and stickiness for imported rice while reddish color of local rice and cohesion are significant determinants while purchasing domestic rice. Of interest is the fact that consumers derive satisfaction from the goods characteristics which has both positive and negative implicit prices. Finally, the paper gives insights into some of the future potential works to be carried in order to find consumer's preference in case of branded rice.

Keywords- Hedonic price, consumer preference, rice

I. INTRODUCTION

CONSUMERS' taste, preference, safety and acceptability of food commodities have changed a lot since the globalization of food markets. Around the world, people are becoming more aware of the quality attributes of the different products and are choosing the commodity that best suits with their preference and taste. This is true for Bhutan as well. Change in the consumer's taste has posed new challenges for Bhutanese market. The producers are increasingly facing pressure to supply those products that are highly sought for in order to stay in the market. In the rice case, consumers' taste and preference, likes and dislikes for a particular attribute, income and other socio-economic factors plays a dominating role while purchasing and consuming a particular brand of rice. Rice is a base staple in Bhutan and Bhutanese have a very strong habit of consuming rice. On an average, consumption of cooked rice is thrice a day. According to Lancaster's theory, consumers often pay a premium for the desired quality attribute of the product. In case of rice, this premium gives insight to producers and agriculturists to improve quality in case of domestic rice and import the rice with high desirable attributes in case of imported rice. Although Bhutan began formalized research in rice as early as in 1984, supply of local rice in the market has remained not very conducive in spite of encouraging yield gains for the rice farmers.

In the absence of a proper study on rice attributes and quality, Bhutanese consumers are at direct loss. Rice quality and price is one of the most important household decisions and as consumers are paying the premium for extra quality attributes, it is important to study and report on the different characteristics of rice found in the market at present.

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1.1 Bhutan- Country Profile

Bhutan is a small country situated in the eastern Himalayas, with an area extending over 38,394 square kilometers. It shares its borders with China in the north and India in the south. Bhutan started its maiden voyage towards modernization only in late 1960s after opening its borders with India. India has been the main ally and development partner since then. Bhutan's population was estimated to be 672,425 (Population and Housing Census, 2005). It reported that 69.1 percent of the residences were living in rural areas while the balance 30.9 percent was in the urban areas.

1.2 Demand for rice

According to the study on rice markets in Bhutan (Ghimmery et.al, 2007) on average rural household consumption of rice was 1,632 kg per year (172 kg/year per persons). Urban areas per capita consumption of rice would be higher because of the lower diversity of staple food. According to Bhutan Living Standards Survey (BLSS, 2007), the mean (nominal) monthly household food consumption expenditure for Bhutan was estimated at Nu.5, 423.00. Out of the total expenditure on food items, rice in rural area accounted for the second highest only second to dairy products while expenditure on rice in the urban areas was the fifth in order. The table below shows the details:

TABLE I
STRUCTURE OF FOOD CONSUMPTION BY AREA (PERCENT), 2007

Food Consumption Major Item	Urban	Rural	Bhutan
Rice	8.5	15.4	12.8
Cereals, cereals preparation and pulses	8.5	9.3	9.5
Dairy products	15.7	18.4	17.3
Fish	3.0	3.1	3.1
Meat	10.3	6.8	8.1
Fruits	5.5	3.5	4.2
Vegetables	11.3	9.6	10.2
Tea and coffee	1.4	1.6	1.5
Cooking oil	4.4	5.1	4.8
Spices and seasoning	6.4	7.2	6.9
Alcoholic Beverages	2.2	4.8	3.8
Non-alcoholic Beverages	3.4	1.6	2.3
Food consumed outside the home	19.5	13.2	15.6
All items	100.00	100.00	100.00
Estimated value of total food consumption (Nu. Millions)	255	425	681

Source: Bhutan Living Standard Survey, 2007

1.3 Location and season for rice production

Rice is produced domestically and the supply gap is filled by the imports only from India. The rice imported from India is subsidized and cost less than the domestic rice.

Rice is cultivated mainly in six dzongkhags (districts) namely, Paro, Punakha, Wangdue, Tsirang, Samtse and Sarpang. These districts elevates from the high (1600-2600m), medium (700-1600) and low (700 m and below) altitudes. Together these Dzongkhags produces around 90% of the domestic rice. In Bhutan, there are two crop seasons for rice cultivation. The first crop is cultivated between July 15 to 30 and harvested during October to January. The second crop which is also called the dry season crop is cultivated from February to April and harvested during April to June.

1.4 Domestic consumption and supply

Rice is the single most consumed staple in the country. Bhutanese on average consumes rice three times a day. The consumption of rice provides necessary nutrients and calories. It is also used in production of local wine which is used in important ceremonies and consumed during special occasions. The consumption of rice has been increasing steadily with the growth of the population. The BLSS, 2007 estimated that rural Bhutanese on average consumed rice more than the urban since urban population has a larger dimension of food to choose from. Rice has been replacing maize as a main food especially in the eastern areas. One reason for this could be the adoption of high yielding varieties introduced by the agriculture ministry which has improved yield of rice considerably. As mentioned earlier, the supply gap of the rice is met by the imports of rice from India. The government agency responsible for importing and supplying rice to the retailers is the Food Corporation of Bhutan (FCB) which is under the Ministry of Agriculture and Forests.

Imported rice is supplied mainly through the channels of many fair price shops operating all over the country which sells the rice at a fixed price. The aim for keeping the price constant is to provide villagers and small farmers in the rural areas supplied with rice during off seasons at affordable prices. Imported rice is also sold in retail shops other than the fair price shops. These retailers sell rice at a higher profit margin.

II. THOERITICAL FRAMEWORK AND REVIEW OF LITERATURE

2.1 The Hedonic Price Model - Theoretical Framework

Theoretically, hedonic price means the implicit prices of a commodity based on the characteristics or attributes that the commodity possesses. The term 'hedonic' is often referred to one deriving satisfaction through consumption of the good at hand. Long before their concept was understood, hedonic methods were employed in price indices (Triplett, 1986). Although Bartik (1987) claimed that hedonic price theory was first contributed by Court in 1941, Colwell and Dillmore (1999) stated that Hass's study implemented hedonic pricing theory more than 15 years before Court.

The major contribution towards the theoretical work on hedonic prices is due to Lancaster's (1966) New Consumer Theory and the extended model by Rosen (1974). The models were based on imputing prices of the goods based on the observed prices and the characteristics of the good.

While Lancaster's model is straight forward because it assumes a linear relationship exists between the price of goods and the characteristics contained in those goods, Rosen's model, in contrast assumes a non-linear relationship between price and the imbedded characteristics of the good. This means that a nonlinear price function implies that the implicit price is

not a constant, but a function of the quantity of the attribute being bought, and, depending on the actual functional form of the equation, on the quantities of other attributes associated with the good as well.

Rosen's model has two distinct stages. The initial stage serves to estimate the marginal price for the attribute of interest by regressing the price of a commodity or good on its attributes. The first stage develops a measure of the price, but does not directly reveal the inverse demand function. The second stage estimation is to identify the inverse demand curve or the marginal willingness to pay function, derived from the implicit price function estimated in the first stage.

One of the major differences between neo-classical theory and hedonic theory is that the former is based on the quantity while the latter is based on the quality aspect. Often in the real world, we are confronted with products with heterogeneous nature which demands a more detailed study than mere observation of the products.

The theory of basing the demand of a product is called hedonic pricing theory. The main idea is to link the price of the product in relation to its implicit attributes or quality. In this chapter, we first explore hedonic price theory and present the basic distinction between neo-classical model and the hedonic theory after which the idea is used to explore on how price is determined by quality of the product.

III. THE SURVEY DESIGN

For the purpose of this study, the study area was selected to be Thimphu, the capital city of Bhutan. The city was divided into urban and rural part along with locating it as north, south, east and west. The consumer survey from 400 randomly selected respondents from Thimphu was conducted for the purpose of the study with the aid of structured questionnaire. The main purpose and intention for the survey was explained in detail before giving the questionnaire to the respondent. The questionnaire contained important socio-economic questions asking for the respondent's details such as age, gender, educational level, family size, location of residence apart from asking them to rate from the scale of 1 to 5 on rice characteristics. (1 being abundance of the stated quality to 5 being the lowest). Consumers were asked to rate on the 11 different rice attributes (see table 3.1). After which consumers were asked to rate against local and imported rice once again. Since some respondents were reluctant to provide their names on the questionnaire, it was kept optional. As far as possible, the person who actually bought the rice in a household was chosen for the interview because they were in the right position to state the correct price of rice along with the stated attributes. An important aspect of the survey was to ask the respondent's family monthly income and the price of rice they were paying at present. Other questions asked the place of purchase and whether they would increase their consumption and change the quality if their income increased besides asking what other qualities they considered most important. Consumers were also asked to state which variety of rice they bought.

To ensure the validity of data, tests for multi-collinearity was conducted by using two methods; Covariance Matrix and Variance Inflation tests. Breusch-Pagan test was used to test for heteroscedacity. This test will ensure that none of the variables are correlated to each other. If a correlation between one of the variables is detected, then the variable that is insignificant will be dropped out of the model.

3.1 Rice prices and characteristics

The price of the different rice varieties were collected through the structured survey questionnaire as they provided crucial market information and these prices would become the dependent variable in the hedonic model. The market price of the rice sold was the present market price and they reflected the degree to which customers were willing-to-pay for the particular type of rice. The market price of rice was obtained from respondents who expressed the price as an average of the prices of rice that they bought. Also the prices of the imported rice were obtained from the FCB and retailers to authenticate the market price. The table 4.2 shows the rice mean price and its standard deviations in regions and across location.

TABLE 4.2
RICE MEAN PRICE AND STANDARD DEVIATION IN NU/KG

Region	South	North	East	West	All Thimphu
Household location					
Rural	41.07 (21.90)	35.26 (18.21)	42.64 (22.44)	42.18 (31.54)	41.03 (24.80)
Urban	40.34 (16.35)	36.99 (18.68)	45.55 (22.57)	38.74 (21.61)	40.36 (19.41)
Rice origin					
Local	54.97 (22.40)	49.07 (25.28)	69.6 (18.99)	69.82 (31.65)	59.58 (25.28)
Imported	34.49 (10.60)	31.56 (11.63)	31.64 (9.31)	28.87 (12.32)	32.09 (11.05)

Source: Author's work

Independent sample t-tests indicated that there is a statistically significant difference between the mean price of rice for rural and urban areas. This may be because of the proximity of location of market and higher income of the urban people as compared to the rural people. The result also shows that a statistically significant difference is present between the mean price of local and imported rice. The fact that the mean price of the local rice (Nu.59.58/kg) is higher than the imported rice (Nu.32.09/kg) explains this variation. However, because of the subsidy on imported rice, it is difficult to state that the quality of imported rice is responsible for its low price.

3.2 Rice varieties

An important aspect of the study was to study the existing rice varieties that are available in the market for both local and imported rice. All together, the study covered 13 different rice types with 11 imported and 2 local types which were available in the market. The name and physical characteristics of these rice types are detailed in the table below.

3.3 General descriptive analysis

The main purpose of this section is to give the general descriptive from the data that was collected for the purpose of this study. The section is divided into three parts. The first part describes the data on the import rice consumers, their general preference while the second part gives the details on local rice consumers. Finally, the last part summarizes the data.

TABLE 4.3.
TYPES OF RICE SOLD IN THE BHUTANESE MARKET WITH THEIR SALIENT FEATURES

Commercial name of the rice	Country of origin	Salient features
Rice Basmati 5 star	India	Slender, long grain, aromatic rice
Bhog rice	India	Slender, small sized aromatic rice
Rice boil	India	Pre-boiled rice usually yellowish in color
Rice special 551 new	India	Medium sized grain, pack rice
SK GOLD	India	Medium sized, stone free rice
QUEEN RICE	India	Medium sized stone free rice
Rice mansuri new	India	Medium sized stone free rice
Rice BN 20	India	Medium sized stone free rice
Rice mango new	India	Medium sized stone free rice
Rice basmati boiled king	India	Small sized parboiled basmati rice
Rice raw	India	Ordinary rice
Red rice local	Bhutan	Short grain rice sold "brown" with the reddish brown bran layers still on
White rice local	Bhutan	Short grain rice sold "white" with the bran layers still on

Source: Author's work

3.4 Imported rice

The questionnaire was collected from a total of 277 respondents from consumers who were purchasing import rice. There was a total of 158 male respondents (57.03%) and 119 female respondents (42.96%) in this category. 79 out of 277 (28.51%) was based in rural area and the balance 198 (71.48%) was living in the urban area. The family size ranged from the smallest of 1 to the maximum of 14. The respondents had at least a primary education. The income earnings ranged from Nu.0-Nu.40000 and above. The age ranged from 17 years to 63 years.

3.5 Local rice

In case of local rice, there were a total of 123 respondents from whom the different rice characteristics was collected. From the 123 respondents, 45 were male (36.58%) and 78 were female respondents (63.41%). Out of the total, 31 (25.20%) respondents were based in rural area and the balance 92 (74.79%) were based in urban area. For the consumer of local rice, the family size ranged from 1 to 10. 4 respondents did not have any formal education. The age ranged from 17 to 68.

TABLE 4.5
RICE CHARACTERISTICS AND CONSUMERS' RATINGS

Rice characteristics	Summary breakdown in Percent(imported rice)	Summary breakdown in Percent(Local rice)
Color (whiteness)	6.86 % rated very white for rice they were purchasing at present at the given price. 20.57% rated white 25.27% rated average 35.74% rated poor 11.55% rated very poor	12.63 % rated very red for rice they were purchasing at present at the given price. 7.94% rated red 9.02% rated average 5.77% rated poor 9.02% rated very poor
Foreign Materials/hulls	20.93% rated absent/very few of foreign materials 26.71 rated few 20.93% rated average 20.93% rated high 10.46% rated very high	13.71% rated absent/very few of foreign materials 28.45% rated few 19.51% rated average 7.58% rated high 4.06% rated very high
Rate of breakage	16.96% rated very low 24.90% rated low 34.65% rated average 17.68% rated high 5.77% rated very high	23.57% rated very low 26.01% rated low 18.69% rated average 26.01% rated high 5.69% rated very high
Shape of grains	5.77% rated long and slim 18.77% rated long and fat 37.18% rated average 23.82% rated short/round 14.44% rated broken	17.88% rated long and slim 21.95% rated long and fat 39.02% rated average 14.63% rated short/round 6.50% rated broken
Ease of cooking	9.38% rated very quick 16.96% rated quick 34.29% rated average 25.63% rated slow 13.71% rated very slow	11.38% rated very quick 16.26% rated quick 34.95% rated average 21.95% rated slow 15.44% rated very slow
Cohesion	6.85% rated very sticky 23.82% rated sticky 32.12% rated average 23.46% rated weakly sticky 13.71% rated not sticky	14.63% rated very sticky 15.44% rated sticky 24.39% rated average 32.52% rated weakly sticky 13.00% rated not sticky
Taste	8.66% rated very good 22.74% rated good 21.66% rated average 24.18% rated poor 22.74% rated very poor	16.26% rated very good 17.88% rated good 19.51% rated average 17.88% rated poor 28.45% rated very poor
Aroma	13.71% rated very good 23.10% rated good 28.51% rated average 19.85% rated no aroma 14.80% rated bad smell	7.31% rated very good 32.52% rated good 21.13% rated average 20.32% rated no aroma 18.69% rated bad smell
After cooking keeping qualities	10.46% rated very long 32.85% rated long 28.25% rated average 19.49% rated short 9.02% rated very short	9.75% rated very long 18.69% rated long 28.45% rated average 18.69% rated short 24.39% rated very short
Swelling capacity	10.10% rated very good 29.96% rated good 33.57% rated average 20.21% rated poor 6.13% rated very poor	18.69% rated very good 22.76% rated good 34.14% rated average 9.75% rated poor 14.63% rated very poor

Texture	15.52% rated very tender 33.57% rated tender 20.57% rated average 24.54% rated hard 5.77% rated very hard	8.13% rated very tender 29.26% rated tender 26.82% rated average 18.69% rated hard 17.07% rated very hard
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Source: Author's work

From the general descriptive we can see some of the important differences between the import rice and local rice based on the consumers' perspective. The major differences are discussed here. For the imported rice, the whiteness of the rice is important while it is very poor. The Indian rice characteristic for whiteness seems to play a significant role in driving consumer's perspective for imported rice. In contrast, for the local rice, consumers reported that the rice color was significantly red which they were purchasing at present. Consumers were asked to rate on their views regarding the foreign materials (unwanted things like rat waste, hair, stone, etc.), almost 46% reported between 'very few' and 'few' in the imported rice, whereas for the local rice, 42% reported between 'very few' and 'few.' The imported rice has good durability because the consumers reported the rate of breakage as 'very low' and 'low' to 'average.' Similarly, for local rice it is the same case but there are also some respondents reporting that the rate of breakage is 'high.' 37.18% of consumers who bought imported rice for consumption rated average and 23.82% rated short/round. Majority of consumers for local rice reported average for the shape. 34.29% rated 'average' for the ease of cooking and 25.63% rated 'slow' in the imported rice case. While for the local rice, 16.26% rated 'quick', 34.95% rated average and 21.95% rated 'slow'. There is an equal representation for sticky and not sticky in imported rice. For local rice, majority respondent reported 'weakly sticky'. Only 8% respondents buying imported rice reported taste as 'very good.' Local rice scored almost double than the imported rice, suggesting that taste of local rice is significant for respondent consuming local rice. Aroma had somewhat equal rating for both categories of rice. When it came to after cooking qualities, imported rice and local rice did not have much difference. 10.10% rated 'very good' 29.96% rated 'good', 33.57% rated 'average' and 20.21% rated 'poor' for imported rice and 18.69% rated 'very good' 22.76% rated 'good' and 34.14% rated 'average' for local rice. For tenderness of imported rice 33.57% rated 'tender' whereas 29.26% rated 'tender' in case of local rice.

3.6. Empirical estimation of hedonic price function

In this study, the assumptions regarding the consumer choice of rice attributes is based on Griliches (1961) model of quality change and further deduced for empirical estimation. It is assumed that there is a functional relationship between the good's price P_r and its characteristics vector x in the form of the equation $P_r = f(x)$.

The reduced form of the hedonic price function for empirical estimation takes the form

$$P_r = \sum_{i=1}^{11} \beta_{ir} x_{ir} + \varepsilon \tag{3.2}$$

This equation can be rewritten as follows with each representing every one of the eleven rice attributes as defined in table 3.1;

$$P_r = \alpha + \beta x_{1r} + \beta x_{2r} + \dots + \beta x_{11r} + \varepsilon \quad (3.3)$$

Where P_r is observed market price of rice and ε is the stochastic error term. P_r the dependent will vary for the different rice characteristics. The dependent variables x_{ir} would explain variance in the rice price and the parameter β_{ir} gives the implicit value of rice grain characteristics.

The attributes considered for evaluation in this research have been listed on table 3.1.

TABLE 3.1
EXPECTED RELATIONSHIPS BETWEEN PRICE AND RICE ATTRIBUTES

Grain Characteristics	Survey Ranking	Expected effect
1. Impurities	1-5 (very few to high)	positive
2. Color	1-5 (white to red)	positive
3. Rate of breakage	1-5 (low to high)	negative
4. Shape of grains	1-5 (long to short)	positive
5. Ease at cooking	1-5 (cooks fast to takes long)	positive
6. Cohesion after cooking	1-5 (very sticky to not sticky)	positive
7. Taste	1-5 (good to bad)	negative
8. Aroma	1-5 (good to bad)	negative
9. Grain size after cooking	1-5 (long to short)	negative
10. Swelling capacity	1-5 (swells to does not swell)	positive
11. Grain texture	1-5 (tender to hard)	positive

IV. RESULTS AND DISCUSSION

The imported rice were sold by different entities like the FCB, FCB fair price shops, retail shops (usually general shops selling groceries all together), and local rice was sold in open sack in the centenary farmer’s market and also in some shops. The price of the imported rice ranged from Nu.12 to Nu.75 while local rice price ranged to Nu.11.6 to Nu.120.

Before coming to the regression analysis part, it is important to describe the rice characteristics in detail. 11 rice characteristics were chosen to form the independent variables of the hedonic regression model as mentioned earlier. Due to resource and time constraints, only the observable physical characteristics were considered and these quality attributes were collected after reviewing literature about rice hedonic models (Mhlanga.S, 2010). The rice characteristics are detailed in table 4.4. Since rice is a heterogeneous product with several different characteristics and price, it was necessary to run separate regressions for local and imported rice. The table below shows the summary statistics of the dependent and independent variables of the hedonic pricing model of rice along with other socio-economic variables. Explanatory variables

Respondents were asked to rate the rice variety that they were purchasing on a scale of 1-5 according to the quality characteristics that they thought was affecting the price. Quality in this context was rated using a cardinal scale from 1-5 (1=good,3=average, 5=bad). The rice quality was assessed by 11 quality attributes which are detailed in table 4.3. If a respondent felt that there was abundance presence of a

particular quality; he/she would give a rating of 1 and otherwise.

Of the randomly selected sample, there seems to be perfect representation of the population with 203 male respondents (50.75%) and 197 female respondents (49.25%). The mean age is 34.665 years suggesting that a young population especially consisting of office goers and private business workers are residing in Thimphu. This is in agreement with the overall national statistics of a young population consisting of 62.3% of the total population who are in the age bracket of 15-64 years (Population and Housing Census of Bhutan 2005).

Of the 400 total sample of respondents, 290 (72.5%) were living in urban area whereas the remaining 110 (27.5%) were based on a rural setting. The area falling outside the boundaries of the city lap plan was considered as a rural area for this particular study. The majority of the respondents had received some kind of formal education and was able to read the questionnaire and write down on their own.

TABLE 4.5. DISTRIBUTION OF THE RESPONDENTS BY LOCATION, REGION AND RICE TYPE

Rice type	South	East	North	West
Imported	93	74	62	48
Urban	71	64	40	23
Rural	22	10	22	25
Local	41	31	32	19
Urban	35	25	22	10
Rural	6	6	10	9

Source: Author’s work

An interesting finding from the study was that the female respondent bought local rice and preferred local rice more than the male counterpart. 78 female respondents (19.5%) preferred local rice and bought local rice whereas only 45 male respondents (11.25%) bought local rice. The majority of the sample 194 (48.5%) preferred both the varieties. The majority of the sample could recognize imported rice from the local rice and 85% stated that they would not eat more rice if there income increased. This is very much in line with the trend in the developing countries. When there is an increase in income, people would usually switch on to other food substitutes and consume less of rice which is a staple food. 53.75% affirmed that they would go for a better quality if their income increased.

4.1 Empirical estimation of the hedonic price model

The model assumed a linear relationship between the dependent and its independent variables. As with ordinary least squares (OLS), the assumption of normality, consistency and constant variance was applied. The main idea behind the use of OLS is that goods are valued by the customers for their unique attributes and consumers derive utility from those characteristics. They are willing to pay for the characteristics at a given price. For the hedonic price function of rice, OLS was selected as the coefficients of the characteristics can be interpreted as their elasticity. Thus, the results can be used by various interested parties to improve the rice varieties for local rice and import rice with desirable qualities in case of imported rice. OLS estimation was used to test the hypothesis that rice price can be expressed as a function of its quality characteristics.

As the results from the hedonic regression shows, it can be stated that a great deal of the changes in the prices are because of the different quality characteristics of rice thus proving the

hypothesis that price variations are caused because of quality characteristics. T-values are used in order to see if a single independent variable can explain the variation in the price. T-values are used as a measure to find if there is a correlation between dependent and independent variables. The H_0 is rejected if the significances are close to zero. Plotting of residuals against the predictor variables were done in order to see if there is a non-linear relationship. The graph did not indicate non-linearity. Non-linearity meant that the residuals have a strong dependence between themselves as well as the explanatory variables. Tests for heteroscedasticity were conducted using Breusch-Pagan test using the F-statistics. The test conformed that there was no problem of heteroscedasticity as the independent variables are jointly significant. The variance inflation factors (VIF) was used to see if there was any correlation between the variables. The results showed that there was no evidence of such correlations among the variables.

Adjusted R-squared indicates the per cent share of the price variation that could be explained through the included variables.

4.6. INTERPRETATION FOR HEDONIC REGRESSION OF IMPORTED RICE:

As mentioned before, the average price of imported rice was significantly lower than the local rice. Prices in the urban and rural areas are not very different. This may be because of the presence of fair price FCB market outlets available in rural pockets. Overall the quality coefficients have both positive and negative relationship with respect to price. From among the variables, whiteness, breakage, shape, foreign materials, ease of cooking, and cohesion has a positive relationship with respect to price although this varies among regions. This

means that residence of Thimphu pays a premium for imported quality rice consisting about 1.21 times more for whiteness, 0.94 times for foreign materials, 0.26 times for breakage, 0.38 times for shape, 0.30 times for texture, 0.47 times for ease of cooking, and 2.48 times more for cohesion. However, the results also showed that aroma, taste, keeping qualities and swelling capacity carried a negative sign. The results show that if there is one unit decrease in the taste, aroma, keeping qualities and swelling capacity, then there would be a decrease of -0.31, -1.8, -1.6, and -0.95 decrease in the price respectively. Family size was immaterial in this study. Location was significant in all of the regions except for western region. This means that urban consumers pay higher premiums for better quality of rice (4.15). The most important factor for consumer preference for imported rice as per the analysis was cohesion of a rice quality and location of the respondents from the proximity of markets.

Consumers in the south region pays about 2.06 for whiteness, and discounts for foreign materials, breakages, ease of cooking, taste, keeping qualities and swelling capacity. This means that consumer in the south region values whiteness and is willing to pay more for whiteness factor in the rice. However, the most important variable was the texture as it is quite obvious from the table. They pay a premium of 2.45 for good texture of rice.

In the east region, all other variables have a positive relationship except for taste and keeping qualities. Only cohesion has a significant effect on price. For the north region, consumers valued cohesion and texture the most. While for the west region, the model seems to discount for shape only.

Although the overall R-squared was only about 15%, still the p-values were found to be significantly different from zero suggesting a strong relationship on the predicated and outcome variables.

TABLE 4.6. EMPIRICAL RESULTS OF THE HEDONIC REGRESSION OF RICE ON ITS CHARACTERISTICS (IMPORTED RICE)

Variable Y=PRICE	Whole Thimphu (N=277)	South (n=93)	East (n=74)	North (n=62)	West (n=48)
Whiteness	1.21 (1.97)	2.06 (1.69)	1.48 (1.12)	1.20 (0.96)	-1.21 (-0.57)
Foreign materials	0.94 (1.67)	-0.03 (-0.03)	1.47 (1.27)	1.63 (1.36)	1.55 (0.84)
Breakage	0.26 (0.42)	-0.25 (-0.24)	0.39 (0.28)	-0.48 (-0.29)	0.22 (0.11)
Shape	0.38 (0.59)	0.38 (0.30)	1.62 (1.22)	0.80 (0.71)	-3.55 (-1.98)
Ease of cooking	0.47 (0.69)	-0.59 (-0.49)	1.81 (1.16)	-1.01 (-0.79)	2.18 (1.00)
Cohesion	2.48 (3.80)	1.90 (1.45)	2.78 (1.91)	3.88 (2.91)	0.46 (0.24)
Taste	-0.31 (-0.46)	-1.77 (-1.39)	-0.24 (-0.17)	0.89 (0.64)	2.69 (1.29)
Aroma	-1.87 (-2.57)	1.88 (1.45)	0.30 (0.19)	-0.45 (-0.34)	3.42 (1.81)
Keeping qualities	-1.61 (-2.24)	-3.55 (-2.43)	-2.72 (-1.77)	0.28 (0.20)	-2.79 (-1.35)
Swelling capacity	-0.95 (-1.32)	-1.10 (-0.80)	0.47 (0.29)	-0.17 (-0.13)	-3.00 (-1.14)
Texture	0.30 (0.50)	2.45 (2.14)	1.17 (0.91)	-2.75 (-2.37)	0.68 (0.32)
Location	4.15 (2.81)	3.33 (1.31)	.300994 (0.07)	3.68 (1.35)	5.75 (1.30)
Constant	16.43 (4.88)	27.65 (4.67)	4.45 (0.51)	16.49 (1.97)	24.04 (2.63)
R-Squared	15%	20.6%	23%	32%	44%
Adj. R-squared	11%	8%	8%	15%	24%

T-values are in parenthesis

TABLE 4.7 EMPIRICAL RESULTS OF THE HEDONIC REGRESSION OF RICE ON ITS CHARACTERISTICS (LOCAL RICE)

Variable Y=PRICE	Whole (N=123)	Thimphu	South (n=41)	East (n=31)	North (n=32)	West (n=19)
Whiteness	-3.146012 (-1.79)		-3.030412 (-1.23)	8.498385 (1.57)	-10.88284 (-3.07)	43.82335
Foreign materials	-2.171665 (-1.01)		.5324037 (0.12)	-8.400639 (-1.23)	-4.24292 (-1.07)	42.29346
Breakage	.6088561 (0.31)		.5161528 (0.17)	-2.241783 (-0.50)	9.595997 (3.16)	-26.54802
Shape	-.0943589 (-0.04)		6.84752 (1.48)	1.459324 (0.25)	-2.286987 (-0.59)	-35.97023
Ease of cooking	-3.845498 (-1.81)		-6.96389 (-1.75)	-11.59313 (-1.74)	-5.088873 (-1.07)	-43.12815
Cohesion	-3.927934 (-2.13)		-4.122642 (-1.40)	-2.844048 (-0.36)	-7.172514 (-3.07)	5.553759
Taste	2.305626 (1.24)		-.1320069 (-0.05)	-10.66682 (-1.69)	4.210885 (1.55)	20.37449
Aroma	-1.293367 (-0.67)		-2.566919 (-0.91)	6.141784 (0.91)	9.295113 (1.97)	-
Keeping qualities	2.73739 (1.54)		5.199337 (1.81)	1.51715 (0.24)	4.085241 (1.60)	-53.46619
Swelling capacity	-2.995914 (-1.50)		-8.580229 (-2.70)	8.623853 (1.23)	5.85241 (1.66)	17.86022
Texture	-.6467905 (-0.31)		1.312159 (0.34)	-3.057664 (-0.48)	-4.14632 (-1.59)	-12.44889
Location	-17.11795 (-3.42)		-26.9389 (-2.52)	18.04043 (1.23)	-9.012382 (-1.14)	-81.11462
Constant	107.5728 (10.41)		111.5005 (3.89)	74.77206 (3.22)	69.13775 (5.10)	162.3386
R-Squared	30%		53%	51%	62%	-
Adj. R-squared	22%		33%	19%	38.7%	-

T-values are in parenthesis

4.7. INTERPRETATION FOR HEDONIC REGRESSION OF LOCAL RICE:

For the local rice, whiteness, foreign materials, Ease of cooking, Cohesion, Aroma and texture had a negative relationship with price. Only location was the main variable that explained variations in prices of local rice. There is a negative relationship between price and location. This means that the proximity of the market place is not very favorable to the rural population. As expected, local rice is not found abundantly in the retail shops. The whiteness indicator has a negative relationship with price. This suggests that people who bought local rice have a strong likeness for the redness characteristics of rice. They prefer to buy the local rice which has less foreign materials, has a big and round shape, and had a good taste.

Adjusted R-squared was 22% meaning that 22 per cent of the variation in the price of local rice could be explained by the included variables and p-values of the coefficients were found to be significantly different from zero. In the Bhutanese rice market, there is a strong presence of the influence of the Indian rice brands and almost all the respondents could tell the difference between the Indian imported rice and the local rice. Price was an important factor while buying rice for the consumers. The nutritional and other information on the Indian rice packs was not available; therefore the consumers had to make the purchase decision based on the physical quality alone and not on the intrinsic quality.

The result indicates that consumer prefer rice with fewer or no impurities, few broken grains, long and slender grains, not sticky too much and also value rice with rich aroma, good taste, grain size after cooking and soft texture.

Overall the result indicated that a rice variety that have little or no foreign materials/hulls, has white color, whole grain, which cooks fast, sticky, swells nicely and which has a rich texture carried a higher probability to be chosen. When consumer finds these attributes in the particular rice, they are willing to pay the premium for that variety. The regression also suggests that Bhutanese consumers give less importance to taste, aroma, after cooking conditions and rate of breakage. In case of imported rice, it is interesting to note that consumers

might be indifferent towards tastes, perfume or breakage. Generally, the result shows that rice quality characteristics are the most important factor in purchasing decisions. It is evident that consumer preference of imported rice is based on quality attributes. Household characteristics have a limited effect on household purchasing decisions. The results illustrate that rice have positive and negative implicit prices. Income increase did not necessarily increase the consumption of rice as per the survey but a significant proportion of the respondents reported switching to better quality of rice if their income increased.

V. SUMMARY AND CONCLUSION

This study employed hedonic pricing theory to estimate implicit prices of the import and domestic rice based on the 11 different characteristics and tried to find the consumers' preference for intrinsic characteristics of domestic and import rice in Bhutan. Based on the consumer survey of 400 respondents, the rice characteristics along with their market prices were collected through a structured questionnaire method. The main idea was derived from the Lancaster's New Consumer Theory introduced by Lancaster (1966). The theory is based on the premises that consumer derive utility based on the characteristics of the good.

There is evidence from the empirical results of the hedonic pricing model that the price of rice has some relationship with the characteristics and other socio-economic variables. In case of imported rice, cohesion which is the stickiness of the rice, foreign materials/hulls, location, and income of the respondents were significant variables in explaining the price of the imported rice. Other variables were not very significant according to the study. This suggests that consumers were indifferent towards color, breakage, shape, ease of cooking, taste, aroma, keeping qualities, swelling capacity, and texture in case if rice imported from India.

For the local rice, cohesion carried a negative relationship with respect to price. Whiteness carried a negative relationship with respect to price suggesting that redness of the rice was more valued in case of local rice. All other variables were insignificant. An interesting finding was on the household head purchasing local rice. The majority of the households headed by female had a distinctive likeness towards local rice and purchased local rice. This meant that female respondents valued own country rice and this could mean that they are more concern about nutritional content. The scope of the study was limited to the capital city Thimphu. Since rice is a brand specific commodity, this study did not take into consideration the different brand of rice which was available in the market. Finding out the consumers' quality likeness was hard to estimate since the quality is subjective to different individuals. However, regression analysis provided a strong basis to estimate the quality factors from the sample.

VI. RECOMMENDATION

Post-harvest activities are fundamental in determining the quality characteristics and price of rice. The study attempt to find what the qualities attributes were that was incremental in explaining price. The Bhutanese rice market does not have a well-established rice grading system. Therefore, scientific estimation of rice grain quality was not possible within the scope and budget of this research. Although rice is the main staple and has several implications to the general public, the quality of the local rice is the least studied part.

Consumers' specific quality and preference of rice is a subject vast enough to be done in one study. This study indicated that local rice has a potential to compete in the market. Also local market lacks strong support from the government. However, the Royal Government of Bhutan (RGoB) under its different programs under the Ministry of Agriculture has started to provide High Yielding Varieties (HYVs) of rice to small farmers. Since price of the local rice is not regulated, the sellers have no scientific basis to rate the rice. Government authorities responsible for price indexing should construct appropriate price index based on quality and rate rice in the market. This would enable local producers to sell their produce at a deserved price.

In case of imported rice, the main variable explaining the price was cohesion. Government intervention to import rice with good cohesion and a fair degree of whiteness, less foreign materials, less breakage, good keeping qualities, and good taste is necessary for maximum consumer satisfaction.

Further a study could be conducted for brand specific rice since import rice is brand specific in nature. Another area for study is the producer-side study. Since this study only concentrated on consumer-side analysis, future study in the

area of producer-consumer pricing would provide a 360 degree view of the problem.

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