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CONSUMER PREFERENCES FOR TABLE CASSAVA CHARACTERISTICS IN PERNAMBUCO, BRAZIL[1]

Carolina González[2]
Nancy Johnson[3]

Abstract: Cassava is a major source of carbohydrate for populations in the tropics; however, there is little information about the preferences of consumers toward the quality characteristics of this crop. This paper analyzes the demand for different cassava attributes, and applies the hedonic price method to estimate the values that consumers give to implicit attributes of cassava. The results show that ease of peeling, time of cooking and texture of cassava are the most important characteristics consumers consider when purchasing and consuming cassava. Cassava varieties, root size, ease of peeling and location of the market are relevant attributes in price determination.

Keywords: cassava, consumer preferences, hedonic price, Northeast of Brazil

1. Introduction

Cassava (Manihot esculenta Crantz) is a root crop from tropical America. It is the fourth most important food staple produced in the tropics, with a global production of 228 million tons (FAOSTAT, 2008) and it is a major source of carbohydrate for populations in the humid tropics, around 700 million people obtain more than 500 calories per day from cassava consumption (HARVESTPLUS, 2008). It is in Sub-Saharan Africa where the per capita consumption is the highest (101 kg/year) (FAOSTAT, 2008). In Latin America and the Caribbean the consumption per capita is lower

[1] Received August 11, 2009; Accepted November 19, 2009.
[2] Research associate in the International Center for Tropical Agriculture (CIAT), Cali, Colombia and a PhD candidate, Department of Agricultural Economics and Social Sciences, University of Hohenheim, Stuttgart, Germany. E-mail: c.gonzalez@cgiar.org or gonzacaro@hotmail.com.
[3] Leader of the Livestock, Livelihoods and Poverty project in the International Livestock Research Institute (ILRI), Nairobi, Kenya. E-mail: n.johnson@cgiar.org.

(21kg/year) however, in Brazil cassava continues to be a principle staple food and average per capita consumption is 41 kg/day (FAOSTAT, 2008).

Cassava is usually considered a subsistence crop, grown and eaten by the poor. However, recent studies in Brazil suggest that because of migration from rural to urban zones and price seasonality among other factors; many people purchase their cassava, even if they also produce (SOUZA, FARIAS, MATTOS, et al., 2006). This means that attention must be paid to consumer and market characteristics as well as to production characteristics such as yield and disease resistance, which have previously been a major focus on breeder attention (CIAT, 2007).

There are many food products derived from cassava. The traditional categories according to the root type are: table or sweet cassava and industrial or bitter cassava. In Brazil, most table cassava is distributed for direct consumption as fresh cassava called macaxeira or aipim. Farinha (a toasted flour) and starches are the main sub products of industrial cassava. Several studies have looked at processed products of cassava, especially in farinha and starch production and commercialization (CAPRILES, SOARES and AREAS, 2007; SOUZA, FARIAS, MATTOS, et al., 2006); however, there are very few studies about fresh cassava. Due to cassava's importance in the agricultural market and diet of the poor people in the Northeast (NE) of Brazil, the objective of this paper is to help fill the knowledge gap about consumer preferences for fresh cassava. First, using a hedonic price analysis, we attempt to measure the consumer's implicit price of cassava characteristics. This approach postulates that the price of goods is a function of the quality characteristics of the product. To complement this analysis, using logit models we look at what consumer say about their preferences for specific cassava attributes. These results should be useful for producers and sellers of fresh cassava since they show to what extent quality differentials are reflected in price. They could also be useful for researchers in their decisions about characteristics to consider in crop improvement programs. The paper is organized as follows. Section 2 and 3 describe the background and the theoretical model employed in the analyses. Section 4 presents

the data and describes the variables used in the analysis. The empirical results are reported and discussed in the Section 5. Finally the conclusions are presented in Section 6.

2. Background

2.1 Crop Characteristics

Historically cassava has played a fundamental role in Brazil as source of carbohydrates for human consumption and as a supply of employment and income in poorer rural areas especially in the Northeast (NE). Cassava varieties are often categorized as either "sweet" (macaxeira or aipim) or "bitter" (mandioca[4]), reflecting the absence or presence, respectively, of toxic levels of cyanogenic glucosidesis. The former can be consumed directly after peeling and either boiling, baking or frying, while the latter needs additional processing such as fermentation or drying. The bitter varieties of cassava are used for industrial uses (OSPINA and CEBALLOS, 2002).

In optimal conditions[5] cassava requires at least 10 months of warm weather to produce a crop. It is traditionally grown in a savanna climate, but can be grown in extremes of rainfall (O'HAIR, 1995). Certain inherent characteristics have made cassava an important crop in Brazil: it has very high productivity per unit land area; it is well adapted to adverse climatic and soil conditions; it has no fixed planting date or time of harvest; and its rarely fails as a crop.

[4] Popular Portuguese name.
[5] The production cycle is the same for both sweet and bitter varieties.

2.2 Price

Two characteristics strongly influence the price of fresh cassava—perishability and competition with other derivate cassava products. These factors plus a market composed of small producers with low technology adoption, low degree of organization and lack of access to information lead to significant fluctuations in prices. In Brazil, studies reveled that cassava has a demand elasticity less than 1; CARDOSO AND SOUZA (1999) showed some elasticity coefficients: -0,02 (1970), -0,02 (1975) and –0,03 (1975). In this condition incentives for more production could be perverse and harmful for producers, leading to reductions in prices and, by extension, in producer incomes. For these reasons it is important to work to add value to fresh cassava, focusing in improve the attributes, which differentiate the product in markets.

3. Theoretical Model

Much work has been done on the impact of quality characteristics on price of agricultural products in developed countries (WAHL, SHI, and MITTELHAMMER, 1995; BOWMAN and ETHRIDG,1992). However, few empirical studies have been conducted to quantify the value of quality characteristics of traditional crops in developing countries (UNNEVEHR, 1986; SAMIKWA, BRORSEN and SANDERS, 1998; DALTON, 2004; EDMEADES, 2006). This method presumes that the price of a marketed good is related to its characteristics. Therefore the observed product price is constructed by the attributes of the product (WILLIAMS, SPYCHER and OKIKE, 2003). The marginal implicit value of output characteristics can be derived from a hedonic price function that traces the behavior of consumers and producers of differentiated products (EDMEADES, 2006).

The buyer's bid function is derived through utility maximization subject to an expenditure constraint, and it can be represented by the utility function.

$$\mu = \mu(z_{1,} z_2, ..., z_m; Y, \alpha) \ , \qquad (1)$$

where, μ(.) is the buyer's bid function for the product in the market, z is a vector of the characteristics of the good, Y is the buyer's total expenditure and α is a vector of observed and unobserved parameters, which characterize the preferences of the consumer. The fist partial derivative of the bid function with respect to an individual characteristic depict the buyer's willingness to pay for an additional unit of the characteristic (CAREW, 2000).

On the supply side, the seller's offer function can be specified as:

$$\varphi = \varphi \ (z_1, z_2, ...z_m; N, \gamma) \ , \qquad (2)$$

where φ (.) is the seller's offer function, N is the output quantity of good produced by the seller with characteristic specification z, and ã is a vector of prices and production technologies. The offer function is defined as the minimum price that the seller is willing to accept for supplying N units of good having characteristic levels z. The first partial derivative of the offer function with respect to an individual characteristic reveals the seller's marginal implicit valuation for providing other unit of that characteristic.

In the market, the sales occur when both, buyer and seller agree on the price of a particular product with a specific set of characteristics. The intersection point between the buyer's bid curve and the seller's offer curve for the characteristics represents this situation. Simultaneously, the intersection point also represents the buyer's and seller's marginal implicit bid and offer, respectively (WAHL, SHI, and MITTELHAMMER, 1995).

Finally, the hedonic price function is estimated by regressing the equilibrium price of products on the characteristics of the product. It can be expressed as:

$$P(z) = f(z_1, z_2, ..., z_m), \quad (3)$$

where P (z) is the price of a good and z is a vector of quality characteristics of the good.

4. Methodology

The NE suffers the highest levels of poverty and underdevelopment in Brazil. In this region, skewed land distribution and semi-arid climate are among the factors that contribute to the region's high relative levels of infant mortality, absolute poverty, unemployment, underemployment, illiteracy, lack of access to basic services and malnutrition (OSPINA and CEBALLOS, 2002). Pernambuco, the focus of this study, is a typical state in the NE Brazil. In terms of population it is second after Bahia with an estimated population of 8.5 million in 2007 (IBGE, 2007). Over 85% of the area of Pernambuco falls into the category of semi-arid (less than 600 mm rainfall in a year). This state is the fourth largest producer of cassava in the NE of Brazil, approximately 660 thousand ton/year. However it has the second highest per capita cassava consumption rates, 125gr/day per capita after Paraiba (WORLD BANK, 1997). In semiarid Pernambuco, low and variable rainfall makes cassava practically the only staple food crop option for farmers, and cassava consequently constitutes the main food source, especially for low-income people.

For analyzing consumer preferences we conducted a survey in the state of Pernambuco during the end of 2006 and beginning of 2007. The interview-based survey was carried out in urban areas of four medium-sized municipalities with high production (in their rural areas) and consumption of cassava. These municipalities represent the two major geographic zone of this state: a. Semiarid (Agreste and Sertao) and Coastal (Zona da Mata and part of Agreste). We took two municipalities from semiarid and two from coastal. They are typical cassava production zones with different varieties of sweet cassava in the local markets. A stratified

random sampling method was employed: households were selected randomly after stratifying each city into zones by income[6]. A sample comprising 414 respondents was achieved. However 473 observations were achieved because there are more than one purchase for some households. Personal interviews were conducted in the people's home with the person in charge of purchasing the household food.

4.1 Variables and empirical model

In this study we only refer to sweet fresh cassava varieties (macaxeira or aipim), for direct consumption. We focused on this type of varieties because they are very important in the diet of poor people. As mentioned earlier, very few studies have addressed looked at the market for this crop –a market that could potentially increase due to Brazil's trend toward urbanization.

Based on a pilot study and on expert opinion of cassava researchers, we identified possible quality characteristics that consumers might consider when buying and consuming sweet cassava. Specifically, we looked at the following characteristics:

a. Colour: We differentiate the peel colour from the flesh colour. In this region consumers normally find in the market cassava with three peel colours: white, pink and yellow. The flesh colour of pink and white peel varieties is white while yellow varieties have a same peel and flesh colour. In some cases, names of the varieties consumed are associated with these colours.

b. Time of cooking: for consumers a good cassava takes around 15 – 20 minutes for cooking after boiling. In the pressure cooker, it should only take 5 minutes.

[6] We interviewed people of medium and low income. However, it is important to say that three of the four municipalities do not have people with high income. In these cases we basically included all the urban area of the municipality.

c. Taste: Some cassava varieties are considered sweet, while others have a more neutral flavor.

d. Texture: This refers to the level of hardness in chewing the cassava. The options in this study are mush or mealy.

e. Easy of peeling: It is very common when people buy cassava to take a little portion to tell if peeling is easy or not. Ease of peeling indicates cassava good quality.

f. Fiber: Cassava is considered fibrous when some strands are difficult to chew. While this is an undesirable characteristic, it is a very difficult one to detect at visually.

g. Size: This refers to the thickness (diameter) of the root. We divided them into fine (18 – 40 mm) medium (41- 55 mm) and thick (>55mm).

We also collected information on the price of cassava by variety, where the cassava was purchased, and quantity and frequency of cassava consumption in the household, along with demographic information (Table 1).

Excluding the influence of market forces that can affect general price levels, an empirical model for fresh cassava can be specified as:

$$\text{Price/kg} = \begin{array}{l} \beta_0 + \beta_1 TypeVariety + \beta_2 Size + \beta_3 Taste + \beta_4 Fiber + \beta_5 Texture \\ \beta_6 TIME + \beta_7 Easepeel + \beta_8 Location + \varepsilon_I \end{array} .$$

Since the model includes only dummy variables to measure quality characteristics, except time of cooking, the estimated coefficients determine the ranking pattern of each attribute on price.

5. Results

Most of the interviewees were female (93%) probably because they are the people who did the majority of shopping in the household (Table 1). Fifty five percent only have elementary education and around a 10% were below the poverty line of US 1 a day per capita. The average number of people in the household is 4.4, and 67% of households have children under 5 years. Approximately, 50% of respondents are housewives and 9% have a formal employment, mostly in the public sector. Around 80% of the respondents buy their cassava in the traditional or local markets, a pattern that is consistent across the two regions. In the semiarid region, the percentage of people who buy the crop in supermarkets (10%) is higher than in the coastal region (only 1%), where sellers who go door to door commonly sell fresh cassava.

Households consumed cassava on average 2.84 times per week, with slightly more frequent consumption in the semiarid than the coastal zones (Table 1). This number shows the importance of cassava as a basic staple, however it is also shows that people do not consume it every day as they do with some staples such as rice in Asia or maize in East Africa and Central America. The average quantity of cassava eaten per meal in a household is 335g. Finally, the average of amount spent on cassava per week in the household is R.$ 1.84/kg, which is approximately 2% of total food expenditure.

Regarding the preferences, respondents were asked to rank, in order of importance, the three main characteristics they consider when buying or eating cassava. The results show that ease of peeling (29%) is the most important characteristic for consumers. One possible explanation is that this characteristic is easy to test, and people consider it an indicator not only of amount of work involved in peeling but also of other quality characteristics. After ease of peeling, time of cooking (28%) is another important characteristics for consumers, followed distantly by texture (16%) and then colour (11%). Price has the lowest place in the consumer ranking, which is consistent with the price inelasticity of cassava.

We have a special interest in colour preferences because there are cassava varieties with other colours different from the commonly white that could be introduced to markets as a high value product (HARVESTPLUS, 2008). The consumers of the areas that we study distinguish between two colours: white and yellow. The most popular varieties have the former colour. The latter colour is better known in the interior (semiarid region) of the country, where people called these types of varieties manteguinha, which means butter in Portuguese. In the semiarid region people consume more yellow cassava than coastal, 50% versus 17%. We asked about reasons why consumers do not purchase or consume yellow varieties. In the semiarid, they mentioned that manteguinha does not cook very well or takes more time than white cassava (12%) for cooking[7]. On the coast, the main reasons are that they have never tasted, eaten or seen it (75%).

5.1 Hedonic price

In the literature, there is some debate regarding the most appropriate functional form to use to estimate the hedonic function. In general, the theory underlying the approach does not provide much guidance about which of these functional forms is most appropriate. ROSEN's (1974) work suggests that hedonic function not be linear (CROPPER, DECK and MCCONNELL, 1988). In this study we used the Akaike Information Criterion (AIC)[8] to select the functional form of hedonic price model; we tested linear, semilog, double-log, quadratic, and a Box-Cox transformation technique. According to the AIC test, linear and semilog were the best functional forms. However, because semilog form has additional properties, it was selected as useful choice for hedonic price model[9]. Price flexibilities—defined as the percentage of change in the

[7] The results suggest that it is a wrong consumer perception; we did not find a significant difference in time cooking between white or yellow cassava (12,5 minutes).

[8] This criterion minimized over choices of the number of parameters (x) in the model to form a tradeoff between the fit of the model and the model's complexity. Given a data set, competing models may be ranked according to their AIC, with the one having the lowest AIC being the best (EDMEADES, 2006).

[9] First, the implicit value of crop characteristics may be a function not only the level of the characteristic itself, but also a function of the levels of other characteristics embodied in the crop. Semilog hedonic model are consistent with this observation (WAHL, SHI, and MITTELHAMMER, 1995). Second, it is more useful to calculate results expressed in price flexibilities.

price with respect to a 1% increase in the characteristic—were estimated to measure sensitivities. For discrete characteristics, the price flexibility is defined as the percentage change in the price due to the presence of the characteristic relative to its absence. Given the semilog specification of the hedonic price model, marginal value has to be estimated[10]; it can be expressed as $p = (e^{\beta_i}) - 1$, where p is calculated at mean of continuous variables and at zero for discrete characteristics.

Parameters obtained via estimation of semilog model, marginal value and price flexibilities are reported in Table 2. In general, estimated parameters were consistent with hypothesized signs, and the F test is statistically significant. The results of the model indicate that varieties with yellow peel colour have a higher value to consumers than pink, with a price premium of R.0.09/kg. The price flexibility of yellow varieties shows that a presence of this characteristic, holding all else constant, increases by 11% the cassava price. Unsurprisingly, people pay for bigger sizes, if cassava size decrease from thick size to medium or fine, respectively, the cassava price would reduce by 7.4 and 13% respectively. If marginal cost of changing from pink to yellow peel varieties, or of producing bigger cassava roots were less than R.0.08/kg and R. 0.09/kg respectively, these results suggest that it would be beneficial for the producer to do so. Additionally, cost of production does not depend on the type of cassava variety; it is more related with the production system. Therefore producing cassavas with characteristics more attractive to the market should not imply an increase in cost. The great marginal gain for producer, however, may be associated with the location. In coastal areas cassava price is lower than in the semiarid regions. The price difference it is around R. 0,39/kg. Regarding to price flexibilities of dummy location variables (semiarid), the coefficient reported is positive; holding all else constant, cassava price in the semiarid would increase by 50%. Nevertheless, it could be not profitable for fresh cassava producers in

[10] Marginal value is defined as the change in the price with respect to one unit increase in the characteristics from its mean value. In the case of discrete variables, it depends on the presence or absence of the characteristics. (WAHL, SHI and MITTELHAMMER, 1995).

coastal region to distribute their production in the semiarid due to the perish ability and the high costs of transportation and refrigeration.

Unexpectedly ease of peeling has a negative coefficient, which could be attributed to the low percentage (3.8%) of consumers of hard-to-peel cassava, who pay a significantly higher price, as compared with consumers of easy-to-peel cassava. When the characteristics of consumers of hard-to-peel cassava were analyzed, results indicated that many of them produced their own cassava or purchased cassava in supermarkets or at their door, which could mean that these consumers pay a higher price for this cassava because they assume they are purchasing a quality product. However, the quality of the cassava is not always as expected. Other attributes such as texture, taste, quantity of fibers and time of cooking are statistically unimportant in terms of their influence on price. This may be due to the fact that these characteristics can only be known after cassava has been boiled and consumed. This suggests that complementary research needs to be done using other methodologies such as sensorial techniques, for example, in order to know the real economic importance of these characteristics.[11]

5.2 Logit model: Consumer preferences

We estimated a logit model for each characteristic to assess the influence of socioeconomic and demographics characteristics of consumers on cassava preferences. Specific factors considered included sex, age, education, monthly household income, region (semiarid and coastal), a dummy variable for purchase and for own production[12] and kilograms of fresh cassava consumed in the household per meal. For each attribute, the dependent variable was one for households that ranked that attribute most important. The estimated results show that not all the characteristics had statistically significant models. Price, colour of the cassava, amount

[11] There are some studies to attempt relate the sensory qualities of cassava roots to their physicochemical properties (PADONOU, MESTRES, and MATHURIN, 2005; BELÉIA, PRUDENCIO-FERREIRA, YAMASHITA et al., 2004), however they did not develop a economic valuation.

[12] In some cases a person could be producer and buyer of cassava at the same time.

of fibers, and other characteristics had less than 10 % of people ranking them as most important. However, we obtained interesting results with time of cooking, texture, taste and ease of peeling (Table 3).

Ease of peeling is more important for women than for men, which make sense because in this zone women not only purchase but also prepare the cassava. Men, on the other hand, place more importance on taste, a significant percentage (70%) prefer sweet cassava toward 13% of women, who prefer a neutral taste.

Some studies show that there are significant differences between consumer preferences among regions (SOUZA, FARIAS, MATTOS, et al., 2006), and the results of the study confirm this. While taste is very important in the semiarid region, texture is determinant in the coastal region; for example, consumers in the former region would prefer the taste of sweet cassava while those in the latter region would prefer cassava with a mush texture. For producers and researchers these findings are very important to know which varieties should be produced and oriented to which regional market.

In the literature, cassava is considered an inferior good, meaning that at lower levels of income more quantity of cassava consumed in households. The results of this study support that contention; households in the study with less income consume more grams of cassava than household with more incomes (362 gr./meal vs. 249gr/meal). The propensity to prefer time of cooking is also negatively influenced by income. Household with higher levels of income in the sample have lower probability of select time of cooking as the most important characteristics for buying and consuming cassava, which might reflect that they are less concerned with the fuel-related costs associated with longer cooking.[13]. Levels of education have significant effects on which characteristics are more important. Time of cooking is more important for consumers with a university education as compared with consumers with only elementary

[13] The average per capita income is 166 reais per month (US $78). Ten percent of the households are extremely poor; many more can be classified as moderately poor.

schooling, who in turn prefer ease of peeling. The preference of the former could be attributed to the less time they have to dedicate to household chores. Households with higher consumption of cassava per meal likely take more into account texture and taste of this crop at purchase or consumption moment. Time of cooking it is less important for them. Finally, ease of peeling is an important characteristic for both consumers who have their own production and also for those who purchase cassava. These results are consistent with the raking of most important characteristics that consumer consider when buying cassava. In sum, the empirical applications of the qualitative model offer valuable insights into the factors that influence decisions regarding the desirable characteristics for consumers.

6. Conclusions

This paper evaluates the consumer preferences for cassava in Pernambuco, a state in NE Brazil. The aim of the paper was to fill an information gap about consumer preferences for quality characteristics in order to help producers and researchers to develop varieties more attractive for the markets. Knowledge about implicit values of quality characteristics indicates which attributes should be focused on and which characteristics could be allowed to vary. The empirical results presented above indicate that some attributes are very important when people buy cassava such as ease of peeling, or time of cooking and texture for cassava consumption. The estimated results in the hedonic model in terms of prices show a big difference between semiarid and coastal region, also among yellow and pink varieties. The price of yellow cassava is higher than other varieties; but its market is smaller because it is only known and preferred in the semiarid region. Fresh cassava with larger size has a premium. According to researchers the size of cassava depends on production system and environmental characteristics. Therefore producers have to take in account those variables in order to obtain a desirable size cassava root.

Consumer preferences toward characteristics such as texture and taste are also highly influenced by region. This result suggests that producers in semiarid should grow a meal fresh cassava, with a sweet taste; while producers in coastal could have good market opportunities with a mush cassava, with neutral taste. Although price is relatively unimportant in the consumers' ranking of attributes, it is truly relevant for producers. Because of inelasticity of cassava demand, it is very important to add value to this crop, to avoid driving down incomes in the long term.

Finally, complementary studies should be carried out including sensorial techniques of cassava characteristics related with an economic valuation. It is important to deepen the market study of the basic staple crops. This type of research could be conducted for other crops as potatoes or beans to guide producers and researchers to varieties which are most valued by consumer.

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Resumo: A mandioca-de mesa (macaxeira ou aipim) é uma das principais fontes de carboidrato das populações nos trópicos. No entanto, há pouca informação sobre as preferências dos consumidores em relação às características de qualidade deste cultivo. Este artigo analisa a demanda de diferentes atributos da mandioca de mesa e aplica o método dos preços hedônicos para estimar o valor que os consumidores dão aos atributos implícitos deste tubérculo. Os resultados mostram que a facilidade de descascamento, o tempo de cozimento e a textura da mandioca de mesa são as características mais importantes para os consumidores quando a compram e consomem. O tipo de variedades, o tamanho da raiz, a facilidade de descascamento e a localização do mercado são atributos relevantes na determinação dos preços.

Palavras - chave: mandioca mansa, preferências do consumidor, preços hedônicos, Nordeste do Brasil

Table 1 - Descriptive statistics

Variables		**Semiarid**	**Coastal**	**Total**
Female respondent, dummy (%)		90.48	96.17	93.00**
Age of respondent (years)		39.43 (14.14)	41.31 (13.63)	40.48 (13.93)
Size of household (people)		4.45 (1.99)	4.33 (1.69)	4.40 (1.87)
Education of respondents (%)	**No formal education**	16.45	15.30	15.94
	Elementary school (1 –6 years)	53.55	57.14	55.56
	High school (7 – 11 years)	22.51	26.78	24.40
	University	3.90	4.37	4.11
Monthly household income (Reais)		429.45 (207.3)	395.76 (192.4)	414.55 * (201.3)
Consumption of cassava in the household	**Price (Reais/kg)**	.91 (.29)	.59 (.18)	.77 *** (.29)
	Cassava consumption (kg/meal)	.391 (0.05)	.290 (0.06)	.335 *** (.05)
	# times eat cassava/ week	3.00 (1.35)	2.63 (1.32)	2.84 *** (1.35)
	Amount spend/week	2.09 (1.36)	1.52 (.77)	1.84 *** (1.17)
	Cassava producer, dummy (%)	16.45	15.85	16.18

N:414; *,**,*** The difference between semiarid and coastal is statistically significant at the 0.10, 0.05 and 0.01 level, respectively

Table 2 - Hedonic price of cassava

Variables		Coef.	Price flexibilities	Marginal Value
Variety (ref. pink)	**white**	-.018 (.029)	-0.018	-0.014
	yellow	.107 ** (.047)	0.113	0.088
Size (ref. thick)	**fine**	-.140 *** (.050)	-0.131	-0.102
	medium	-.077 ** (.035)	-0.074	-0.058
Taste (ref. neutral)	**sweet**	.041 (.032)	0.042	0.033
Fibers (ref. low)	**much**	.029 (.064)	0.029	0.023
Texture (ref. mealy)	**mush**	-.021 (.031)	-0.021	-0.016
Ease of peeling (ref. Not important)		-.136 ** (0.67)	-0.127	-0.099
Time of cooking (min)		-.003 (0.003)	-0.038	-0.002
Location (semiarid)		.408 *** (.030)	0.504	0.392
Intercept		-.336*** (.090)		
F(10, 462)		30.20***		
R-squared		40%		

N:473; *,**,*** Statistically significant at the 0.10, 0.05 and 0.01 level, respectively

Table 3 - Socioeconomic factors explaining cassava preferences (logit models)

Variables		Time of cooking		Texture		Taste		Ease peeling	
		Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE.
Female respondent		.03	.44	.63	1.06	-1.66***	.62	.95**	.47
Age (years)		.01	.01	-.01	.02	.01	.021	.01	01
Education Elementary school	**No education**	-.31	.33	.071	.59	.34	.78	.08	.31
	High school	-.11	.28	.66	.41	.94	.62	-.10	.27
	University	1.92***	.61	-.34	1.09	b.		-1.47**	.70
Household income (R.)		-.00***	.00	.00	.00	.00	.00	.00**	.00
Kg/meal/per capita		-8.92***	2.45	5.54*	2.94	6.99*	1.08	2.20	1.97
Own production, dummy		-.68	.50	a.		a.		1.10***	.43
Cassava buyers, dummy		-.29	.61	-.54	.54	.23	1.08	1.29**	.54
Semiarid, dummy		-.28	.23	-1.36***	.41	1.01*	.61	.28	.22
Intercept		1.15	.89	-2.41*	1.37	-4.36***	1.65	-3.81***	.87
Log likelihood		-247.90		-114.27		-61.93		-264.31	
Chi-squared		37.72***		25.37***		16.53**		24.69***	

N:414; *,**,*** Statistically significant at the 0.10, 0.05 and 0.01 level, respectively

a. Variable dropped because there are not people that simultaneously are producer and buyer.

b. Variable education-university = 0 predicts failure perfectly; it was dropped and 17 observations not used.