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Using contingent valuation to estimate consumers' willingness to pay for differentiated coffees in Puerto Rico[1,2]

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ABSTRACT

Product differentiation is a strategy used to develop products with particular attributes valued by consumers who are willing to buy them at higher prices. We use a single-bounded dichotomous choice contingent valuation method through in-person interviews (N=575) to estimate consumers' willingness to pay (WTP) for high-quality and regular coffees produced locally. The results show that consumers are willing to pay $13.60 for a 227-g (8-ounce) bag of high-quality coffee produced locally and $10.90 for regular coffee produced locally. It may be inferred that consumers are willing to pay $2.70 more for high-quality coffee, holding all else constant, which suggest that consumers value more the attribute of being locally produced than that of quality. The results also suggest that household size, income and education level of consumers can affect WTP values. We provide evidence that additional revenue can be generated by producing differentiated coffees. However, a cost analysis is required to complement this study and to better understand the economic viability of producing coffee with the characteristics evaluated in this investigation.

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Key words: contingent valuation, coffee, high-quality, Puerto Rico, willingness to pay

RESUMEN

Uso de la valoración contingente para estimar la disposición a pagar de los consumidores por cafés diferenciados en Puerto Rico

La diferenciación de un producto es una estrategia utilizada para desarrollar productos con atributos particulares valorados por consumidores que están dispuestos a comprarlos a precios más altos. Utilizamos el método de valoración contingente dicotómico simple por medio de entrevistas presenciales (N=575) para estimar la disposición a pagar (DAP) de los consumidores por un café de alta calidad producido localmente, y por un café regular producido localmente. Los resultados muestran que los consumidores están dispuestos a pagar $13.60 por un empaque de 227 g (8 onzas) de café de alta calidad que es producido localmente, y están dispuestos a pagar $10.90 por un empaque de 227 g (8 onzas) de café regular producido localmente. Se pudiera inferir que los consumidores están dispuestos a pagar $2.70 más por un café de alta calidad, manteniendo todo lo demás constante, lo cual sugiere que los consumidores valoran más el atributo de producción local, comparado con el atributo de alta calidad. Los resultados también sugieren que el tamaño familiar, el ingreso y educación de los consumidores afectan la DAP. El estudio provee evidencia de que se pueden generar ingresos adicionales al comercializar productos diferenciados. Sin embargo, un análisis de costo es requerido para complementar este estudio y para entender mejor la viabilidad económica de producir café con las características evaluadas en esta investigación.

Palabras clave: valoración contingente, café, alta calidad, Puerto Rico, disposición a pagar

INTRODUCTION

Product differentiation is a strategy used to develop products with particular characteristics valued by consumers who are willing to pay a premium for these products. Differentiated products[6] have the potential to generate additional income depending on consumer demand, and the efficiency and effectiveness of producers and marketers. This may explain why researchers have studied consumer preferences and willingness to pay (WTP) for characteristics of differentiated products, including place of origin (Darby et al., 2008; Li et al., 2018), quality (Wann et al., 2018), fair-trade (McCluskey and Loureiro, 2003; Didier and Lucie, 2008; Tavárez et al., 2020), organic (Loureiro and Hine, 2002; Janssen and Hamm, 2012; Narine, 2015; Katz et al., 2019), eco-

[6]Differentiated products can be described as close but imperfect substitutes. They fulfill the same basic function as a conventional product, but have different attributes such as type, style, quality, reputation, appearance and location (Álamo, 2012).

friendly (McCluskey and Loureiro, 2003; Jensen et al., 2004; Tavárez and Álamo, 2021) and free of genetically modified organisms (Loureiro and Hine, 2002). However, most published studies on WTP for differentiated products are conducted in the United States and Europe. To address this subject, our study seeks to explore consumers' WTP for differentiated coffees in Puerto Rico, particularly for high-quality and regular coffees that are produced locally. The results of this study could be valuable for local coffee producers who wish to increase profits by adopting production systems, such as agroecological systems oriented to produce high-quality coffee, and marketing strategies based on differentiated attributes that meet consumer demand.

Coffee consumption in the United States is changing from traditional or regular brands to differentiated coffee brands (National Coffee Association Inc, 2010). Coffee differentiation strategies are being implemented by producing countries to increase their profits and welfare (Álamo, 2012). Differentiated coffees at farm level can be divided into two groups: differentiated by country of origin or by a cause, such as environmentally friendly production and fair trade (Alamo, 2012). The differentiation of coffee by quality is a trend promoted by the Specialty Coffee Association (SCA) through the certification of high-quality coffees.

The shift in perspective from traditional coffee to high-quality coffee can be traced to the "quality-turn" in the 20th century when consumers began to perceive coffee as a specialty item, taking an interest in the quality of its sensory characteristics and additional extrinsic attributes rather than only its psychoactive effects (Morris, 2017). Prior literature has found that consumers' personal preferences, coffee attributes and sociodemographic characteristics determine consumer consumption and purchasing behavior (Samoggia and Riedel, 2018). Consumption of high-quality coffee has increased because its production is based on more rigorous procedures that guarantee better product quality. After the "quality-turn", producing coffee to meet consumer demand involves adding processes. Buyers recognize those added processes at the purchasing level, paying a premium over the commodity price (Donnet et al., 2007). Although there is ample research on high-quality coffee consumption and purchasing behavior, the literature studying these characteristics in Puerto Rico is scarce. It is important to understand consumer preferences and the factors that affect consumer WTP for differentiated coffee since these values could contribute significantly to the future of the coffee industry in Puerto Rico.

The "quality-turn" brought interest to a myriad of coffee attributes that consumers consider in their buying process and also caused disparity in assigning a term and definition to quality coffee.

"High-quality coffee" has been defined as coffee produced with controls in the supply chain and cupping (Illy, 2002), while specialty coffee, considered premium coffee, has a multitude of definitions which typically include two aspects, intrinsic and extrinsic (Sepúlveda et al., 2016). The intrinsic aspect encompasses sensory characteristics such as taste, acidity, aroma and packaging (Wann et al., 2018); while the extrinsic aspect encompasses all processes in the supply chain like sustainable farm practices and labor fairness (Sepúlveda et al., 2016). Specialty coffee is also simply defined as coffee that stands apart from the norm (Wilson and Wilson, 2014). The SCA provides more specific parameters to characterize high-quality coffee, defining specialty coffees as those that obtain a score of more than 80 in cupping tests carried out by certified cuppers from the Coffee Quality Institute. In general, coffee identified by these terms is deemed of higher quality than traditional coffee. In this study, we use "high-quality" as a general term for coffee produced with desirable sensory qualities.

Sensory qualities, such as taste and aroma, are indispensable to consumers (Samoggia and Riedel, 2018). Prior studies have stated that sensory characteristics are the main reasons that people do not consume coffee (Sousa et al., 2016). A study in Costa Rica found that aroma and taste are among the most important characteristics influencing coffee consumption (Aguirre, 2016). The study's sample also indicated that 50% of respondents are willing to pay double for high-quality coffee. Similar studies taking into account taste and extrinsic attributes found that taste was the principal driver of consumption (Bento de Sá et al., 2017; Wilson and Wilson, 2014). Sensory preferences vary among consumers and, even though they have influence, they do not restrict consumer purchasing behavior. Consumer behavior can also be influenced by additional attributes like health effects and sustainability, including organic and fair trade (Samoggia and Riedel, 2018); these attributes also affect consumers' sensory perceptions (Li et al., 2018).

Specialty coffee grew from a niche market to an industry with 8% of global green coffee exports containing some type of ethical certification in 2009 (Pierrot et al., 2010; Sepúlveda et al., 2016). The "quality-turn" showed that consumers are interested in information about their coffee (Morris, 2017). Having information on coffee attributes affects consumer purchasing behavior, but each distinct attribute also has its singular effect (Samoggia and Riedel, 2018). Because this information is increasingly available, consumers are willing to pay an additional amount for premium coffee (Aguirre, 2016). The more information on the product, the greater their likelihood of purchasing that coffee (Li et al., 2018).

Consumers prefer and are willing to pay more for coffee with some sort of certification (Liu et al., 2019). Place of origin, fair-trade and organic labels are three of the most studied characteristics (Samoggia and Riedel, 2018; Wann et al., 2018). Sepúlveda et al. (2016) found that coffee originating from Colombia has a positive effect on consumer preference, while Basu and Hicks (2008) observed that country of origin was not significant. In the United States, a study on the demand for regular and differentiated coffee found that consumers are willing to pay from 19% to 217% more for coffee differentiated by country of origin than for regular coffee (Álamo, 2012). These distinct results may be influenced by the population's perception of foreign products. In the United States, consumers are concerned about the origin of their food (Loureiro and Umberger, 2003) and value local products to the extent that they are willing to pay a premium for local specialty foods (Giraud et al., 2005). In Italy, organic certification is perceived as the most significant ethical label (Gallenti et al., 2016; Cosmina et al., 2016), while in other parts of the world, the most critical ethical label is fair-trade (Rotaris and Danielis, 2011). Basu and Hicks (2008) studied how WTP was affected by the label for fair-trade coffee that carried an "increase grower's revenue". They found that consumers place importance on the revenue farmers receive and are willing to pay a premium for coffee that is known to increase grower's revenue and wellbeing.

Puerto Rico is currently experiencing an economic crisis and the adverse effects of recent natural disasters (AAFAF, 2019). Stakeholders are interested in production and marketing strategies that contribute to the local economy and farmer's livelihood. Coffee is one of the leading sectors of agriculture on the island, and research on the trends in coffee consumption is needed to understand the potential market for high-quality coffee, especially locally produced coffee, and to develop agricultural policies oriented towards improving the local economy.

Tavárez et al. (2020) used choice experiments to evaluate consumer WTP for multiple characteristics of differentiated coffee in Puerto Rico. High-quality coffee was not evaluated as one of the differentiated attributes in the study. They found that residents place the highest value on locally produced coffee and fair-trade coffee. Although they investigated consumers' WTP for coffee produced locally, no information was provided to consumers about the implications of locally produced coffee on the economy and farmer's livelihood.

The overarching goal of this study is to contribute to the economic literature on differentiated coffees. The specific objectives are: (1) estimate consumer WTP for high-quality coffee produced locally, (2) estimate consumer WTP for regular coffee produced locally, and (3) identify the factors that affect WTP values. The objectives are met by

using a contingent valuation method, which has been widely used to value non-market goods and services in the economic literature.

MATERIALS AND METHODS

Study and survey design

To fulfill the objectives of this study, we developed two versions of a questionnaire consisting of three main sections: sociodemographic characteristics (SDCs) of respondents, coffee consumption behavior and preferences, and the contingent valuation questions (one valuation question per questionnaire version). The general structure of both versions of the questionnaire did not vary, except for the contingent valuation question where one version was oriented to obtain information on high-quality coffee produced locally and the other was designed to obtain information on regular coffee produced locally. The sociodemographic questions included gender, education, age, household size (number of persons in the household), coffee consumption, and household income. The questions pertaining to coffee consumption behavior and preferences included the amount and frequency of consumption, locations of consumption, and buying tendencies towards brand, package size, price and other characteristics[7]. To explore the importance of coffee attributes, consumers were asked questions on a Likert scale (1=very important, 5=not important) about certain attributes which included the origin of the coffee, fair wages for farmers and workers, environmentally friendly practices, product quality and price.

The questionnaires were distributed to consumers in both retail stores and coffee shops from December 2018 to January 2019 by three interviewers who received training to reduce potential interviewer bias[8]. A stratified sampling procedure was employed, which divided the population into eight groups corresponding to the eight political districts of Puerto Rico, including San Juan, Bayamón, Arecibo, Mayagüez, Ponce, Guayama, Humacao, and Carolina. The number of questionnaires for each stratum was proportional to the total number of residents in each district.

Economic valuation method

A variety of economic valuation methods is used to estimate the value of non-market goods and services. These methods can be divided into two main categories: revealed preference and stated preference-based

[7]This information will be used in a different study.

[8]Interviewer bias occurs when interviewers affect choices in the valuation question. Lack or excessive information to respondents may contribute to interviewer bias. Unbalanced information across respondents may also contribute to interviewer bias.

methods (Bateman et al., 2002). The revealed preference methods use actual data from consumer behavior to infer the value of non-market goods and services (Boyle, 2003). Stated preference-based methods ask the respondents surveyed to state their preferences and WTP for non-market goods and services through hypothetical questions (Brown, 2003; Mullan, 2014). This study used a stated preference-based approach because actual data and information about consumer behavior for differentiated coffee was not available. We used the contingent valuation method in particular because it is suitable to exploring consumer WTP for a single scenario change. The contingent valuation method has been used to estimate WTP for agricultural products (Loureiro and Lotade, 2005; Narine, 2015; Del Rio, 2016).

Numerous variations of the contingent valuation format are commonly found in the literature. We used a single-bounded dichotomous choice (SBDC) approach because this format reduces outliers and avoids non-responses (Bateman et al., 2002). After receiving information on the proposed coffee, consumers were asked through a hypothetical question if they would agree to pay for the product. The cost of an 8-ounce package of coffee ranged from $4.00 to $18.00 in both versions of the questionnaire, based on information from focus groups organized for similar studies. Only one SBDC contingent valuation question was included per questionnaire. To reduce hypothetical bias[9], a cheap-talk script was added before the contingent valuation question. The crucial valuation questions designed for estimating consumers' WTP for a high-quality coffee produced locally and for regular coffee produced locally can be found in Appendix A and Appendix B, respectively.

Respondents were asked to state the reasons for supporting or not supporting the proposed coffee with the corresponding cost. Their responses were evaluated to determine the validity of the response to the SBDC contingent valuation question following Bateman et al. (2002) and Tavárez and Elbakidze (2019).

Theoretical framework

The contingent valuation surveys are capable of mapping respondents' monetary measure of welfare, WTP, associated with the change or substitution of goods (Hoyos and Mariel, 2013). Consumer WTP can be determined using an indirect utility function, which states that individual utility decomposes into deterministic and stochastic components

[9]Hypothetical bias occurs when there is a difference between stated WTP and their actual WTP involving their money (Loomis, 2011). Cheap-talk is an *ex ante* approach, which informs respondents of the existence of hypothetical bias and asks to report their answer as if it were a real life decision (Cummings and Taylor, 1999).

(McFadden, 1974). Having both deterministic and stochastic components draws a connection between the theoretical framework and the econometric model (Carson and Hanemann, 2005). This connection is made by using a random utility maximization (RUM) approach which states that individuals know their preferences with certainty and they do not consider them stochastic, but unobservable components may exist and are treated as stochastic by the investigator (Hanemann, 1984). The utility function can be expressed as follows:

$$u^i = v(Q^i, Z, Y; \varepsilon_i) \qquad i = 0,1 \qquad [1]$$

where i is the indicator variable with higher-quality coffee produced locally (or regular coffee produced locally) denoted as i=1; Z is a vector of explanatory variables; Y is the consumer income and ε_i are the error terms. Using the SBDC format, the probability for respondents to answer "yes" is written as (Carson and Hanemann, 2005):

$$\Pr(\text{“}yes\text{”} \mid COST) = \Pr(v(Q^1, Z, Y - COST\varepsilon_i) > v(Q^0, Z, Y; \varepsilon_0)) \qquad [2]$$

where COST is the amount of money offered in the valuation question. Assuming that the utility function is linear, the indirect utility function is represented as:

$$v_i = \alpha_o + \beta_z Z + \beta_{COST} COST + \varepsilon_i \qquad i=0,1 \qquad [3]$$

where α_0 is a constant term, β_Z are the coefficients of the explanatory variables, and β_{COST} is the COST coefficient. Mean WTP estimates can be obtained following Hanemann (1989).

Estimation models

We used logit and probit models to estimate variable coefficients and WTP values in each contingent valuation question. The only difference between the logit and probit models is the regression error term distribution. The logit model assumes that the cumulative distribution function of the error terms is logistic, while the probit model assumes it is normal. The independent variable in both models is binary indicating whether the consumer agrees to pay for the coffee. The explanatory variables are the SDCs of respondents, including age, gender, household size, education and income[10]. We generated two binary variables corresponding to the household income and education of respondent.

[10]We also estimated a model that includes a binary variable to explore if residents of the metropolitan region are more likely to support differentiated coffees. However, this variable was insignificant, and the model did not improve the goodness of fit, as reported by the adjusted Pseudo-R^2 and the Akaike Information Criterion (AIC).

The binary income variable takes the value of one if annual household income is higher than $50,000 and zero otherwise. The binary education variable takes the value of one if the consumer has a master's degree or higher and zero otherwise. Table 1 presents the variables included in the regression models with corresponding definitions, codifications and expected signs.

RESULTS AND DISCUSSION

A total of 580 consumers were interviewed. In this study, each consumer represents a household. However, five respondents refused to answer the contingent valuation questions. Table 2 shows the mean and standard error of the SDCs of respondents across treatments (i.e., questionnaire versions). In treatment 1 (questionnaire version designed to estimate WTP for high-quality coffee produced locally), the average age of respondents is 38 years old. Forty-three percent of the respondents are male. Twenty percent of respondents have a master's degree or higher, and 33 respondents have a gross annual income of $50,000 or more. The average number of persons living in the household is 2.6 occupants. In treatment 2 (questionnaire version designed to estimate WTP for regular coffee produced locally), the average age of respondents is 38 years old. Thirty-nine percent of the respondents are male. Twenty-one percent of respondents have a master's degree or higher, and 39 respondents have a gross annual income of $50,000 or more. The average number of persons living in the household is 2.7 occupants. SDCs of respondents are similar across the two treatment groups. The results from chi-squared and t-tests indicate that there are no statistical differences in the SDCs of individuals between the two contingent valuation treatments, indicating that any variation in

TABLE 1.—*Variables included in the regression models, their codifications and expected signs.*

Sociodemographic characteristics	Definitions	Codifications	Expected signs
Age	Age of respondent	Continuous	—
Education	Education level of respondents (1=graduate degree, 0=otherwise)	Binary	+
Household size	Number of persons living in household	Continuous	+
Income	Gross annual household income (1=$50,000 or more, 0=otherwise)	Binary	+
Gender	Gender of respondent (1=Male, 0=Female)	Binary	+
Cost	Cost of differentiated coffee	Continuous	—

TABLE 2.—*Characteristics of respondents across contingent valuation treatments.*

Sociodemographic characteristics	High-quality coffee produced locally Mean (SD)	Regular coffee produced locally Mean (SD)	Statistical test	p-value
Age	38.38 (13.91)	37.93 (14.35)	t-test	0.70
Education	0.20 (0.40)	0.21 (0.41)	chi-squared	0.84
Household size	2.61 (1.29)	2.70 (1.33)	t-test	0.38
Income	0.33 (0.47)	0.39 (0.49)	chi-squared	0.20
Gender	0.43 (0.50)	0.39 (0.49)	chi-squared	0.40

regression results across treatments is not attributable to differences in the SDCs of individuals.

The income and education of the sampled respondents is higher than the general population (US Census Bureau, 2019). It could be inferred that consumers in coffee shops have additional income that allows them to buy and consume coffee out of home. In this regard, our sample may not be representative of the general population. Nevertheless, it is not clear how our sample differs from the population of consumers visiting supermarkets. It is important to consider this outcome for future studies on this topic.

We use Likert-scale questions to understand consumer preferences for characteristics of a differentiated coffee. Within the range of characteristics evaluated, the price of the coffee is the least important characteristic, and the quality of the coffee is the most important, followed by coffee produced in compliance with fair salaries to agricultural workers (Table 3). The results from these questions are aligned with prior studies in the country that found similar responses to Likert-scale questions. For example, Tavárez et al. (2020) found that consumers assign a high value to products produced locally and in compliance with fair trade.

Table 4 shows the cost distribution across the sample and the probability of a "yes" response by cost in the contingent valuation questions. Although we planned to distribute the cost levels equally across

TABLE 3.—*Importance of multiple characteristics of coffee.*

Characteristics	Very important	Important	Regular	Somewhat important	Not important
Local	61%	25%	8%	1%	5%
Price	23%	28%	28%	4%	17%
Quality	77%	18%	3%	1%	1%
Eco-friendly	61%	26%	9%	1%	3%
Fair-trade	72%	21%	5%	1%	1%

TABLE 4.—*Distribution of respondents who would support the proposed coffee by cost.*

	Costs							
Amount	$4	$6	$8	$10	$12	$14	$16	$18
Treatment 1: High-quality coffee produced locally								
Yes response	46/49	27/32	37/45	18/28	33/49	15/25	20/35	11/27
Prob (yes)	94%	84%	82%	64%	67%	60%	57%	41%
Treatment 2: Regular coffee produced locally								
Yes response	25/28	42/47	22/28	25/41	12/24	31/50	11/31	10/37
Prob (yes)	89%	89%	79%	61%	50%	62%	35%	27%

the sample, unexpected field complications restricted us from accomplishing this goal. The survival function shows how the likelihood of support decreases as costs increase. Figures 1 and 2 show that, overall, the probability of a "yes" response decreases as the cost increases. However, this does not hold true for the entire distribution of cost levels. For example, Figure 1 shows that the probability of responding in favor of the proposed coffee is higher for $12 than $10. Similarly, Figure 2 shows that the probability of responding in favor of the proposed coffee is higher for $14 than $12. This outcome is regularly found in the contingent valuation literature (Whittington, 2002; Zhongmin et al., 2003; Lindhjem and Navrud, 2011).

Tables 5 and 6 report coefficient results and marginal effects for the logit and probit models corresponding to the contingent valuation questions. Pseudo-R^2 s are notably higher for the regression models in treatment 2. Although both models perform similarly in terms of the percentage of correct predictions, the probit model reports a slightly higher value in both treatments.

In all regression models, the cost coefficient is significant and negative, indicating that the probability of a "yes" response decreases as the cost increases. Additionally, the income coefficient is significant and positive, indicating that individuals with higher incomes are more likely to respond in favor of the proposed coffee. Other explanatory variables are not significant in the regression models for high-quality coffee produced locally. However, education and household size coefficients are significant and positive in the regression models for regular coffee produced locally, indicating that individuals with higher education and higher household size are more likely to respond in favor of the proposed coffee.

Results from the marginal effects show that consumers with incomes above $50,000 increase the probability of WTP for high-quality coffee produced locally by 14%, and the probability of WTP for regular

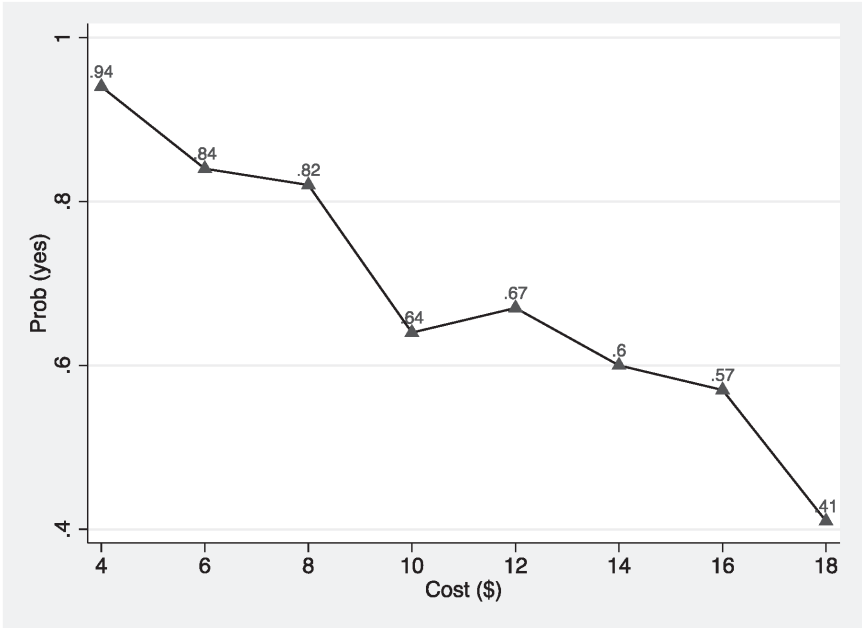

FIGURE 1. Survival function for treatment 1.

coffee produced locally by 13%. Individuals with graduate degrees increase the probability of willingness to pay for regular coffee produced locally by 15%. In general, the results suggest that income of consumers affects attitudes and behavior towards both sensory qualities and locally made coffee, while education of respondents and household size only affect preferences for locally made coffee.

Some variables that have been found to influence WTP for differentiated products in the literature are not significant in this study. For example, prior studies show that the age of consumers affect choice decision for specialty coffee and that consumers between 18 and 24 years old are more willing to pay for specialty coffee (Álamo et al., 2005). Yet, age is statistically insignificant in this study. Prior studies have found that younger women with a larger number of family members in the household would pay more for coffee (Shang-Ho et al., 2014). However, respondent's gender is not significant in our study. Further studies are needed to make conclusions with regard to these variables.

We estimate consumer WTP for high-quality and regular coffees produced locally following Hanemann (1989). The results show that consumers are willing to pay $13.60 for a 227-g (8-ounce) bag of high-quality coffee produced locally (Table 7). This result indicates

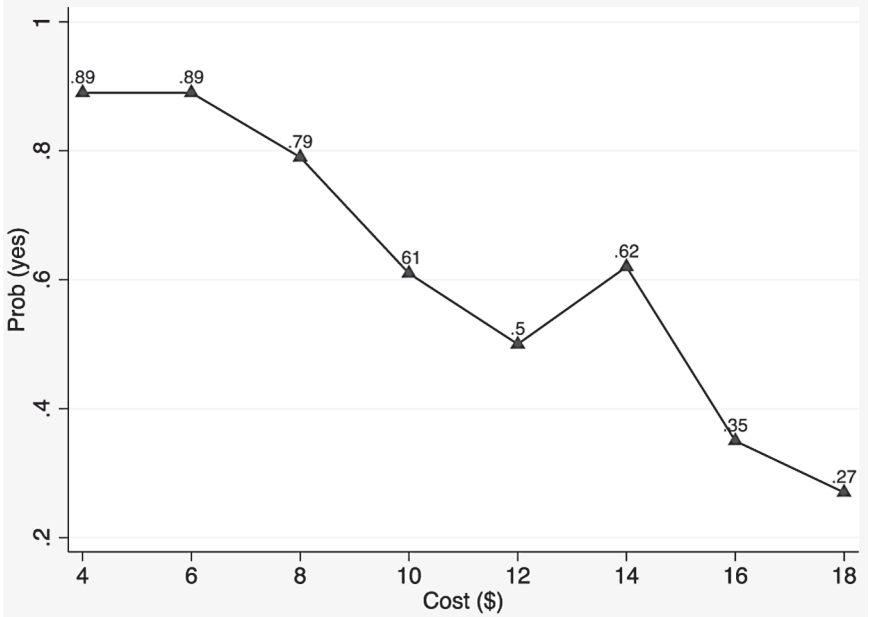

FIGURE 2. Survival function for treatment 2.

that consumers are willing to pay about four times more for a locally produced high-quality coffee, compared to a 227-g (8-ounce) bag of undifferentiated regular coffee where prices range from $2.00 to $3.15 (Álamo, 2020). The results also indicate that consumers are willing to pay $10.90 for a 227-g (8-ounce) bag of regular coffee produced locally, rather than buy imported coffee. These numbers seem to be high compared to findings of similar studies in such regions as Colorado and Wyoming (Loureiro and Lotade, 2005). However, producers currently sell a 283-g (10-ounce) bag of local coffee for $10 at local festivals and farmers markets, and typically, no information on quality and implications of locally made products is provided to consumers.

The results from both contingent valuation questions allow us to obtain an approximation of consumers' WTP for a high-quality coffee, holding all else constant[11]. The results suggest that consumers are

[11]The law of decreasing marginal utility is likely to affect inferred WTP value for high-quality coffee. In one contingent valuation question consumers are asked to state their WTP for two differentiated characteristics (high-quality coffee, produced locally), whereas in the other valuation question consumers are asked to state their WTP for only one differentiated characteristic (produced locally).

TABLE 5.—*Results for a high-quality coffee produced locally (treatment 1).*

Variables	Logit coefficients	Marginal effects	Probit coefficients	Marginal effects
Cost	-0.176 (0.033)***	-0.033	-0.105 (0.019)***	-0.034
d_income	0.795 (0.339)**	0.139	0.461 (0.194)**	0.140
d_education	0.132 (0.373)	0.024	0.090 (0.219)	0.028
Gender	0.132 (0.294)	0.025	0.069 (0.173)	0.022
Age	-0.004 (0.010)	-0.001	-0.002 (0.006)	-0.001
Household size	0.021 (0.115)	0.004	0.009 (0.067)	0.003
Constant	2.154 (0.605)***		1.290 (0.352)***	
Pseudo-R^2	0.12		0.12	
% correct predictions	74.5		74.8	
N	286		286	

*** Significant at 0.01, ** Significant at 0.05
Standard errors in parentheses.

willing to pay approximately $2.70 more for a 227-g (8-ounce) bag of high-quality coffee, holding all else equal, which is almost double the price of regular coffee. This finding is consistent with a prior study conducted in Costa Rica that indicated 50% of consumers are willing to pay approximately double for high-quality coffee (Aguirre, 2016). Our results suggest that consumers value a high-quality coffee and are willing to pay a premium price for this attribute; however, consumers value more a coffee that is sown and harvested locally, and are willing to pay $10.90 for this attribute.

The WTP estimates in this study are higher than those reported by Tavárez et al. (2020). The authors used a choice experiment method to estimate consumer WTP for attributes of differentiated coffee and found that consumers in Puerto Rico are willing to pay $4.38, in addition to the current price, for a 227-g (8-ounce) bag of coffee that is produced locally[12]. However, in this study we provide additional information on the implications of buying a locally produced coffee to the community and the economy, whereas Tavárez et al. (2020) does not provide such information in the experiment, which may explain differences in WTP values. It has been documented that complementary information affects the respondent decision-making process in economic valuation studies (Ajzen et al., 1996; MacMillan et al., 2006). In this regard, our results suggest that labelling coffee as locally produced may not be sufficient as a marketing strategy, and that consumers should

[12]Both methods, the contingent valuation and choice experiments, are based on Random Utility Theory and are expected to deliver similar WTP values.

TABLE 6.—*Results for a regular coffee produced locally (treatment 2).*

Variables	Logit coefficients	Marginal effects	Probit coefficients	Marginal effects
Cost	-0.139 (0.020)***	-0.035	-0.139 (0.020)***	-0.051
d_income	0.355 (0.183)**	0.077	0.355 (0.183)**	0.129
d_education	0.431 (0.215)**	0.077	0.431 (0.215)**	0.150
Gender	0.001 (0.169)	0.046	0.001 (0.169)	0.001
Age	-0.002 (0.006)	-0.001	-0.002 (0.006)	-0.001
Household size	0.182 (0.068)***	0.018	0.182 (0.068)***	0.067
Constant	0.862 (0.336)***		0.862 (0.336)***	
Pseudo-R^2	0.20		0.20	
% correct predictions	73.0		73.4	
N	289		289	

*** Significant at 0.01, ** Significant at 0.05
Standard errors in parentheses.

be informed about all aspects of the product and corresponding implications.

At first glance, it seems that consumers are willing to pay more for characteristics of differentiated products in the coffee sector, compared to other agricultural sectors in Puerto Rico. For example, Tavárez and Álamo (2021) found that consumers are willing to pay only between $0.74 and $1.26, in addition to the current price of 2L, for characteristics of differentiated cow's milk, contrasting with the results of this study and the results from Tavárez et al. (2020) that found a much higher WTP values for similar characteristics of a 227-g (8-ounce) bag of differentiated coffee. However, reported consumption of coffee and milk (units per month) differs across products, which suggests that additional studies are needed to explore how the total value of differentiated attributes varies across agricultural sectors.

The results of this study are robust in diverse ways. First, the results are aligned with economic theory. Particularly, the cost coefficient is negative, and the income coefficient is positive. Second, our results

TABLE 7.—*Willingness to pay ($) for differentiated coffees across regressions models.*

	High-quality coffee produced locally		Regular coffee produced locally	
Regression models	WTP	Confidence Intervals (95%)	WTP	Confidence Intervals (95%)
Logit	13.59	11.79-17.31	11.00	9.68-12.39
Probit	13.60	11.76-17.39	10.90	9.57-12.33

Confidence intervals are calculated following the procedure by Krinsky and Robb (1986).

show the same trend of prior research on differentiated coffee in Puerto Rico. These findings may be used to validate our study. Studies that fail to pass validity tests are often criticized by experts in the field (Hausman, 2012; Johnston et al., 2017).

Producing differentiated coffee may increase marginal costs at the farm level. Although this study shows that additional revenues can be generated by commercializing differentiated coffee, it is equally important to understand changes in marginal costs corresponding to new production systems, such as those oriented to the production of high-quality coffee. In this sense, further studies are needed to estimate associated costs to evaluate the economic viability of commercializing this product in Puerto Rico.

CONCLUSION

Coffee plays a critical role in the beverage intake and culture of many households in Puerto Rico. The economic crisis, combined with recent natural disasters on the island, has hurt farmers' livelihood in all agricultural sectors, including coffee. Thus, new production and marketing strategies are needed. To address this concern, we explore consumers' WTP for differentiated coffees in Puerto Rico. Product differentiation is a strategy used to develop products with the attributes that the consumer is seeking, which may increase farmers' profits by allowing them to sell their coffee at higher prices.

We use a contingent valuation method to estimate consumer WTP for high-quality and regular coffees produced locally. The results show that consumers are willing to pay $13.60 for a 227-g (8-ounce) bag of high-quality coffee produced locally. The results also show that consumers are willing to pay $10.90 for a 227-g (8-ounce) bag of regular coffee produced locally. Thus, consumers are willing to pay $2.70 more for a high-quality coffee than a regular coffee, holding all else constant. We provide evidence that extra revenue can be generated by producing differentiated coffees. However, further studies are needed to estimate associated costs for cost-benefit analyses and evaluate the economic viability of commercializing this product in Puerto Rico.

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Appendix A

Even though this is a hypothetical survey, please try to respond as if it were a real situation in which you would consider your actual budget. Many investigators have found significant differences as to what respondents state they are willing to pay and what they, in reality, would pay. It is necessary that you answer honestly for this research to be valid.

High-quality coffee is expected to have better aroma and flavor compared to regular coffee due to established protocols through coffee tasting. At this time, I would like you to consider a high-quality coffee produced locally. This high-quality coffee sown and harvested locally contributes to the livelihood of farmers, farm workers and their families, allowing them to plan for their future and to improve their quality of life. This is particularly true as one dollar invested in agriculture generates 3.4 dollars to the local economy. However, this production strategy results in high production costs. This type of coffee is not commonly available on a retail level. However, understanding consumers' willingness to pay for high-quality coffee 100% locally produced would be beneficial for enterprise owners to be able to sell this product.

Are you willing to pay [COST] for a 227-g (8-ounce) package of coffee, labeled and certified as high-quality, while being sown and harvested 100% locally?

Yes___ No___

Appendix B

Even though this is a hypothetical survey, please try to respond as if it were a real situation in which you would consider your actual budget. Many investigators have found significant differences as to what respondents state they are willing to pay and what they, in reality, would pay. It is necessary that you answer honestly for this research to be valid.

At this time, I would like you to consider a regular coffee produced locally. This coffee sown and harvested locally contributes to the livelihood of farmers, farm workers and their families, allowing them to plan for their future and to improve their quality of life. This is particularly true as one dollar invested in agriculture generates 3.4 dollars to the local economy. Locally produced coffee is often associated with high production costs; however, this type of coffee could be commercialized in retail outlets, which increase revenues. Understanding consumers' willingness to pay for regular coffee 100% locally produced would be beneficial for enterprise owners to be able to sell this product.

Are you willing to pay [COST] for a 227-g (8-ounce) package of coffee, labeled and certified as being sown and harvested 100% locally?

Yes___ No___