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IMPLICIT PRICE ESTIMATION OF QUALITY ATTRIBUTES INFLUENCING RICE PRICES AND CHOICE DECISIONS OF CONSUMERS IN NIGERIA

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Abstract. Consumers' preference for imported rice brands in Nigeria has been largely due to differences in the quality attributes of local and imported rice brands. This paper presents the findings of a study conducted in the Federal Capital Territory (FCT), Nigeria to determine the relative importance and prices consumers pay for rice quality attributes. Hedonic model was estimated using 2014 dataset collected from a survey of 460 rice consumer households. The results showed that the household respondents paid an average price of NGN10,416 ($53) and NGN7,567 ($38) for a 50 kg bag of imported and local rice brands respectively. Quality attributes contribute about 48–52% of the prices consumers paid for rice. High swelling capacity, whiter after-cook color, neatness, and grains separateness mostly influence market prices of imported rice in Nigeria as consumers would pay an average of additional NGN326 ($1.65), NGN320 ($1.60), NGN158 ($0.80) and NGN122 ($0.61) respectively on these quality attributes in order to avoid local rice. These findings present rice breeders, processors and marketers with investment challenges as well as opportunities of which the implications for designing quality improvement and marketing policies and programmes for the development of Nigeria's rice industry were discussed.

Keywords: marginal implicit price, quality attributes, rice brands, Nigeria

INTRODUCTION

Rice (*Oryza sativa*) is the staple food most widely consumed by over 170 million people in Nigeria. The annual per capita rice consumption is estimated at 35 kg which means a total of 5.2 million metric tons of milled rice consumed in Nigeria per annum (Gyimah-Brempong et al., 2012). Despite the suitability of Nigeria's environmental conditions, the country's domestic rice production is estimated at 3 million metric tons per annum, leaving a consumption gap of about 2.2 million metric tons per annum (USDA, 2012) which is being bridged by imports (Johnson et al., 2013). There is no doubt that rice importation has been a multi-million dollar business in Nigeria. It is estimated that the import bills of over USD 6 million (Johnson et al., 2013) Nigeria pays on a daily basis are not only a huge drain on the country's foreign exchange earnings but also a threat to the growth of the domestic rice industry. Various fiscal and protectionist policy measures taken by the government to stop the huge importation seem to be ineffective as the demand for, and availability of, imported rice brands in Nigeria's domestic markets continue to rise over the years (Gyimah-Brempong et al., 2012; Hiroyuki et al., 2012).

In the last seven years, the Nigerian government has put in place some programs and policies to discourage rice importation and encourage domestic production, such as increased import tariff on rice; ban on importation of rice through the land borders; and the establishment of the commercial agricultural credit support scheme (CACS). These policies and programs have so far attracted many investors, resulting in massive and

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expanded investments in paddy rice production and in the establishment of several modern large-scale rice processing mills. Many improved local rice varieties such as NERICA (New Rice for Africa), FAROs 44, 54 and 58 have been adopted (Dontsop Nguezet et al., 2012). Domestic rice production has been stimulated and has increased at an annual rate of more than 5% (Seck et al., 2010). In the last five years, rice production, processing, polishing and packaging in Nigeria have tremendously improved. Today, there are many local rice brands featuring improved quality attributes (AfricaRice, 2012). In spite of improvements in the physicochemical quality of local rice, the demand for imported rice brands continues to rise. Several studies have pointed to better quality attributes as one of the major reasons behind higher prices of, and consumers' preference for, imported rice brands (Gyimah-Brempong et al., 2012; Hiroyuki et al., 2012; Johnson et al., 2013; Tomlins et al., 2005). In Nigeria markets today, several brands of imported rice that demonstrate different levels of quality attributes sought by consumers are sold. Popular brands and countries of origin include: Caprice (Thailand), Stallion (Thailand), Crystal (India), Elephant Gold (Thailand), Peacock (Thailand), Golden penny (Thailand/America), Tomato Gold (Thailand), Double Bull (India), Mama Gold (Thailand), Turkey Gold (Thailand), Royal Umbrella (Thailand), Family Pride (India), Salsa Rice (America), Unity Rice (India), and Sarina (India). These imported rice brands demonstrate the desired intrinsic quality attributes such as good aroma, taste, bright color, high swelling capacity, separated grains, strong texture (do not easily soak), neatness, and long grains.

Quality attributes are used by breeders, processors and marketers to differentiate and determine the prices of food crop varieties (Hussein et al., 2015). Recent studies have emphasized the role of rice breeding programs, which use genetic and molecular techniques, such as marker assisted backcrossing (MABC) to develop rice varieties with intrinsic quality attributes that are appealing to consumers (Hasan et al., 2015; Wendy et al., 2016). There is evidence of strong correlation between physicochemical attributes, palatability, genetic traits and rice eating quality (Mi-Young et al., 2011). According to some research findings, such as Tomlins et al. (2005), Gyimah-Brempong et al. (2012), and Hiroyuki et al. (2012), quality attributes are one of the major determinants of consumers' preference for, and market values of, rice brands. It is important to understand the consumers' own perceptions and preferences of quality attributes as they usually will be making purchasing decisions based on these beliefs (Rijswijk and Frewer, 2008). However, there is no clear empirical evidence to substantiate how much consumers pay to reflect the importance they attach to these quality attributes. Consumers who are final buyers of food products such as rice often pay retail prices, but there is limited published research to link these rice quality attributes to consumer's preference at retail level. Therefore, the relationship between the retail prices consumers pay for rice brands and the quality attributes associated with such brands has not received adequate attention in the Nigerian rice marketing research literature.

Imported rice brands are sold at prices higher than those of local rice brands. Previous studies have recommended that producers (breeders, farmers and processors) of local rice need to invest in rice varieties and improved processing technologies that enhance the quality attributes of local rice in order to make them competitive with imported rice brands (Hiroyuki et al., 2012; Tomlins et al., 2005). For the local producers, it is important to know the added value (in monetary terms) an improvement in each quality attribute of local rice would attract to the total price consumers pay for similar (but desirable) quality attributes of imported rice brands. These producers could make better strategic choices if the benefit (implicit price) associated with improvements in a particular quality attribute of local rice was greater than the relative costs incurred (Oczkowski, 1994). This could underpin the economic incentives these producers would derive from embarking in such breeding and processing programs. This study is unique as it attempts to estimate the marginal implicit prices of rice quality attributes from the consumers' perspective. Therefore, the findings of this study would help local rice producers (breeders, farmers, processors), marketers and policymakers to set their research and development priorities and strategically target rice varieties with quality attributes that attract higher consumers' preference pricing. Therefore, the primary objectives of this study were to:

- identify the key quality attributes and their effects on the price variability of imported rice brands in Nigeria;
- estimate the marginal implicit prices of rice quality attributes paid by consumers in urban, semi-urban and rural areas;

- determine the economic incentives for quality improvements of local rice.

THEORETICAL MODEL

The hedonic price model has been the most widely used technique to empirically estimate the prices of quality attributes of agricultural commodities. Hedonic price functions have been used in the pricing of milk and in estimating implicit quality prices for cotton (Wilson, 1984). Other agricultural commodities explored by hedonic techniques include tomatoes, eggs, rice, wheat, feeder cattle, boars and cucumbers (Dalton, 2004; Ladd, 1982; Waugh, 1928). Product quality and hedonic price models have also been explored to the consumer or retail level. Their theoretical foundation is consumer utility maximization, as developed independently by Houthakker (1952), Theil (1965), and later by Lancaster (1966). The applications of hedonic modeling in agriculture at both the consumer and producer levels were explored mostly by Ladd and Martin (1976), Ladd and Suvannunt (1976), Ladd (1982) and Wilson (1984). Based on the hedonic technique, Ladd and Suvannunt (1976) developed the Consumer Goods Characteristics Model (CGCM). Several studies such as Eastwood et al. (1986), Chiou et al. (1993) and Goodwin et al. (1995) used the CGCM to analyze the monetary values associated with quality attributes of agricultural commodities. This model assumes that consumers of an agricultural commodity such as rice have a demand not just for the rice as a food product but for the bundle of its intrinsic quality attributes, such as color, aroma, taste, shape, texture, neatness, swelling capacity, etc. The basic premise of the CGCM is that consumers buy a product based on the utilities derived from its quality attributes. Hence, the total utility a consumer enjoys from buying a product depends on the total number of the product's quality attributes purchased. Consumers cannot buy the quality attributes they need from the market; they can only buy the products which provide those quality attributes. Therefore, the price the consumer pays for a product is the sum of the marginal values of the product's quality attributes.

CGCM is the most logical model for this study which aims at estimating the prices consumers pay for quality attributes of various brands of imported rice. There are at least 15 different brands of imported rice in Nigeria markets. The theoretical framework assumes the existence of n brands of imported rice; each of the first m intrinsic quality attributes is provided by several brands (Ladd and Suvannunt, 1976). Also, it is assumed that each rice brand is unique as it demonstrates a quality attribute beyond those offered by any other brand. According to Jordan et al. (1985), the total consumption of each quality attribute is then expressed as a function of the quantities of rice brands consumed and of consumption input-output coefficients as follows:

$$X_{Tj} = f_j(Q_1, Q_2, \ldots, Q_n; x_{1j}, x_{2j}, \ldots, x_{nj}) \quad \text{for } j = 1, 2, 3, \ldots, m \tag{1}$$

$$\text{and } X_{Tm+i} = f_{m+i}(Q_i, x_{im+1}) \text{ for } i = 1, 2, 3, \ldots, n \tag{2}$$

where X_{Tj} is the total amount of the j^{th} quality attribute provided by all the n rice brands; x_{ij} is the quantity of the j^{th} quality attribute provided by one unit of i^{th} brand; Q_i is the quantity of i^{th} brand consumed; m is the total number of quality attributes of each i^{th} brand; while n is the total number of rice brands. Equation (2) depicts the uniqueness of each rice brand based on the fact that, compared to other brands, it offers more in terms of a particular quality attribute that could influence consumer's purchase behavior. According to equation (2), each i^{th} rice brand provides the consumer with a larger quantity (m+1) of a particular quality attribute than any other rice brand (Ladd and Suvannunt, 1976), hence x_{im+1}. Thus, a household's total utility function is:

$$TU = f(X_{T1}, X_{T2}, \ldots, X_{Tm}, X_{Tm+1}, \ldots, X_{Tm+n}) \tag{3}$$

Based on equation (3), a consumer household will maximize its total utility subject to a budget constraint, $I = \Sigma P_i Q_i$, where I is the household income. Differentiating equation (3) gives the first order conditions:

$$\Sigma\left(\frac{\partial TU}{\partial X_{Tj}}\right)\left(\frac{\partial X_{Tj}}{\partial Q_i}\right)+\left(\frac{\partial TU}{\partial X_{Tm+i}}\right)\left(\frac{\partial X_{Tm+i}}{\partial Q_i}\right)-\left(\frac{\partial TU}{\partial I}\right)P_i = 0 \tag{4}$$

It is assumed that the utility a consumer derives from the consumption of rice is independent of all the utilities obtained from other possible goods purchased, subject to the budget constraint. The amount a consumer allocates to the purchase of rice is independent of his/her other purchases.

Solving equation (4) for P_i gives the hedonic price function where one unit of each brand of rice supplies one unit of its quality attribute:

$$P_i = \Sigma\left(\frac{\partial X_{Tj}}{\partial Q_i}\right)\left(\frac{\partial E}{\partial X_{Tj}}\right)+\left(\frac{\partial E}{\partial X_{Tm+i}}\right) \quad (5)$$

where P_i is the unit price of i^{th} brand paid by consumer household, $\left(\frac{\partial X_{Tj}}{\partial Q_i}\right)$ is the marginal yield of j^{th} quality attribute of the i^{th} brand of imported rice; E (assumed to be equal to income *I*) is the total expenditure on all the brands; and $\left(\frac{\partial E}{\partial X_{Tj}}\right)$ is the marginal rate of substitution between expenditure and the j^{th} quality attribute or the marginal implicit price (MIP) a consumer household paid for the j^{th} quality attribute.

According to Ladd and Suvannunt (1976), equation (5) shows that for each rice brand consumed, the price paid by the consumer equals the sum of the marginal monetary values of the brand's quality attributes. The marginal monetary value of each quality attribute equals the quantity of the quality attribute obtained from the marginal unit of the brand consumed multiplied by the marginal implicit price (MIP) of the quality attribute. Therefore, MIP_{ij} of each j^{th} quality attribute of the i^{th} brand of imported rice equals the product of the mean market price of the i^{th} brand ($\bar{P}_i$) and marginal yield of the j^{th} quality attribute (β_j) divided by the mean quantity of the j^{th} quality attribute ($\bar{j}$). Thus, equation (5) could be rearranged as follows:

$$MIP_{ij} = \frac{\beta_j \bar{P}_i}{\bar{j}} \quad (6)$$

MATERIALS AND METHODS

Study location and data

This study was conducted in the Federal Capital Territory (FCT) located in North Central Nigeria, at latitudes between 8°23' N and 9°15' N and at a longitude of 6°35'E. This is a savannah vegetation zone and the center of the country, with a landmass of 7,315 sq. km. FCT is characterized by alternating dry and wet seasons with a mean annual rainfall varying from 1100 to 1600 mm and a temperature range from 12°C to 33°C. FCT is composed of six area councils, namely: Abuja Municipal Area Council (AMAC), Bwari, Gwagwalada, Kwali, Kuje and Abaji. The level of infrastructural and socioeconomic development of these six area councils is directly dependent on their proximity to Abuja, the FCT capital. In this study, AMAC is classed as an urban area. Kuje, Bwari and Gwagwalada, the three area councils closer to Abuja, share some degree of development and are hence classed as semi-urban. The other, predominantly rural, three area councils (Bwari, Kwali and Abaji) are satellite towns farthest from Abuja with the lowest infrastructural development.

FCT has a total population of about 3.5 million (NPC, 2013), including at least 2.45 million (70%) rice consumers who constitute the target population of about 490,000 households (based on average of 5 people per household). Therefore, a sample size of at least 400 household respondents is considered adequate for interviewing and data collection purposes. To cover a wider geographical area of the FCT, multi-stage random and convenience sampling methods were used to select a total of 460 respondent households as follows: AMAC (76)[1], Kuje (77), Gwagwalada (77), Abaji (77), Kwali (76) and Bwari (77). Sampling frames were obtained from the Federal Capital Development Authority (FCDA) and Abuja Geographical Information System (AGIS).

Data was collected using a structured and validated questionnaire. The Jury's method was used to validate the questionnaire content, while the test-retest method was used to evaluate the questionnaire's reliability. The questionnaire was primarily administered to the household heads during a face-to-face interview whereas other household members contributed in providing answers to the questions asked during the interviews. Data was collected on the consumer households' socioeconomic characteristics, their desirability and preference of rice quality attributes, and market prices they paid for imported rice brands.

Empirical model

The observed market price of a product is the sum of implicit prices paid for each of its quality attributes (Rosen, 1974). Implicit prices can be estimated by employing a hedonic price model which is a regression model capable of expressing the observable price of any particular product as a function of its quality attributes (directly or indirectly observable). In the simplified empirical model used in this study, the price (P_i) that a consumer household paid for the i^{th} brand of imported rice

[1] Values in parenthesis denote the number of households interviewed in the area council surveyed.

depended on the quality attributes of that brand. This model can be expressed linearly as:

$$P_i = \beta_0 + \sum_{j=1}^{n} \beta_j X_j + \varepsilon_i \quad (7)$$

where: X_j represents the values of j^{th} quality attributes of imported rice brands, ranked in accordance with the consumers' preferences, as described in Table 1; and ε_i is the error term. The usual purpose of the hedonic method is to obtain the parameter estimates (β_j) of equation (7) using the ordinary least squares (OLS) technique by regressing (P_i) on all their quality attributes X_j and choosing the best fitting functional form (Goodwin et al., 1995).

Explanatory variables of this study

For this study, 13 quality attributes of rice were identified and defined based on past empirical studies (Jordan et al., 1985; Goodwin et al., 1995), as shown in Table 1. As per the established procedure by Dalton (2004),

Table 1. Definitions and measure of explanatory variables of this study
Tabela 1. Definicje i miary zmiennych objaśniających użyte w niniejszym badaniu

Quality attribute Atrybut jakościowy	Value = 13 Wartość = 13	Value = 1 Wartość = 1
Colour – Barwa	Brown/yellow; not desirable Brązowa/żółta; cecha niepożądana	Very white; very desirable Intensywnie biała; cecha bardzo pożądana
Grain texture – Struktura ziarna	Soft; not desirable Miękka; cecha niepożądana	Hard, very desirable Twarda; cecha bardzo pożądana
Aroma – Zapach	No aroma; not desirable Brak zapachu; cecha niepożądana	Very aromatic; very desirable Intensywny zapach; cecha bardzo pożądana
Neatness – Czystość	Very dirty; not desirable Bardzo zabrudzone; cecha niepożądana	Very neat; very desirable Bardzo czyste; cecha bardzo pożądana
Grain separateness – Sklejanie się ziaren	Poorly separated; not desirable Silnie posklejane; cecha niepożądana	Well separated very desirable Oddzielone; cecha bardzo pożądana
Flavour/Taste – Smak	No taste; not desirable Brak smaku; cecha niepożądana	Very tasty; very desirable Wyraźny smak; cecha bardzo pożądana
Grain shape – Kształt ziarna	Short & fat; not desirable Krótkie i szerokie; cecha niepożądana	Long & slender; very desirable Długie i smukłe; cecha bardzo pożądana
Grain brokenness – Uszkodzenia ziaren	Much; not desirable Wiele uszkodzonych ziaren; cecha niepożądana	None; very desirable Brak; cecha bardzo pożądana
Cooking duration Czas gotowania	Very long; not desirable Bardzo długi; cecha niepożądana	Very short; very desirable Bardzo krótki; cecha bardzo pożądana
Swelling capacity Zdolność do pęcznienia	Very low; not desirable Bardzo niska; cecha niepożądana	Very high; very desirable Bardzo wysoka; cecha bardzo pożądana
Perceived nutrient level Postrzegana zawartość składników odżywczych	Low; not desirable Niska; cecha niepożądana	High; very desirable Wysoka; cecha bardzo pożądana
Perceived freshness Postrzegana świeżość	Low; not desirable Niska; cecha niepożądana	High; very desirable Wysoka; cecha bardzo pożądana
Perceived storage with chemicals Przekonanie o użyciu środków chemicznych do magazynowania	High; not desirable Duże ilości środków chemicznych; cecha niepożądana	Low; very desirable Niewielkie ilości środków chemicznych; cecha bardzo pożądana

Note: quality attribute values were ranked on a Likert scale of 1 to 13 such that no two or more attributes were ranked equally.
Source: field survey data, 2014.
Uwaga: atrybutom jakościowym nadano wartości od 1 do 13 według skali Likerta, tak aby nie istniała żadna para (ani większa liczba) atrybutów o tej samej wartości.
Źródło: dane z badania w terenie, 2014 r.

each household respondent was asked to rank all the 13 quality attributes in a Likert scale of 1 to 13 such that no two or more quality attributes were ranked equally. The choice of direct ranking of quality attributes on a 1-to-13 scale was adopted to reduce the effect of multicollinearity since the sample size is sufficiently large (Wooldridge, 2006); and to avoid the dummy variable trap, a situation likely to occur when too many dummy variables describe a given number of groups (Mhlanga, 2010).

RESULTS AND DISCUSSION

Consumer Households' socioeconomic characteristics

The socio-economic characteristics of the household respondents are presented in Table 2. In the entire sample of household heads, the share of men and women was 35% and 65%, respectively. Most of them (93%) were married while 7% were single. On average, the household heads were 47 years old and had 16 years of formal schooling

Table 2. Socio-economic characteristics of households in the survey
Tabela 2. Społeczno-gospodarcze cechy gospodarstw domowych objętych badaniem

Characteristics Cecha	Category Kategoria	No of respondents Liczba respondentów	Percentage Odsetek	Mean Średnia
Gender – Płeć	male – mężczyzna	163	35.4	N/A
	female – kobieta	297	64.6	
Age (years) – Wiek (lata)	25–35	20	4.30	47.27
	36–46	72	15.4	
	47–57	*223*	48.5	
	58–68	*145*	31.5	
Education Level (Number of years spent in formal Schooling) Poziom wykształcenia (liczba ukończonych klas w formalnym systemie szkolnictwa)	podstawowe (1–6)	74	16.2	16
	średnie (7–12)	82	17.8	
	wyższe (13–18)	267	58.0	
	podyplomowe (19–24)	37	8.00	
Marital status Stan cywilny	single – osoba samotna	31	6.70	–
	married – żonaty/zamężna	427	92.80	
	divorced – oosba rozwiedziona	2	0.50	
Household size Liczba osób w gospodarstwie	2–4	119	25.90	5
	5–7	268	58.30	
	8–10	73	15.80	
Household monthly income (N'000) Miesięczny dochód gospodarstwa domowego (tys. NGN)	20–120	260	56.5	N88,350
	121–221	128	27.8	
	222–322	54	11.7	
	323–423	18	3.9	

Source: field survey data, 2014.
Źródło: dane z badania w terenie, 2014 r.

behind them. This suggests that household heads were educated people. The average household size is 5, with the majority of household heads receiving an average monthly income of NGN 88,350 (about USD 441) indicating that the households live on an average of about USD 10 a day, which is well above the national minimum wage of NGN 600 (about USD 3) per day.

Consumers' preference ranking of rice quality attributes

Table 3 shows the ranking of the 13 identified quality attributes of imported rice brands in their order of preference by the surveyed consumer households. About 42%, 63%, 71%, 65% and 79% of the household respondents ranked grains' high swelling capacity, whiter color, neatness, aroma and long shape as the most preferred quality attributes, respectively. In turn, the perceived nutrient level, cooking duration and perceived chemical storage appear to be of least concern to consumers. These preference rankings are consistent with the findings of several other studies (Abansi et al., 1992; Dalton, 2004; Demont et al., 2012; Sudha et al., 2013; USAID, 2009).

Table 3. Consumers' preference ranking of quality attributes of imported rice
Tabela 3. Ranking atrybutów jakościowych importowanego ryżu według preferencji konsumentów

Quality attribute Atrybut jakościowy	Preference rank (1 = most preferred; 13 = least preferred) Ranking według preferencji (1 = najbardziej preferowany; 13 = najmniej preferowany)													Mean rank Średnia ranga	Std. dev. Odchylenie standardowe
	1	2	3	4	5	6	7	8	9	10	11	12	13		
Colour Barwa	116 (25)	**292** **(63)**	47 (10)	2 (0.4)	–	1 (0.2)	–	1 (0.2)	–	–	–	1 (0.2)	–	1.90	0.833
Grain Texture Struktura ziarna	–	–	1 (0.2)	–	–	11 (2.4)	130 (28)	**261** **(57)**	55 (12)	–	1 (0.2)	–	1 (0.2)	7.80	0.765
Grain separateness Sklejanie się ziaren	2 (0.4)	–	1 (0.2)	–	1` (0.2)	105 (23)	**238** **(52)**	101 (22)	10 (2.2)	1 (0.2)	1 (0.2)	–	–	7.01	0.889
Swelling capacity Zdolność do pęcznienia	**193** **(42)**	243 (53)	22 (5)	–	–	–	–	1 (0.2)	1 (0.2)	–	–	–	–	1.66	0.732
Neatness Czystość	18 (3.9)	81 (18)	**326** **(71)**	31 (6.7)	–	1 (0.2)	1 (0.2)	1 (0.2)	–	1 (0.2)	–	–	–	2.85	0.771
Taste/Flavour Smak	1 (0.2)	–	–	1 (0.2)	–	–	2 (0.4)	131 (29)	**264** **(57)**	57 (12)	2 (0.4)	–	2 (0.4)	8.82	0.823
Grain shape Kształt ziarna	–	1 (0.2)	3 (0.6)	41 (8.9)	**361** **(79)**	46 (10)	3 (0.6)	2 (0.4)	2 (0.4)	–	1 (0.2)	–	–	5.05	0.668
Grain brokenness Uszkodzenia ziaren	–	–	1 (0.2)	–	79 (17)	**310** **(64)**	64 (14)	4 (0.8)	1 (0.2)	–	–	1 (0.2)	–	5.99	0.681
Cooking duration Czas gotowania	1 (0.2)	–	–	–	–	–	–	–	–	7 (1.5)	103 (22)	**263** **(57)**	86 (19)	11.91	0.853
Aroma Zapach	–	–	68 (15)	**301** **(65)**	85 (18)	4 (0.9)	–	–	2 (0.4)	–	–	–	–	4.08	0.686
Perceived Nutrient level Postrzegana zawartość składników odżywczych	–	–	–	–	–	2 (0.4)	1 (0.2)	–	11 (2.4)	122 (27)	**197** **(43)**	104 (23)	23 (5)	10.98	0.965
Perceived freshness Postrzegana świeżość	–	–	2 (0.4)	1 (0.2)	–	1 (0.2)	1 (0.2)	–	72 (16)	**286** **(62)**	78 (17)	5 (1.1)	14 (3)	10.06	0.993
Perceived chemical storage Przekonanie o użyciu środków chemicznych do magazynowania	1 (0.2)	1 (0.2)	–	–	–	–	–	–	–	1 (0.2)	73 (16)	163 (35)	**221** **(48)**	12.27	1.027

Note: values in parenthesis are percentages of household respondents.
Source: field survey data 2014.
Uwaga: w nawiasach podano odsetek respondentów z gospodarstw domowych.
Źródło: dane z badania w terenie, 2014 r.

A hedonic model of the effects of quality attributes on prices of rice at consumer level

The model summary of Ordinary Least Square (OLS) regression of market price of imported rice brands against the 13 quality attributes is as shown in Table 4. In spite of the low R^2 (0.308), the *F*-value (15.249) shows that the estimated model's overall goodness of fit is adequate and significant (Louviere et al., 2000). Therefore, the parameter estimates of the linear function can reliably be used for further analysis. In this study, the estimated model is not affected by multicollinearity because the variance inflation factor (VIF) for all the variables included in the model was less than 10 (Menard, 1995).

Although the price has been a major factor in the household consumers' choice of rice variety (Sar et al., 2012), quality attributes appear to have a stronger impact on the consumers' buying decisions because they, in turn, influence the prices. As shown in Table 4, there is a significant relationship between the market price consumers pay and the quality attributes of rice such that the 30.8% variation in prices could be explained by these 13 quality attributes. These are quality attributes whose implicit prices contribute significantly in determining the overall prices of rice in the market. Taste and perceived storage with chemicals are the two quality attributes that did significantly influence the price consumers paid for imported rice brands. This could be attributed to the fact that rice consumers do not easily appreciate the taste of rice because the staple is consumed either with stew or cooked as jollof. Stew or jollof rice are prepared with the addition of seasonings such as Maggi, Knorr, Royco, Aji no moto, etc. that are readily available in the local market. The taste and flavor of these seasonings which consumers buy to enhance the taste of stew or jollof rice overtakes the natural taste of the rice. Thus, consumers may not appreciate the taste of ordinarily boiled white rice. Also, this result seems to suggest that in the opinion of many rice consumers in FCT-Abuja, imported rice brands are not subject to prolonged storage in silos with the use of chemicals, as claimed by local rice millers (Punch, 2012). This supports the findings of Lloyd et al. (2014) that despite limited vitamin content in rice after a long period of storage, rice retains much of its sensory quality due to the presence of minerals and other stable macronutrients which makes it possible for consumers to consider it suitable for use.

Estimated marginal implicit prices of rice quality attributes

Estimated standardized coefficients, as shown in Table 4, were used to calculate the marginal implicit prices (MIP) for quality attributes based on responses of the surveyed households. The linear functional form was used in this study, and the MIP of the i^{th} quality attribute for the j^{th} brand was estimated using equation (6). Marginal implicit prices (MIPs) of quality attributes of local and imported rice brands across the six area councils surveyed are as shown in Table 5. The estimation indicates that while the MIPs vary largely between local and imported rice brands due to differences in their market prices, they vary slightly across the six area councils surveyed. The consumers paid an average price of NGN 10,416 (USD 53)[2] and NGN 7,567 (USD 38) for a 50 kg bag of imported and local rice brands, respectively. The contribution of quality attributes to the prices consumers paid for rice was about 48–52%. This suggests that the price premiums paid by Nigerian consumers for quality attributes of rice are higher than the level of 25–34% obtainable in other countries (Demont et al., 2012). Another finding is that the rice brand with quality attributes least desired by consumers could be sold for only 50% of the price of a rice brand that demonstrates the quality attributes most desired by consumers. From the consumers' perspective, the three quality attributes with MIPs representing the highest contribution to the price of rice are the color, swelling capacity and neatness.

In this survey, brightly white grain is the quality attribute of rice valued most by the consumers. This is because for every 50 kg bag of imported and local rice brands, consumers paid the highest MIP of NGN 1,180 (USD 6) and NGN 857 (USD 4.5), respectively, for white grains (Table 5). This is consistent with the findings of Goodwin et al. (1992) that grain color has the second highest MIP after flavor. Consumers in urban areas tend to prefer and hence pay more for rice brands of whiter grains than consumers in rural areas. Rice varieties of whiter grains are graded higher and sell at better prices, which make some producers and wholesalers strive to whiten their milled rice by blending and mixing different rice varieties (Wedgwood and Duff, 1992). A possible explanation could be that consumers preferred and paid more for brightly-white but highly

[2] USD 1 = NGN 200 in 2014.

Table 4. Parameter estimates of the effects of quality attributes on the price of imported rice
Tabela 4. Oszacowane parametryczne wartości wpływu atrybutów jakościowych na cenę ryżu importowanego

Model	Unstandardized coefficients Współczynniki nieustandaryzowane		Standardized coefficients* Współczynniki ustandaryzowane*	*t*	Sig
	β	Std. error	β		
Constant – Stała	39209.24	3330.53		11.77	0.000
Colour – Barwa	–370.73	94.41	–0.187	–3.92	0.000***
Grain texture – Struktura ziarna	220.28	98.84	0.098	2.23	0.026**
Grain separateness – Sklejanie się ziaren	–544.73	90.58	–0.282	–6.01	0.000***
Swelling capacity – Zdolność do pęcznienia	–367.74	108.41	–0.156	–3.39	0.001***
Neatness – Czystość	–324.73	102.21	–0.146	–3.18	0.002**
Taste/Flavour – Smak	–125.89	88.46	–0.060	–1.42	0.155
Grain shape – Kształt ziarna	–247.41	115.19	–0.096	–2.15	0.032**
Grain brokenness – Uszkodzenia ziaren	–273.24	116.89	–0.108	–2.34	0.020**
Cooking duration – Czas gotowania	–665.91	85.89	–0.330	–7.75	0.000***
Aroma – Zapach	–311.07	106.14	–0.124	–2.93	0.004***
Perceived nutrient level Postrzegana zawartość składników odżywczych	–743.22	77.38	–0.417	–9.60	0.000***
Perceived freshness – Postrzegana świeżość	–167.80	76.73	–0.097	–2.19	0.029**
Perceived chemical storage Przekonanie o użyciu środków chemicznych do magazynowania	–112.25	86.18	–0.067	–1.30	0.193
R			0.555		
R^2			0.308		
Std. error of estimate – Błąd standardowy oszacowania			1451.590		
Durbin-Watson statistics – Statystyka Durbina-Watsona			2.063		
F-value – Wartość *F*			15.24		
Significance – Istotność			0.000***		
VIF – Czynnik inflacji wariancji			1.445		

*The negative signs of estimated coefficients which are due to respondents' ranking of quality attributes in reversal order (1 = most desirable; 13 = least desirable) is inconsequential since the primary purpose is to compute the MIPs. Since ranking involves consumer's assigning of categorical values to the quality attributes such that the degree of weight consumer attaches to one attribute over the other is not measurable, it is more logical to use the standardized coefficients in estimating the MIPs, as it gives a better comparison of how strongly each quality attribute (based on household respondents' ranking) contribute to the price consumer pays and ensures that the sum of the estimated MIPs is less than or equal to the market price of rice.
Dependent variable is the price of a 50 kg bag of imported rice; **significant at 5%; ***significant at 1%.
Source: field survey data, 2014.
*Ujemne znaki oszacowanych współczynników wynikające z rang nadawanych przez respondentów atrybutom jakościowym w kolejności odwrotnej (1 = cecha najbardziej pożądana; 13 = cecha najmniej pożądana) nie mają istotnego znaczenia, ponieważ celem podstawowym jest obliczenie cen krańcowych. Tworzenie rankingu wiąże się z przypisywaniem przez konsumentów wartości kategorycznych do atrybutów jakościowych w taki sposób, że niemierzalna jest waga, jaką konsument przywiązuje do danego atrybutu w porównaniu z innym atrybutem. W efekcie na potrzeby szacowania cen krańcowych bardziej logiczne wydaje się użycie współczynników ustandaryzowanych, ponieważ dzięki nim łatwiej jest dokonać porównania (na podstawie rankingu ułożonego przez respondentów z gospodarstw domowych) pomiędzy stopniami, w jakich poszczególne atrybuty jakościowe wpływają na cenę płaconą przez konsumenta. Ponadto w takim przypadku suma oszacowanych cen krańcowych jest niższa lub równa cenie rynkowej ryżu.
Zmienną zależną jest cena pięćdziesięciokilogramowego worka ryżu importowanego; **zmienna istotna na poziomie istotności 5%; ***zmienna istotna na poziomie istotności 1%.
Źródło: dane z badania w terenie, 2014 r.

Table 5. Mean MIPs of quality attributes of local and imported rice brands across locations
Tabela 5. Średnie ceny krańcowe atrybutów jakościowych lokalnych i zagranicznych marek ryżu w podziale na lokalizacje

Quality attributes Atrybut jakościowy	Pooled – Łącznie		Urban* Obszary miejskie*		Semi-urban Obszary miejsko-wiejskie		Rural Obszary wiejskie	
	local lokalne	imported zagraniczne	local lokalne	imported zagraniczne	local lokalne	imported zagraniczne	local lokalne	imported zagraniczne
Colour Barwa	857	1,180 (11.33)	1,106	1,549 (14.53)	764	1,064 (10.11)	865	1,166 (11.40)
Grain texture Struktura ziarna	96	132 (1.27)	96	134 (1.25)	95	133 (1.26)	97	130 (1.27)
Grain separateness Sklejanie się ziaren	317	436 (4.19)	312	437 (4.09)	324	451 (4.29)	308	415 (4.06)
Swelling capacity Zdolność do pęcznienia	833	1,147 (11.01)	804	1,125 (10.55)	847	1,179 (11.20)	825	1,113 (10.88)
Neatness Czystość	421	580 (5.57)	416	583 (5.46)	417	581 (5.52)	429	578 (5.66)
Taste/Flavour Smak	53	72 (0.70)	51	71 (0.66)	54	75 (0.71)	52	70 (0.69)
Grain shape Kształt ziarna	146	202 (1.94)	147	206 (1.93)	147	204 (1.94)	145	196 (1.91)
Grain brokenness Uszkodzenia ziaren	138	190 (1.82)	142	199 (1.87)	137	190 (1.81)	137	185 (1.81)
Cooking duration Czas gotowania	215	297 (2.85)	211	295 (2.77)	219	305 (2.90)	211	285 (2.79)
Aroma Zapach	237	326 (3.13)	238	333 (3.12)	234	326 (3.10)	239	322 (3.15)
Perceived nutrient level Postrzegana zawartość składników odżywczych	291	401 (3.85)	292	408 (3.83)	292	407 (3.86)	289	390 (3.81)
Perceived freshness Postrzegana świeżość	74	102 (0.98)	71	100 (0.93)	75	105 (1.00)	74	99 (0.97)
Perceived chemical storage Przekonanie o użyciu środków chemicznych do magazynowania	43	59 (0.57)	41	58 (0.54)	44	62 (0.59)	41	55 (0.54)
Mean price of rice Średnia cena ryżu	7,567	10,416	7,616	10,664	7,556	10,491	7,584	10,227

Note: MIPs were estimated in Naira (N) based on the price of 50 kg bag of rice. MIPs of local rice brands were estimated based on the assumption that consumers' preference ranking of rice quality attributes remains constant irrespective of the rice variety or brand (Sars et al., 2012). Values in parenthesis are percentages of MIPs to mean price of rice paid by consumers.
*AMAC is urban area; Gwagwalada, Kuje and Bwari are semi-urban areas; while Kwali and Abaji are rural areas.
Source: field survey data, 2014.
Uwaga: ceny krańcowe zostały oszacowane w nairach (NGN) na podstawie ceny pięćdziesięciokilogramowego worka ryżu. Ceny krańcowe ryżu marek lokalnych oszacowano przy założeniu, że oparty na preferencjach konsumentów ranking atrybutów jakościowych ryżu nie ulega zmianom bez względu na odmianę czy markę ryżu (Sars i in., 2012). W nawiasach podano wyrażony w procentach stosunek ceny krańcowej do średniej ceny ryżu płaconej przez konsumentów.
*Stołeczna gmina Abudża to obszar miejski; Gwagwalada, Kuje i Bwari to obszary miejsko-wiejskie; natomiast Kwali i Abaji to obszary wiejskie.
Źródło: dane z badania w terenie, 2014 r.

polished imported rice grains due to their perception that such grains are neater, and that any dirt, chaff or stone can easily be seen and removed, thereby making cooking preparations easier (Dalton, 2004). This also implies that rice consumers in the FCT may not have been adequately sensitized, and hence not aware of the nutritional implications of highly-polished rice grains, which contain mostly starch and very little vitamins and minerals. Thus, nutrients that are beneficial to health are less abundant in well-milled rice than in partially milled and brown rice (Roy et al., 2008). This is consistent with previous findings that the lack of education on nutritional and health issues associated with highly polished (brightly white) rice have been found to be a major reason for the consumers' preference of brightly-white rice over brown rice (Demont et al., 2012; Sudha et al., 2013).

High swelling capacity is another quality attribute of rice highly valued by the consumers that strongly influences their buying decisions because of its economic implications (Wedgwood and Duff, 1992). For each 50 kg bag of imported and local rice brands, consumers paid a MIP of NGN 1,147 (USD 5.7) and NGN 833 (USD 4), respectively, for its swelling capacity (Table 5). This is consistent with the findings of Abansi et al. (1992) that volume expansion is the second most important rice quality attribute after price. The result across locations indicated that consumers in semi-urban and in rural areas, who are predominantly low income groups, spent a higher percentage of the price of imported rice brands on swelling capacity compared to urban consumers. This finding is consistent with Demont et al. (2012); Sar et al. (2012); and Sudha et al. (2013) who found, in their separate studies, that low-income consumers preferred to buy rice brands that demonstrate a higher swelling capacity because they actually spend less to obtain more. The possible explanation of this economic behavior is that low-income consumers are likely to prefer quantity over quality attributes of rice in order to feed their entire family (Abansi et al., 1992). The high swelling capacity of imported rice brands could be due to lower moisture content caused by prolonged storage and ageing (Maranan et al., 1992; Unnevehr, 1992). The storage period has been found to significantly increase water absorption, volume expansion and elongation ratios which give a better cooking performance and eating quality (Butt et al., 2008). Therefore, both natural and artificial ageing has the potential of improving rice cooking quality (Faruq et al., 2015). This implies that the lower swelling capacity of local rice brands could be attributed to the fact that natural ageing does not take place as the rice is consumed within a few weeks of harvest.

Neatness is a very important quality attribute that influences the consumers' choice and preference for rice brands. Consumers would always prefer rice brands that are very neat and free of foreign matter (dirt, chaff, stone, etc). For each 50 kg bag of imported and local rice brands, consumers paid a MIP of NGN 580 (USD 2.7) and NGN 421 (USD 2.25), respectively (Table 5). Imported rice brands are well-processed with the use of modern processing technologies that enhance neatness and ensure the complete removal of dirt, chaff, stones, and other impurities. This finding supports the conclusions made by USAID (2009) that neatness of rice grains makes cooking preparations easier, and could be a plausible reason behind high demand for imported rice brands, especially among the urban consumers who value convenience due to their busy work schedules. According to Wedgwood and Duff (1992), there are different levels of rice grains cleaning operations which determine the degree of grain neatness, but also attract additional labor costs. This may have accounted for the differences in the MIPs of neatness and market prices of local and imported rice brands. Seck et al. (2010) reported that some of these levels of grain cleaning operations, which are not practiced by cottage rice mills in rural areas, are responsible for the presence of impurities in local rice, especially that consumed in rural areas.

Consumers would always prefer rice grains which do not become sticky after cooking. For each 50 kg bag of imported and local rice brands, consumers paid a MIP of NGN 436 (USD 2.18) and NGN 317 (USD 1.59), respectively, for grains that remain separate (i.e. non-sticky) after cooking (Table 5). The after-cook separateness of rice grains is an important determinant of the consumers' purchasing decisions. Rice brands imported to Nigeria demonstrate a high level of after-cooking separateness. High amylose content is partly responsible for grain stickiness, but this decreases over time (Butt et al., 2008). Therefore, imported rice brands might have lower amylose content which could explain their high level of grain separateness. This is also an indication that imported rice brands may have been stored for a long period before being delivered to Nigeria because long storage periods of milled rice mean enough time for a decrease in the amylose content. This, in turn,

results in better cooking performance and eating quality (Butt et al., 2008).

The findings of this study are consistent with previous studies such as Dalton (2004) and Abansi et al. (1992) who found that the most commonly cited reasons affecting the consumers' choice of rice were the volume expansion, grain whiteness, tenderness and cleanliness. Modern rice varieties are whiter and aged, thereby providing better physical and cooking quality attributes which consumers are willing to pay higher prices for (Maranan et al., 1992). While urban consumers would be willing to pay more for neatness, rural consumers would be willing to pay more for a higher swelling capacity.

Economic incentives for quality improvement of local rice

The development of the Nigerian rice industry largely depends on improving the quality attributes of local rice to successfully compete with those of imported brands. For each quality attribute to be improved, local rice producers would like to know the economic benefit or incentive which could take the form of a price premium the consumers are willing to pay. Figure 1 shows the differences in MIPs of quality attributes of local and imported rice brands that largely explain the differences in the market prices of these two sets of brands.

In this study, this economic incentive for quality improvement of local rice was estimated as the difference between the MIPs of local and imported rice brands. Figure 1 shows the additional MIPs the consumers paid for preferring the quality attributes of imported rice brands. While there is only a slight difference between the MIPs paid for the color and swelling capacity, the differences between the MIPs of other quality attributes are larger. For each 50 kg bag, the consumers would pay an average additional amount of NGN 320 (USD 1.60), NGN 326 (USD 1.65), NGN 158 (USD 0.80) and NGN 122 (USD 0.61) for the color, swelling capacity, neatness and grain separateness, respectively (Fig. 1). Should these quality attributes of local rice be improved,

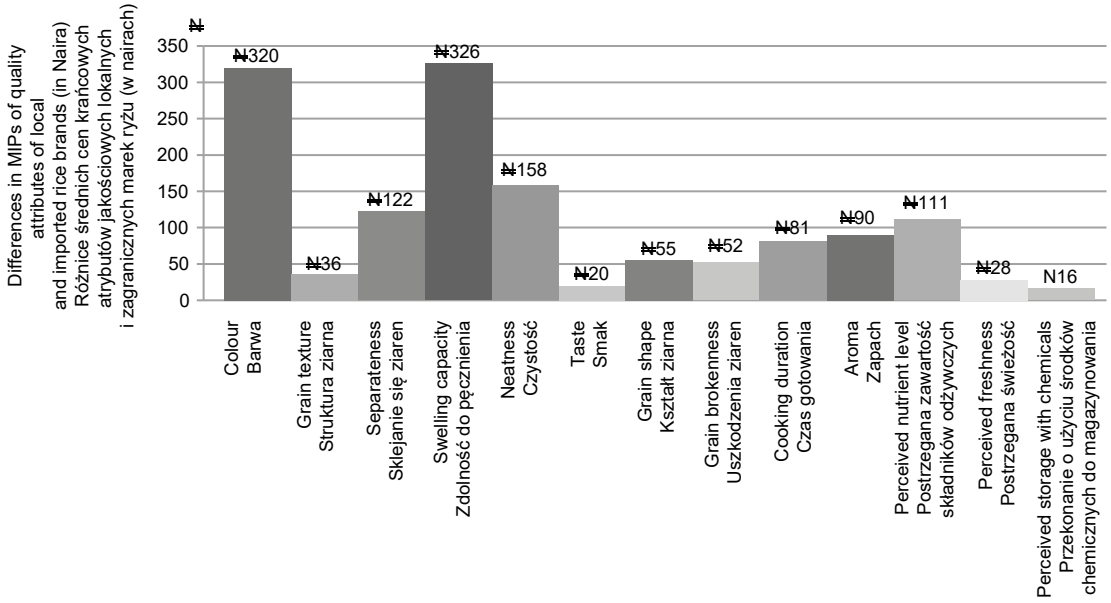

Fig. 1. Mean MIPs consumers pay for quality attributes of imported rice brands above the mean MIPs they pay for quality attributes of local rice brands
Source: field survey data, 2014
Rys. 1. Średnie ceny krańcowe, jakie konsumenci płacą za atrybuty jakościowe marek ryżu importowanego ponad średnie ceny krańcowe, jakie płacą oni za atrybuty jakościowe lokalnych marek ryżu
Źródło: dane z badania w terenie, 2014 r.

they could successfully compete with those of imported brands. Therefore, rice quality improvement programs in Nigeria should focus on these four attributes to ensure higher prices and economic benefits. However, further studies are needed to ascertain the unit cost of improvements of each quality attribute.

CONCLUSIONS

Quality attributes contribute about 48–52% of the prices consumers pay for rice in Nigeria. High swelling capacity, whiter after-cook color, neatness, and grains separateness mostly influence the market prices of imported rice. The consumers would pay an average surplus of NGN 326 (USD 1.65), NGN 320 (USD 1.60), NGN 158 (USD 0.80) and NGN 122 (USD 0.61), respectively, for these quality attributes in order to avoid local rice. Modern rice processing and polishing that integrates artificial ageing technologies is needed to improve the swelling capacity, color, neatness and grain separateness of local rice, as a way to improve the consumer acceptability, increase the prices and boost the competitiveness. Also, this will provide an incentive for the local rice breeders, farmers, processors and marketers to develop appropriate policies and programs.

REFERENCES

Abansi, C. L., Lantican, F. A., Duff, B., Catedral, I. G. (1992). Hedonic Model Estimation: Application to Consumer Demand for Rice Grain Quality. Trans. Nat. Acad. Sci. Technol., 12, 235–256.

AfricaRice (2012). Boosting Africa's rice sector: A research for development strategy 2011–2020. Cotonou, Benin: AfricaRice Center.

Butt, M. S., Anjum, F. M., Rehman, S., Nadeem, M. T., Sharif, M. K., Anwer, M. (2008). Selected quality attributes of fine basmatic rice: Effect of storage history and varieties. Int. J. Food Prop., 11(3), 698–711.

Chamhuri, N., Batt, P. J. (2013). Understanding the relationship between perceived quality cues and quality attributes in the purchase of meat in Malaysia. J. Int. Food Agribus. Mark., 25(3), 187–208.

Chiou, G. T., Chen, D. T., Capps, O. (1993). A structural investigation of biotechnological impacts on cotton quality and returns. Am. J. Agric. Econ., 75, 467–478.

Dalton, T. J. (2004). A household hedonic model of rice traits: economic values from farmers in West Africa. Agric. Econ., 31, 149–159.

Demont, M., Zossou, E., Rutsaert, P., Ndour, M., Van Mele, P. and Verbeke, W. (2012). Consumer valuation of improved rice parboiling technologies in Benin. Food Qual. Pref., 23(1), 63–70.

DontsopNguezet, P. M., Okoruwa, V. O., Adeoti, A. I., Adenegan, K. O. (2012). Productivity impact differential of improved rice technology adoption among rice farming households in Nigeria. J. Crop Improv., 26(1), 1–21.

Duvenage, S. S., Schonfeldt, H. C., Kruger, R. (2010). Food product attributes guiding purchasing choice of maize meal by low-income South African consumers. Dev. South. Afr., 27(3), 309–331.

Eastwood, D. B., Brooker, J. R., Terry, D. E. (1986). Household nutrient demand: uses of characteristics theory and a common attributes model. South. J. Agric. Econ., 18, (2), 235–46.

Faruq, G., Zakaria, H. P., Arash, N. (2015). Effects of ageing on selected cooking quality parameters of rice. Int. J. Food Prop., 18(1), 922–933.

Goodwin, H. L., Holcomb, R. B., Rister, M. E. (1995). A study of Asian-American rice demand. Work. paper, Dept. of Agricultural Economics, Texas A&M University.

Gyimah-Brempong, K., Dorosh, P., Kuku, O., Pradesha, A., Ajibola, A. (2012). Informing Nigeria's agricultural transformation agenda with policy analysis and research evidence. Paper presented at NSSP National Conference held in Abuja, Nigeria, November 13–14.

Hasan, M. M., Rafii, M. Y., Ismail, M. R., Mahmood, M., Rahim, H. A., Alam, M. A., Ashkani, S., Malek, M. A., Latif, M. A. (2015). Maker-assisted backcrossing: a useful method for rice improvement. Biotech. Biotechnol. Equip., 29(2), 237–254.

Hiroyuki, T., Michael, J., Jawoo, K., Tewodaj, M., Akeem, A. (2012). Growth potential for the domestic rice economy. Paper presented at NSSP National Conference held in Abuja, Nigeria, November 13–14.

Houthakker, H. S. (1952). Compensated changes in quantities and qualities consumed. Rev. Econ. Stud., 19, 155–164.

Hubbard, E. M., Jervis, S. M., and Drake, M. A. (2016). The effect of extrinsic attributes on liking of cottage cheese. J. Dairy Sci., (99), 183–193.

Johnson, M., Takeshima, H., Gyimah-Brempong, K., Kuku-Shittu, O. (2013). Policy options for accelerated growth and competitiveness of the domestic rice economy in Nigeria. IFPRI policy note 35, IFPRI Washington D.C. Retrieved Feb 30th 2014 from: http://ebrary.ifpri.org/utils/getfile/collection/p15738coll2/id/127869/filename/128080.pdf

Jordan, L. J., Shewfelt, R. L., Prussia, S. E., Hurst, W. C. (1985). Estimating implicit marginal prices of quality characteristics of tomatoes. South. J. Agric. Econ., 12.

Kaur, S., Panesar, P. S., Bera, M. B., Kumari, S. (2014). Physio-chemical, textural, pasting, and in vitro digestion properties of some Basmatic and Non-Basmatic rice cultivars. Int. J. Food Prop., 17(5), 1055–1066.

Kim, H. S., Yim, H. R. (2014). Exploratory study of Korean traditional food, rice cake's product attributes, and customers' satisfaction and loyalty. J. Culin. Sci. Technol., 12(4), 339–353.

Ladd, G. W. (1982). Survey of promising developments in demand analysis: economics of product characteristics. In: G. C. Rausser (Ed.), New Directions in Econometric Modeling and Forecasting in U.S. Agriculture (p. 17–54). New York: North Holland.

Ladd, G. W., Martin, M. B. (1976). Prices and demands for input characteristics. Am. J. Agric. Econ., 58, 21–30.

Ladd, G. W., Suvannunt, V. (1976). A Model of Consumer Goods Characteristics. Am. J. Agric. Econ., 58, 504–510.

Lancaster, K. J. (1966). A new approach to consumer theory. J. Polit. Econ., 74(2), 132–157.

Lloyd, M. A., Coons, L. M., Engstrom, E. E., Shintaro P., Pahulu, H. F., Ogden, L.V., Pike, O. A. (2014). Sensory and nutritional quality of white rice after residential storage for up to 30 years. Int. J. Food Sci. Nutr., 65(3), 320–326.

Loose, S. M., Szolnoki, G. (2012). Market price differentials for food packaging characteristics. Food Qual. Pref., 25(2), 171–182.

Louviere, J. J., Hensher, D. A., Swait, D. J. (2000). Stated choice methods. Analysis and applications. Cambridge University Press.

Maranan, C. L., Duff, B., Juliano, B. O. (1992). Quality preferences for modern and traditional rice at the retail level: the Philippine case. In: Consumer demand for rice grain quality (87–95). International Rice Research Institute, P.O. Box 933, Manila, Philippines.

Mhlanga, S. (2010). Economic Analysis of Consumer Based Attributes for Rice in Benin. Unpublished M.Sc Thesis, Department of Agricultural Economics, McGill University.

Mi-Young, K., Rico, C. W., Chae-Eun, K., Sang-Chul, L. (2011). Physiochemical properties and eating qualities of milled rice from different Korean elite rice varieties. Int. J. Food Prop., 14(3), 640–653.

Morris, C. F. (2016). Grain Quality Attributes for Cereals Other than Wheat. Food Science.

Muriel, C. D., Siet, J. S., Gerrit, A. (2016). Consumer segmentation based on food category attribute importance: The relation with healthiness and sustainability perceptions. Food Qual. Pref., 48(A), 99–106.

NPC (2006). National Population and Housing Census. National Population Commission. Retrieved Dec 20th 2013 from: http://www.population.gov.ng/index.php/censuses

Oczkowski, E. (1994). Hedonic price function for Australian Premium Table wine. Aust. J. Agric. Econ., 38(1), 93–110.

Olszewski, W., Wolinsky, A. (2016). Search for an object with two attributes. J. Econ. Theory, 161, 145–160.

Punch (2012). Nigerians eating 10 year old rice Retrieved Dec 20th 2013 from: http://www.punchng.com/business/business-economy/nigerians-eating-10-year-old-rice-investigation/

Rijswijk, W. V., Frewer, L. J. (2008). Consumer perceptions of food quality and safety and their relation to traceability. Brit. Food J., 110(10), 1034–1046.

Rosen, S. (1974). Hedonic prices and implicit markets: Product differentiation in pure competition. Journal Polit. Econ., 82(1), 34–55.

Roy, P., Ijiri, T., Okadome, H., Nei, D., Orikasa, T., Nakamura, N., Shiina, T. (2008). Effect of processing conditions on overall energy consumption and quality of rice (*Oryza sativa* L.). J. Food Eng., 89(3), 343–348.

Sar, S., Gilbert, R. G., Marks, G. C. (2012). Household rice choice and consumption behaviour across agro-climatic zones of Cambodia. J. Hunger Env. Nutr., 7(2–3), 333–346.

Seck, P. A., Tollens, E., Wopereis, M. C. S., Diagne, A., Bamba, I. (2010). Rising trends and variability of rice prices: threats and opportunities for sub-Saharan Africa. Food Policy, 35(5), 403–411.

Sudha, V., Donna, S., Biling, H., Malik, V., Jones, C., Wedick, N. M., Hu, F. B., Willet, W., Bai, M. R., Ponnalagu, M. M., Arumugan, K., Mohan, V. (2013). Consumer acceptance and preference study (CAPS) on brown and undermilled Indian rice varieties in Chennai, India. J. Am. Coll. Nutr., 32 (1), 50–57.

Suwannaporn, P., Linnemann, A. (2008). Consumer preferences and buying criteria in Rice: A study to identify market strategy for Thailand Jasmine rice export. J. Food Prod. Mark., 14(4), 33–53.

Theil, H. (1965). Qualities, Prices, and Budget Inquiries. Rev. Econ. Stud., 19, 129–147.

Tomlins, K. I., Manful, J. T., Larwer, P., Hammond, L. (2005). Urban consumer preferences and sensory evaluation of locally produced and imported rice in West Africa. Food Qual. Pref., 16(1), 79–89.

Unnevehr, L. J. (1992). Methodologies for measuring consumer preferences and welfare effects of quality improvement. In: Consumer demand for rice grain quality (p. 21–33). International Rice Research Institute, P.O. Box 933, Manila, Philippines.

USAID (2009). Global food security response: West Africa rice value chain analysis. MicroReport, No. 161. Washington, D.C.: United States Agency for International Development.

USDA (2012). United States Department of Agriculture, International Data Base.

Waugh, F. V. (1928). Quality factors influencing vegetable prices. J. Farm Econ.. 19, 185–96.

Wedgwood, H., Duff, B. (1992). The economics of rough rice quality at the farm level. In: Consumer demand for rice grain quality (p. 159–174). International Rice Research Institute, P.O. Box 933, Manila, Philippines.

Wendy, C. P., Latif, M. A., Rafii, M. Y., Ismail, M. R., Puteh, A. (2016). Advances to improve the eating and cooking qualities of rice by marker-assisted breeding. Crit. Rev. Biotech., 36(1), 87–98.

Wilson, W. W. (1984). Hedonic prices in the malting barley market. West. J. Agric. Econ., 9, 29–40.

Wooldridge, J. M. (2006). Introductory Econometrics. Thomson Higher Education.

SZACOWANIE CEN ATRYBUTÓW JAKOŚCIOWYCH WPŁYWAJĄCYCH NA CENY RYŻU I WYBORY DOKONYWANE PRZEZ KONSUMENTÓW W NIGERII

Streszczenie. Fakt, że nigeryjscy konsumenci preferują marki ryżu importowanego, wynika przede wszystkim z różnic jakościowych pomiędzy markami lokalnymi i zagranicznymi. W niniejszym artykule przedstawiono wnioski z badania przeprowadzonego w Federalnym Terytorium Stołecznym Nigerii w celu ustalenia względnej istotności atrybutów jakościowych ryżu oraz obliczenia cen płaconych przez konsumenta z tego tytułu. Model hedoniczny został oszacowany na podstawie zestawu danych z 2014 r. zebranych w ramach ankiety, która objęła 460 gospodarstw domowych będących konsumentami ryżu. Jak wykazały wyniki, respondenci z gospodarstw domowych płacili średnio 10 416 NGN (53 USD) za pięćdziesięciokilogramowy worek ryżu marki zagranicznej oraz 7 567 NGN (38 USD) za taką samą ilość ryżu marki lokalnej. Udział atrybutów jakościowych w cenie płaconej przez konsumentów za ryż waha się od 48% do 52%. Wysoka zdolność do pęcznienia, bielsza barwa po ugotowaniu, czystość i niesklejające się ziarna to czynniki, które w najwyższym stopniu wpływają na ceny rynkowe importowanego ryżu w Nigerii. Konsumenci są skłonni dopłacić średnio 326 NGN (1,65 USD), 320 NGN (1,60 USD), 158 NGN (0,80 USD) i 122 NGN (0,61 USD) za powyższe atrybuty jakościowe (w podanej kolejności). Dla rolników uprawiających ryż, zakładów przetwórczych i sprzedawców ryżu oznacza to zarówno wyzwania dotyczące inwestycji, jak i nowe możliwości. Niniejsze rozważania dotyczą tego, w jaki sposób sytuacja ta może oddziaływać na doskonalenie jakości oraz opracowywanie strategii i programów marketingowych na rzecz rozwoju nigeryjskiej branży producentów ryżu.

Słowa kluczowe: końcowa cena produktu, atrybuty jakościowe, marki ryżu, Nigeria

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