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Abstract

Purpose – Starting from a territorial development project in Western Honduras (Copán and Ocotepeque), farmers aimed to increase and add value to agricultural production by producing and commercializing granulated brown sugar (panela). The Western Honduras sugar market was studied, from the supply and demand side, in order to particularly understand consumer preference which is considered a key to increase smallholder farmers' income in rural areas.

Design/methodology/approach – The research included a qualitative study by means of six visits for observation and data compilation to stores, four face-to-face open semi-structured interviews with store owners and a focus group with local producers to acquire a global picture of the main regional sugar market characteristics from the supply side. Moreover a quantitative analysis applying a Choice Experiment to study consumer preferences was performed acquiring higher knowledge from the demand side.

Findings – First, it was found that Honduras sugar market could be experiencing monopolistic practices and white sugar to 9 lempiras per pound was the most popular product according to the qualitative study. Second, for consumers who knew *dulce de panela*, granulated brown sugar was preferred over refined white sugar. Consumers who had a high level of education, came from rural areas, considered brown sugar to be healthier and read nutritional information were more prone to consume granulated brown sugar. On the other hand, the estimated selling price was around 16 lempiras/pound, but consumers were willing to pay at the most 11.59 lempiras/pound. Nevertheless, market share simulation showed a market niche to comercialize granulated brown sugar – panela.

Originality/value – This research is of academics, farmers and policy makers value. There are no studies analyzing consumer behavior regarding granulated brown sugar in Honduras. The results provide information about the previous steps which need to be given for smallholders in order to commercialize this novelty product; and it stressed the necessity of highlighting health claims on panela which would involve political actions.

Keywords Focus groups, Consumer behaviour, Interviews, Choice experiment, Granulated brown sugar – panela, Smallholder farmers

Paper type Research paper

1. Introduction

In Latin America, the Local Economic Development (LED) approach has become an alternative to welfare policies for tackling poverty, particularly in rural areas (Alburquerque, 2004) due to both higher rural poverty (De Janvry and Sadoulet, 2000) and also the importance of rural sectors in generating employment and exports (Kydd and Dorward, 2004). In the current context, the increasing decentralization

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process has created opportunities for local actors, public and private ones, to respond and take development into their own hands. Thus private and public partnerships in localities and regions are assuming greater responsibility for their own development (Helmsing, 2001, 2003). As a result, the prospect of economic development based on each territory's local actors and social capital has become more important (Lundy *et al.*, 2002). In this sense, LED attempts to manage existing resources to create jobs and stimulate the economy of a well-defined area by means of local agents (Helmsing, 2003). In rural areas, to improve the livelihood of population it is necessary to diversify activities and incomes (Alburquerque, 2004; Lundy *et al.*, 2002; Helmsing, 2003) and to add value to agricultural production through post-harvest processing (Rosegrant *et al.*, 2001). Therefore, National and regional LED strategies in Latin America have been developed to a large extent by productive projects lead to smallholder farmers, especially in Central America (Biekart, 2005), and notably so in Honduras (Barquero, 2013).

In this regard, national and regional LED strategies in Honduras – *Visión de País 2010-2038* or *Plan de Nación 2010-2022* (Government of Honduras, 2010) – have addressed territorial development plans at the local level. Such initiatives have received financial assistance from multilateral agencies. One of the main plan aims is to seek ways to improve post-harvest transformation and develop commercialization methods through the promotion of micro-enterprises (Ramírez and Murillo, 2002), being international cooperation initiatives aligned with these policy guidelines. However, productive projects in developing countries, especially those supported by NGOs, have usually suffered from organizations' lack of expertise in market research (Dahan *et al.*, 2010; Helmsing, 2003; North and Cameron, 2000); the above-mentioned together with the existing small farmers' cautiousness in participating in entrepreneurial activities such as production of food with novel or desirable traits (millets, taro, yams, quinoa) or beverages and natural health products (acai or rooibos) which reflects concerns related to unforeseen economic, social and cultural changes (Johns *et al.*, 2013) may hinder the advance of local development. In this context, understanding the markets and particularly consumer preferences are key issues in order to design successful products and even marketing strategies that generate increased sales and consequently increased incomes (Deaton and Muellbauer, 1980; Foxall, 2002) for the micro-enterprises conformed by local smallholder farmers. This paper attempts to go beyond territorial development plans and shows the importance of analyzing the market within the framework of local rural farmers' business initiatives, particularly when there are high levels of rural poverty and the support provided by international cooperation is one-off and short-term. The research started with a producers' association called *Luz y Vida* comprising 25 members who grow sugarcane in the Ocotopeque region (Honduras). Starting from an NGO-sponsored territorial development project, farmers aimed to increase sugarcane production, to add value by means of producing granulated brown sugar (panela) and to expand its commercialization. Granulated panela follows a different manufacturing process from brown sugar, with different organoleptic and nutritional features; it is a novelty product in Honduras sugar market where it has very recent and marginal presence. Thus, the sugar market at a regional level in Western Honduras (Copán and Ocotepeque) was analyzed by means of qualitative methods such as six visits to stores for observation and data compilation four face-to-face open semi-structured interviews with store owners and a focus group with local producers to acquire a global picture of the main characteristics from the supply side. Later, from the demand side, a quantitative method called Choice Experiment (CE) was applied in order to study consumer preferences regarding

granulated brown sugar in the above-mentioned regions of Western Honduras, considering the trade-offs among different sugars' features.

The paper is structured as follows. Section 2 shows the characteristics of the sugar market from the supply side. Section 3 presents the data-gathering process and CE design. Section 4 sets out the results obtained from the CE. Section 5 provides a discussion of the findings and Section 6 presents some conclusions.

2. Building the rural farmers' initiatives framework: an analysis from the supply side

As an initial step of the business initiative, the farmers expected to produce and commercialize brown sugar from sugarcane. The characteristics of the sugar market from the supply side were first defined by a literature review, especially of sectoral studies, finding only two researches by Arturo (2003) and CDPC/BM (2007). It showed that sugar production, commerce and distribution in Honduras are governed by seven large groups. All are unionized in a very large producers' association (APHA). The seven sugar mills sell their production to the Sugar Miller's Central (CISA), which is owned by APAH and has ten warehouses in the country. CISA distributes nationwide white sugar, golden sugar and brown sugar.

CDPC/BM (2007) shows that according to the Herfindahl-Hirschman Index, which measures the economic concentration of the market, sugar production in Honduras is moderately concentrated whereas distribution is extremely concentrated. This study, therefore, indicates that the CISA faces a lack of competition in the market in terms of distribution. This company influences the determination of the price at the national level, as well as production quotas, in what constitutes a monopolistic practice (Arturo, 2003) controlling the import, production, distribution and marketing (Caceres-Rivas and Zelaya, 2012). This is a key issue in Latin America where the existence of monopolies can impede the access to the benefits of economic growth on the part of the rural poverty given that the power of landlord classes which were able to diversify into commercial, financial and industrial activities has just been a constraint in other development process such as those in Ecuador (North and Cameron, 2000).

After making a first approximation of the national sugar market, a fact-finding study of the sugars available in Western regional markets was carried out. This study entailed six visits to stores for observation and data compilation in the cities of Santa Rosa de Copán (Copán region) or San Marcos (Ocotepeque region), the largest cities in the regional area (Cortés, 2012; MANVASEN, 2012), and four face-to-face open semi-structured interviews with store owners. The observation and data compilation visits were carried out by two surveyors who had to make detailed notes of the types of sugar, brands and prices. The analysis of the visits revealed the existence of four different brands corresponding to different types of sugar (white, golden and brown) with prices around 9 lempiras per pound, all of which were distributed by CISA. They also showed the marginal presence of a sugar called granulated brown sugar (granulated panela) with a price between 15 and 20 lempiras per pound produced by the Red COMAL, a group of local rural small producers.

The thematic foci that guided the questions of the individual face-to-face interviews were defined but there was no fixed order of questions (Montañés, 2001). The thematic foci were: consumer preferences (type of sugar, packaging and brands); opinion about brown sugar and consumer profiles; origin of the sugar available in the market; and existence of local sugar suppliers. The stores owners pointed out that, according to their experience, consumer behavior when choosing sugar was influenced to a great

extent by type and price, so there was unanimity in the characteristics of the preferred option in sweetener: white sugar to 9 lempiras per pound. Likewise, they stressed that purchase of brown sugar was still very limited and done by people worried by their health who mainly lived in urban areas, and that a new sweetener can be successful only if inform about their benefits and its price is close to the white sugar price. They also highlighted that only one type of sugar, the granulated brown sugar, was not produced by the sugar mills nor distributed by CISA. Regarding this product, they noted that the origin and type of manufacturing were important features for those consumers who preferred it, being its production very recent and marginal. In addition, store owners emphasized CISA monopoly practices and the difficulty of introducing new brands of white, golden and brown sugar given that they would be fined by health inspectors if they sold brands not belonging to CISA. However, granulated brown sugar was out of CISA interest and government legal requirements, particularly the one related to enrich with vitamin A the sugar consumed in the country. It is not possible to get this feature in a handmade production like the one makes by the small producers, turning into one of the monopolistic market feature (Arturo, 2003).

The fact-finding study was followed by a focus group, which provides diverse outlooks based on the ideas and opinions (Merton *et al.*, 1956), with six representatives of producers in the Association, lasting for two hours. Respondents were asked to order their preferences about commercializing brown sugar or granulated brown sugar – panela – studying the advantages and disadvantages of both options according to the information compiled. The representatives decided to carry out a market survey on granulated brown sugar – panela – to examine the potential of this foodstuff as a business initiative since this product may be outside the control of the monopoly. Another strength of granulated brown sugar is its higher nutritional value in terms of minerals' and vitamins' content compared to other sugars from sugarcane (Hernández *et al.* 2002; Guerra and Mújica, 2010), which makes it a healthier option given that it is considered a whole sweetener, without refined and chemical additives (Kumar and Tiwari, 2006) with a high potential antioxidant activity (Harish *et al.*, 2009). In addition, farmers were producing *dulce de panela* on a very small scale, a traditional product (see Ducuara *et al.*, 2003; Zambrano, 2008) selling informally to neighbors, and the granulated brown sugar only required an additional milling process (a grinding process is recommended at a later stage, once the mixture is stable; although, it is also possible to extract a less processed product by means of a spinning process prior to the consolidation of the mixture) which would add value to the agricultural product. Therefore, some consumers could already know panela by means of the above-mentioned traditional product. Finally, producers were asked about the production cost of *dulce de panela* and the profit margin. The milling, packaging, labeling and distribution costs were estimated by consulting local enterprises and the local distributor AMPROCAL (women's association) (see Table I).

3. CE methodology

3.1 Data sources

Data were gathered using 203 face-to-face surveys administered in 2013. The sample was selected from people over 17 years old who lived in the cities of Santa Rosa de Copán (Copán region) or San Marcos (Ocotepeque region) – total population of these cities and their features were obtained from Local Governments of Valle de Sensenti and Rio Higuito which provided a population census according to baselines from development projects for 2011. Those cities were chosen because they are the largest cities with the highest income levels (Cortés, 2012; MANVASEN, 2012) inside the area

where the farmers could distribute the product. The sampling followed a stratified random methodology with proportional allocation to gender and age; a pre-test (6 percent of the sample) was carried out to detect potential biases in understanding. The questionnaire was structured into several sections to separate behavioral and opinion variables about food, handmade and regional food products; sugar purchasing habits, knowledge and opinion about granulated brown sugar; and the CE exercise. The validity of the sample with respect to the population was verified by performing a χ^2-test between sample and census variables, included in Table II.

3.2 CE design

A CE was used to analyze consumer preferences as to granulated brown sugar because the limited commercial availability of this product made it impossible to apply revealed preference methods. This discrete choice modeling method, which uses stated preferences, is based on both Lancaster's consumer theory (Lancaster, 1966) and random utility theory (Manski, 1997). In this regard, consumers' decisions are based on the utility derived from the defining characteristics/attributes of a product; consumers will choose from different alternatives of the product (with the same attributes but with characteristics at different levels or intensities) whichever option offers maximum utility, including the status quo or baseline option.

CE tries to simulate real purchasing decisions where a consumer has to select a product from a set of options. Individual utility is not directly observed and is given by a systematic utility and a random component, following this functional form (Domencich and McFadden, 1975): $U_{ij} = V_{ij}(x_{ij}, \beta) + \varepsilon_{ij}, j = 1, \ldots, J_i$, where U is the utility function that respondent i has from selecting alternative j; V_{ij} is the deterministic component which depends on both the alternative's and respondent's x_{ij} vector of observed features and the vector of the parameters to estimate β; and ε_{ij} is the stochastic part or error term which has a random character and involves the non-observable preference components. Given that the utility has a random component, the individual i's probability of choosing alternative j will be: $Pr(U_{ij} > U_{iq})$; $\forall q \neq j$. In order to estimate the above-mentioned probability, different probabilistic models can be applied. The model used in this research is the conditional logit regression (McFadden, 1974) due to its simplicity and robustness: $Pr(U_i = j) = e^{\beta' x_{ij}} / \sum_{q=1}^{J_i} e^{\beta' x_{ij}}$, although a limitation is that it makes strict assumptions related to the error terms as it supposes that they are distributed identically and independently (IID) (Louviere *et al.*, 2000) across the utilities with an extreme value distribution. Modeling results are used to generate probabilities of choosing an alternative, representing averages values for the respondents. However, the classical conditional logit regression does not

Description	Cost (lempiras)
Dulce de panela production (one pound)	5.00
Milling (one pound of *Dulce de panela*)	3.00
Packaging	1.00
Labeling	1.00
20% profit margin	3.00
% distribution	3.00
Granulated brown sugar	16.00

Source: Own elaboration from producers, enterprises and AMPROCAL data

Table I.
Estimated costs of granulated brown sugar of producer association *Luz y Vida*

Characteristics	Sample (%)	Population (%)	Sample representativeness[a]
Gender			
Female	53.7	54.0	$\chi^2 = 0.003$ p-value = 0.952
Age			
⩽18 years old and ⩾30 years old	46.7	46.9	$\chi^2 = 0.001$
⩽31 years old and ⩾50 years old	34.9	34.8	p-value = 0.992
⩽51 years old	18.2		
Usual buyers by age			
⩽18 years old and ⩾30 years old	59.3		
⩽31 years old and ⩾50 years old	81.6		
⩽51 years old	77.7		
Education level			
Primary or no studies	57.1		
Secondary studies	21.2		
University studies	6.9		
Do not know	14.8		
Household income (lempiras per month)			
> 4000	50.1		
⩽4000 and ⩾8000	36.3		
< 8000	11.7		
Origin			
Urban	74.3		
Rural	25.3		

Note: [a]The χ^2 values do not exceed the critical values: $\chi^2_{1;0.05} = 3.841$; $\chi^2_{2;0.05} = 5.991$; $\chi^2_{3;0.05} = 7.815$
Source: Own elaboration

Table II.
Descriptive analysis of sample and population socio-demographic characteristics

take sources of heterogeneity in preferences into account. In order to introduce potential sources of heterogeneity into the analysis, a hybrid conditional logit regression was carried out. Heterogeneity was introduced into the utility function by the interactions of individual feature variables with both the alternative-specific constant (ASC) and the attribute considered, leading to the following econometric model (Kallas *et al.*, 2007):

$$Pr(U_i = j) = e^{\beta_0 + \sum i\beta_i x_{ij} + \sum p\alpha_p(\beta_0 \times S_{pn}) + \sum i \sum p\alpha_{ip}(x_{ij} \times S_{pn})} \Big/ \sum_{q=1}^{J_i} e^{\beta_0 + \sum i\beta_i x_{ij} + \sum p\alpha_p(\beta_0 \times S_{pn}) + \sum i \sum p\alpha_{ip}(x_{ij} \times S_{pn})} \quad (1)$$

where β_O is the ASC; β_i the parameter of attribute i; i the attributes which characterize alternative j; x_{ij} the value of attribute i in alternative j; p the socioeconomic characteristics of individual n; α the interaction coefficient between the attribute i and the socioeconomic characteristic p; $\beta_O \times S_{pn}$ the combined effect of the ASC by socioeconomic characteristic (S_{pn}); and $x_{ij} \times S_{pn}$ the combined effect of attribute j by socioeconomic characteristic p of individual n (S_{pn}).

Later, estimates of marginal values for the willingness to pay (WTP) for each attribute were obtained. According to Hanemann (1984), the WTP for a change in the status quo was estimated as the negative ratio between the mean parameters'

coefficients for each attribute and the mean parameters' coefficient of the payment attribute. Finally, from the estimated parameter of choice modeling it is possible to calculate simulated market shares for different sugars, assuming that the sugar market is comprised only of the selected alternatives.

In this study, the utility function (U_{ij}) is associated with consumer preferences as to granulated brown sugar, in order to analyze its potential commercialization, so this product necessarily had to be one of the attributes. Another obvious choice was the most widely commercially available sugar on the market – refined white sugar. Initially the alternative of including all the sugars available in the market was considered. However, the spectrum of available products was simplified to refined white and granulated brown sugar in order to facilitate the choice task and to make clear that both products were substantially different. If golden and brown sugar had been included, the experimental design would have generated too many sugar profiles which would have hindered their differentiation in the CE.

The other attributes and their levels were identified by means of a literature review (CDPC/BM, 2007), the face-to-face interviews with the store owners (see Section 2) and by consulting two experts in agri-food markets, drawing on those characteristics which can add value and differentiate the product (taste was not included as granulated brown sugar is a novel product being its presence in the market very marginal and recent). Finally, the price levels were assigned considering current white sugar market prices (between 7 and 11 lempiras/pound) and also to offset the higher production costs of granulated brown sugar (priced at between 16 and 20 lempiras/pound). Therefore, handmade granulated brown sugar should be priced higher than white sugar in order for the exercise to be realistic. The chosen attributes and their levels are given in Table III. The attributes were coded using dummy coding and the main effects, which tipically represent between 80 and 90 percent of the variance, were checked. Price was considered a continuous variable.

CE is carried out by presenting respondents with a sequence of choice questions where two or more options are presented simultaneously and they have to choose the option they prefer. In our case, respondents were faced with three options, one of which represented the status quo or baseline option, i.e. to purchase the usual sugar (97 percent of the sample described their usual sugar as refined white sugar, produced outside Ocotepeque, industrially produced and at an average price of 8.56 lempiras/pound). The number of attributes and levels led to a high number of potential choice sets (32). Orthogonal optimal in the difference fractional factorial design was developed following the methodological approach of Street and Burgess (2007).

Attributes	Attribute description	Levels
Sugar	Type of sugar	Refined white sugar Granulated brown sugar
Location	Production location	Ocotepeque region Outside Ocotepeque
Production	Type of production	Handmade Industrial production
Price	Price per pound	8 lempiras 12 lempiras 16 lempiras 20 lempiras

Source: Own elaboration

Table III.
Attributes and levels

To this end, we employed the NGENE software resulting in 16 choice sets that were split into two blocks – the design's D-optimality was 97.2 percent (see Figure 1 to find an example of the visual representation and structure of a choice set card).

Finally, prior segmentation was made in order to better identify the heterogeneous preferences (Wind, 1978; Hoek *et al.*, 1996). The segmentation variable was knowledge of *dulce de panela*. This variable was selected because knowledge usually plays a relevant role in the models of consumer behavior (Brucks, 1985) and because was mentioned as a key factor in the focus group session. This may be especially true if we consider that *dulce de panela* was traditionally used before the expansion of the sugar industry in the 1970s, so it has allowed us to analyze whether consumers who were familiar with a similar sugar (*dulce de panela*) have shown a higher preference for granulated brown sugar. Thus, one general model using the entire sample and two applying the level of knowledge of *dulce de panela* as segmentation instrument were appraised. The level of knowledge was measured by a five-point Likert scale (1 to express the lowest level and 5 to indicate the highest level). Then, in order to segment the sample, respondents were classified as "no or minimal knowledge" (Points 1, 2 and 3 on the Likert scale) comprising 36 percent of the sample (S1), with the remainder classified as "knowledge" (S2). While acknowledging that the sample size may suffer from some weakness after the segmentation, the trade-off between sample statistical power and the richness of the findings is well worth it. Indeed, not having uncovered this source of heterogeneity the findings well would it have driven to misleading conclusions since the policy implications are dramatically different when considering the two subsamples.

The general model is estimated by means of the classical conditional logit regression, while the segmentation models have been estimated using both the classical and hybrid conditional logit regression. To implement the hybrid models, together with the different socioeconomic variables (age, years of schooling and origin), respondents were also asked about health considerations, as granulated brown sugar has better nutritional properties

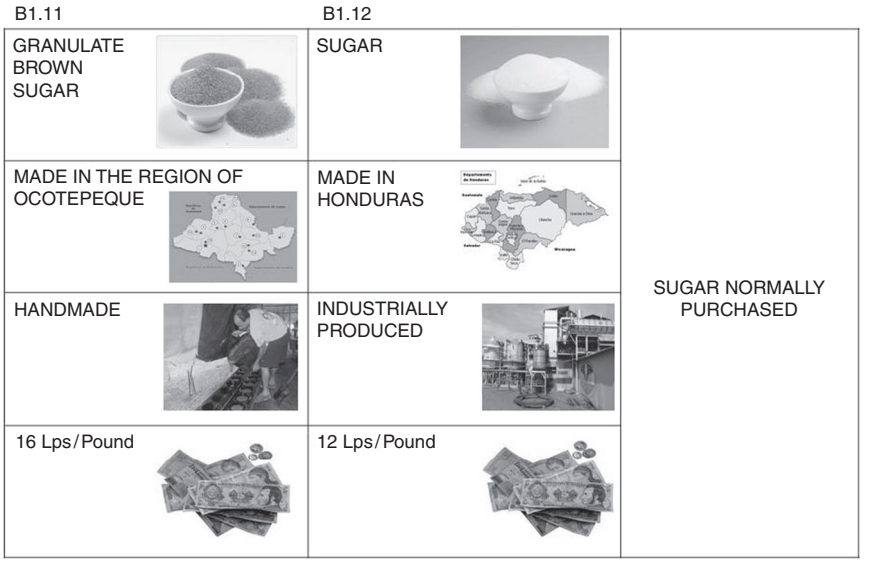

Figure 1.
Example of a visual representation and structure of a choice set card

Source: Own elaboration

than other sugars (Hernández *et al.*, 2002; Mujica *et al.*, 2008), as well as who usually did the shopping in the households. Table IV shows the definition of the variables included in the hybrid models for the whole sample and for S1 – people with scarce knowledge of *dulce de panela* and S2 – people with knowledge about dulce de panela.

Variable name	Variable description	Frequency distributions (%)	Mean	SD
Whole sample				
Health	Brown sugar is healthier than white sugar (5-point increasing scale)	1 = 0; 2 = 6.8; 3 = 14.3; 4 = 45.3; 5 = 33.5	4.19	0.84
Read	I read the nutritional information on food labels (5-point increasing scale)	1 = 24.6; 2 = 10.8; 3 = 27.1; 4 = 6.4; 5 = 31.0	3.50	1.39
Who-buys	Doing the shopping usually and personally (1 if yes)	1 = 63.5	0.63	0.48
Age[a]	Age of respondents ⩽18 years old and ⩾30 years old ⩽31 years old and ⩾50 years old ⩽51 years old		1.70	0.75
Education	Schooling level (5-point increasing scale)	1 = 4.6; 2 = 45.7; 3 = 16.8; 4 = 24.9; 5 = 8.1	2.86	1.00
Origin[a]	Respondents residing in a rural area (1 if yes)		0.24	0.42
Sample 1				
Health	Brown sugar is healthier than white sugar (5-point increasing scale)	1 = 0; 2 = 6.8; 3 = 16.4; 4 = 46.6; 5 = 30.1		
Read	I read the nutritional information on food labels (5-point increasing scale)	1 = 28.8; 2 = 2.7; 3 = 24.7; 4 = 9.6; 5 = 34.2		
Who-buys	Doing the shopping usually and personally (1 if yes)	1 = 63.0		
Age	Age of respondents ⩽18 years old and ⩾30 years old ⩽31 years old and ⩾50 years old ⩽51 years old	1 = 52.1; 2 = 37.0; 3 = 11.0		
Education	Schooling level (5-point increasing scale)	1 = 1.6; 2 = 45.2; 3 = 22.6; 4 = 25.8; 5 = 4.8		
Origin	Respondents residing in a rural area (1 if yes)	1 = 25.0		
Sample 2				
Health	Brown sugar is healthier than white sugar (5-point increasing scale)	1 = 0; 2 = 6.9; 2; 3 = 13.1; 4 = 44.6; 5 = 35.4		
Read	I read the nutritional information on food labels (5-point increasing scale)	1 = 22.3; 2 = 15.4; 3 = 28.5; 4 = 4.6; 5 = 29.2		
Who-buys	Doing the shopping usually and personally (1 if yes)	1 = 63.8		
Age	Age of respondents ⩽18 years old and ⩾30 years old ⩽31 years old and ⩾50 years old ⩽51 years old	1 = 44.6; 2 = 33.8; 3 = 21.5		
Education	Schooling level (5-point increasing scale)	1 = 6.3; 2 = 45.9; 3 = 13.5; 4 = 24.3; 5 = 9.9		
Origin	Respondents residing in a rural area (1 if yes)	1 = 23.8		

Note: [a]Frequency distributions of age and origin variables are showed in Table II
Source: Own elaboration

Table IV.
Definition of the variables which represent individual characteristics included in the hybrid models

4. Studying consumers' preferences regarding granulated brown sugar: an analysis from the demand side

The 203 consumers were presented with eight choice sets (4,872 observations corresponding to 1,624 choices). The distribution of these 1,624 choices shows that 28.1 percent of consumers preferred to purchase their traditional sugar (status quo option); 32.6 percent the A alternatives; and 39.3 percent the B alternatives.

In the general model (with the overall sample), the likelihood ratio test ($\chi^2_{(4)} = 174.06$) proved significant at any conventional level. The results are displayed in Table V.

The coefficients for location and type of sugar were not significant. Thus, considering the aggregated results of the whole sample, the consumers did not show preferences for consuming either sugar made in Ocotopeque or outside, and similarly showed no preference for refined white over granulated brown sugar. However, the type of production proved significant in that handmade sugar was preferred to industrial production. The price was also very significant: As economic theory and also the country's socioeconomic features would suggest, the higher the price the lower the consumers' utility.

The preference heterogeneity revealed by the segmentation sample, translated into significant differences among consumers with distinct levels of knowledge of *dulce de panela*, is shown in Table VI where the base and hybrid models are included.

For those consumers who declared knowledge of *dulce de panela* in the base model, the type of production and the type of sugar were significant. Both attributes had a positive sign. Thus, granulated brown sugar was preferred over refined white sugar. Handmade sugar was also preferred, which coincides with the result obtained with the general model. Obviously, the price again depicted a strong inverse relationship with consumers' utility function. The hybrid model showed consumers' preference heterogeneity in relation to some characteristics, increasing the pseudo R^2 and the model significance. In this regard, the four interactions with the type of sugar proved significant and positive, which means that the presence of these features increase the utility derived from consuming granulated brown sugar. As a result, granulated brown sugar was preferred more by consumers who have a high level of education, come from rural areas, consider brown sugar to be healthier than white sugar and who read nutritional information on food labels. In addition, the alternative-specific constant interactions showed that older people have a higher probability of choosing the alternatives which include granulated brown sugar, while people who usually do the shopping display a higher probability of choosing the alternative which includes their usual sugar (refined white sugar).

	Coefficients	SE
ASC_{AB}	0.851***	0.089
Location	−0.088^{ns}	0.061
Sugar	−0.066^{ns}	0.061
Production	0.141*	0.061
Price	−0.108***	0.008
Log-likelihood	−1,064.432	
χ^2	174.060***	
McFadden_Pseudo-R^2	0.049	
n	1624	

Table V.
Overall model estimates

Notes: ns, non-significant. *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$
Source: Own elaboration

	Knowledge of *Dulce de Panela*		No or minimal knowledge of *Dulce de Panela*	
	Base model	Hybrid model	Base model	Hybrid model
ASC_{AB}	0.740 (0.113[a])***	0.807 (0.211)***	1.005 (0.147)***	1.980 (0.292)***
Location	−0.048 (0.077)[ns]	−0.074 (0.080)[ns]	−0.141 (0.104)[ns]	−0.132 (0.106)[ns]
Sugar	0.186 (0.078)*	−2.981 (0.443)***	−0.515 (0.105)***	−3.344 (0.722)***
Production	0.177 (0.078)*	0.189 (0.080)*	0.084 (0.104)[ns]	0.088 (0.106)[ns]
Price	−0.118 (0.011)***	−0.127 (0.011)***	−0.093 (0.014)***	−0.095 (0.014)***
Sugar × health	–	0.352 (0.084)***	–	0.332 (0.142)*
Sugar × origin	–	0.593 (0.161)***	–	0.626 (0.223)**
Sugar × read	–	0.268 (0.049)***	–	0.172 (0.075)*
Sugar × education	–	0.193 (0.067)**	–	0.161 (0.111)[ns]
ASC_{AB} × who-buys	–	−0.814 (0.166)***	–	−0.690 (0.218)**
ASC_{AB} × age	–	0.305 (0.100)**	–	−0.316 (0.143)*
Log-likelihood	−1,064.432	−1,015.561	−600.834	−578.182
X^2	132.768***	230.51***	73.38***	118.68***
McFadden_Pseudo-R^2	0.059	0.102	0.058	0.093
n	1,040	1,040	584	584
% Sample	64	64	36	36

Notes: ns, non-significant. [a]The standard errors are displayed in brackets. *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$

Source: Own elaboration

Table VI. Base and hybrid model estimates for the segmentation

On the other hand, for those consumers who were not familiar with *dulce de panela* and thus neither granulated brown sugar, only the type of sugar and the price proved significant in the base model. In this sense, consumers' utility in terms of purchasing refined white sugar resulted much higher than for purchasing granulated brown sugar, contrary to the previous case. Furthermore, the lower the price the higher the utility. However, in the hybrid model, the consumers' perception of health benefits of granulated brown sugar compared to white refined sugar, origin in rural areas and habit of reading health claims on food labels depicted a positive interaction with the type of sugar. A direct relationship existed between the utility obtained by consumers with respect to granulated brown sugar and the above-mentioned consumers' features, although the interaction between level of education and type of sugar had not been significant. At the same time, the interactions with the constant show that the person who usually does the shopping preferred to keep buying their usual sugar and not the granulated brown sugar. In a similar vein, the negative sign in the interaction between age and the constant meant that older consumers exhibited less probability of choosing the granulated brown sugar alternatives.

Another interesting point is the marginal WTP for each significant attribute together with their confidence intervals, which are displayed in Table VII.

People who know granulated brown sugar had similar marginal WTP for both the granulated brown sugar and the handmade production type. The quantities were 1.58 and 1.51 lempiras per pound so consumers were willing to pay a premium for a sugar with those characteristics. If the usual sugar price is 8.50 lempiras per pound, these consumers will pay 3.09 lempiras more to buy handmade, granulated brown sugar, resulting in a product which would cost 11.59 lempiras per pound. However, the refined white sugar WTP for those consumers who were unfamiliar with granulated brown sugar reached −5.52 lempiras, so hypothetically they would need to be compensated in terms of price in order to accept the granulated brown sugar.

Attributes	Segmentation	WTP[a]	Description
Production location	Knowledge of granulated brown sugar	−0.41[ns]	Marginal WTP for Ocotepeque production instead of national production
	No or minimal knowledge of granulated brown sugar	−1.51[ns]	
Type of sugar	Knowledge of granulated brown sugar	1.58 (0.27 to 2.90)[b]	Marginal WTP for granulated brown sugar instead of white refined sugar
	No or minimal knowledge of granulated brown sugar	−5.52 (−8.20 to −2.86)[b]	
Type of production	Knowledge of granulated brown sugar	1.51 (0.20 to 2.82)[b]	Marginal WTP for handmade instead of industrially produced sugar
	No or minimal knowledge of granulated brown sugar	0.90[ns]	

Table VII.
Willingness to pay estimates for segmentation

Notes: ns, non-significant. [a]95 percent confidence intervals (in brackets) calculated using the Delta method assuming a Normal WTP distribution; [b]Significantly different from zero (5 percent)
Source: Own elaboration

Finally, the market share simulations were performed assuming the market was comprised of the following three hypothetical sugar competitors: Sugar 1, refined white sugar of national origin, industrially processed and at a price of 8 lempiras; Sugar 2, refined white sugar of national origin, industrially processed and at a price of 10 lempiras; and Sugar 3, granulated brown sugar of regional origin (Ocotepeque), handmade and at a price of 18 and 16 lempiras.

Table VIII shows the estimated market shares of hypothetical sugars profiles representing a simplification of the reality so these may not be accurate. Concretely, we can observe the level of "success" an hypothetical sugar would have according to its attributes in this simplified market. Nonetheless, it represents an instrument to shed light about the adequateness of boosting a granulated brown sugar initiative inside the Honduras sugar market which is dominated by industrially processed, refined white sugar. Having a look to Table VIII, it can be observed that despite the much larger market shares for the conventional sugar there are a market share which can represent a business opportunity. The market niche corresponding to granulated brown sugar would be around 15 percent and describes somewhat an inelastic behavior regarding the price (at least from higher prices) since the gaining in the market share due to a reduction from 16 to 18 lempiras is not pronounced.

	Simulated market share[a]	
Sugar	Scenario 1 (%)	Scenario 2 (%)
Sugar 1	47.25	45.60
Sugar 2	38.05	36.73
Sugar 3	14.70[b]	17.67[c]

Table VIII.
Simulation of market shares

Notes: [a]The simulated market shares were obtained as an average of both choice model subsamples; [b]hypothetical market share for granulated brown sugar at a price of 18 lempiras; [c]hypothetical market share for granulated brown sugar at a price of 16 lempiras
Source: Own elaboration

5. Discussion

The information derived from the visits and interviews was coherent with that from secondary data which showed that sugar distribution market extremely concentrated leading to a trade monopoly. Therefore, a very important market constraint appears on further development of smallholder farmers of sugarcane, which may limit the role played by them in Western Honduras as a key element to reduce poverty. To avoid monopolistic practices, granulated brown sugar – panela – was chosen to diversify agricultural production. However, the selling price estimated for the production of granulated brown sugar was around 16 lempiras per pound – higher than the price for white, golden and brown sugar which were found in the stores, but similar to that of the only granulated brown sugar available in the local market. The higher price of the granulated brown sugar was due to the local, handmade production and it can also be partly justified by its above-mentioned healthier nutritional properties; although these properties needs to be known by consumers in order to pay a price premium for the panela.

Given these facts, consumers' study revealed that, in general, the price seemed to be the main driver in the utility function of the consumers when the whole sample is considered. Nonetheless, this is not a surprising finding given that the level of economic development of the country and the context of lack of information. Additionally, the type of production proved a very valued feature, in that handmade was preferred to industrially produced. There is a lack of literature on the handmade products in developing countries; however, in developed countries, such as the European countries (Akaichi and Gil, 2009; or Koutroulou and Tsourgiannis, 2011), "handmade" represents a positive feature for consumers who are even willing to pay a price premium for it. In line with that fact, those consumers who knew *dulce de panela* preferred to purchase granulated brown sugar instead of their usual sugar and they were willing to pay nearly 11.6 lempiras per pound. The last higher preference may come because consumers tend to have a better attitude toward familiar products since they know some of their features, while the consumers' uncertainty which involve new products may discourage the consumption based on the unknown features and even effects. In this sense, the study of Groves (2001) gathers that handmade food with natural materials are perceived with a patina of authenticity by consumers of nowadays, which leads to greater confidence to these products. The consumers' observed heterogeneity provided an explanation as to consumer preferences. Thus, if the consumers were older, of rural origin, had a higher level of education and showed health considerations – such as believing granulated brown sugar to be healthier and reading the nutritional information on food labels, the probability of consuming granulated brown sugar increased. However, people who usually do the shopping displayed a higher probability of choosing their usual sugar. Those consumers who did not know *dulce de panela* obtained higher utility from purchasing refined white sugar and their hypothetical willingness to accept granulated brown sugar was low. So this market segment is highly driven by the market status quo that is cheap refined white sugar. It is remarkable how against the information given by the stores owners, in the individual face-to-face interviews, the consumers of rural origin showed greatest interest in purchasing granulated brown sugar. This trend can be explained for the higher knowledge this group of consumers have of *dulce de panela*, raw material of the granulated brown sugar that is produced principally in rural areas today.

Again, the potential price of 16 lempiras per pound, which the local farmers need to offset production costs and generate a profit margin, is too high considering the

consumers' granulated brown sugar WTP of 11.59 lempiras per pound. This result is consistent with the information previously pointed out by the stores owners who had placed necessarily the price of a novel sweetener around 9 lempiras per pound. Nonetheless, the market share simulation can help to forecast the "success" of granulated brown sugar by estimating a starting benchmark. Even allowing for the possible inaccuracy of the estimations due to over-simplification of the market, the estimated market shares of granulated brown sugar show that there is a market niche. Therefore, despite the fact that the larger market shares belong to the conventional sugar, the market niche for the granulated brown sugar can embody a strategy to develop a local entrepreneurial culture as a mechanism of endogenous rural development.

In any case, we must take into account that the most relevant limitations of the study are the sample size and the experimental design. Regarding the latter, as we mentioned above, ideally the design should have been considered all the sweetener options available in the market. Nonetheless, there is a clear trade-off between using a full profile approach and the consistency of the study. The higher complexity of the CE the larger the likelihood of appearing different sources of unobserved heterogeneity that would hinder the determination of the consumers' utility function due to the difficulty to account for them. Regarding the sample size, it has to be acknowledged that we could have incurred in potential bias when segmenting the sample because of a loss of statistical power. Nonetheless, it was worth running this risk in order to uncover differential consumers' behavior patterns that would otherwise have remained supressed biasing the policy implications.

6. Conclusion

This research has allowed us to underline the importance of analyzing the market in the framework of local rural farmers' business initiatives, especially those sponsored by NGOs. From a supply side, in the context of the current Honduran sugar market, it is very difficult to formulate alternatives to diversify the agricultural output of sugar production. In fact, there is a high level of concentration in the distribution. This finding meant that the local producers' abandoned their initial aim of commercializing brown sugar and decided to focus on granulated panela (granulated brown sugar), which is the only type of sugar that falls outside the monopoly. In addition, it has a production technically and culturally accessible for the farmers and still has little presence in the stores, so it appears to be a good niche market. We had to take into account that local farmers' awareness of commercializing brown sugar came from a training course they received. In this regard, although it is out of the scope of this research, it may be worth in the field of management of NGOs dedicated to the development, evaluating the necessity of carrying out market research before delivering these training courses.

From the demand side, the type of production proved a very valued feature, in that handmade was preferred to industrially produced, as well as knowing previously *dulce de panela* meant higher preferences for the studied product. However, as often happens in other markets, where there is a clear consumer misinformation about the differential characteristics of the products, price becomes the major factor driving consumer behavior; and a price gap was found between the consumers' WTP, 11.59 lempiras per pound, and the panela selling price, 16 lempiras per pound. Therefore, to compensate for this price gap, it is necessary to identify suitable strategies to encourage granulated brown sugar consumption. In this regard, knowledge of the product as well as health associations proved essential elements to increase consumer preferences for granulated

brown sugar. Thus, familiarizing people with both the product itself and its healthy qualities becomes a key marketing strategy before launching the product in the regional markets. It is essential to design and plan an awareness-raising campaign focussing on granulated brown sugar characteristics, including taste and uses, and emphasizing its healthier qualities. It is also necessary to design the packaging and labeling so that there is room for the above-mentioned health claims on the labels. The marketing plans also should pay particular attention to those people who usually do the shopping.

A potential market niche for panela sugar exists but it may only be possible to plan and perform those marketing strategies by encouraging local panela producers to work together more effectively. This is only achievable with the involvement of local authorities and NGOs to coordinate territorial development plans that must have as a clear objective the improved cooperation of local producers. Undoubtedly, the role of the government is also essential in order to establish coordination frames between the local and international actors tending to the promotion of producers' training in marketing, as well as for the formulation of strategies and marketing plans for products that potentially could have a good reception in the sugar market. Only thus and thanks to public investment supporting marketing strategies of these products, the smallholder agriculture will be able to play an important role in the reduction of the poverty in the Honduran households, overcoming this way the exclusion from commercial markets.

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