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College Students' Preferences and Willingness to Pay for Fresh Apple Varieties in Peru

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Abstract

We investigate Peruvian college students' preferences for fresh apple quality attributes. We conducted a sensory taste test and incentive-compatible experimental auction to elicit preferences for three apple varieties available in the Peruvian market: 'Delicia', 'Royal Gala', and 'Fuji'. We found that college students participating in our sensory taste test preferred apples with the 'Royal Gala' quality profile over 'Delicia' and 'Fuji'. Revealing the name of the apple variety and its associated country of origin did not affect willingness to pay. In general, panelists were willing to pay a price premium for larger fruit sizes and higher crispness. Our findings underscore the importance of appearance and eating quality apple attributes on overall preference and willingness to pay. This information, although not representative of the general Peruvian population, could serve as an indication of the factors deemed most important to individuals when choosing to consume a fruit product.

Keywords: apple varieties, experimental auctions**,** Peru, sensory taste test, willingness to pay

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Introduction

Food choice is, in general, a complex process. The literature suggests that including the perspectives of different disciplines when studying food choice enables more reliable modeling compared to what would be achieved using a single discipline (Köster, 2003). A common belief held by economists studying food (and non-food) decisions is that individuals are rational, their choices are guided by conscious motives, and explanations for their behavior can be explicitly reported (Köster, 2003). However, disciplines such as psychology postulate that consumers do not necessarily process information systematically but rather use simple heuristics to select or eliminate products from their choice set on the basis of a few salient quality characteristics (Combris et al., 2009). Hence, when studying food choice, it is important to understand how consumers perceive and value a food product based on the available intrinsic and/or extrinsic information.

The objective of this study is twofold: First, we elicit the value that individuals posit on inherent apple quality attributes or whether attribute bundles are valued equally across different apple varieties. Second, we investigate whether disclosing the name of the apple variety and its associated country of origin influenced consumers' willingness to pay (WTP).

We choose fresh apples because, unlike from other fresh food products, they exhibit external characteristics that enable consumers to visually differentiate across varieties. In this context, apple varieties act like brand categories, in which members of one category share common characteristics that distinguish them from other categories (Richards and Patterson, 2000). The salient differences in external appearance for fresh apples—that is, how the fruit looks, its color, shape, and size—are believed to drive consumers' first impulses to buy the apple (Shapiro, 1983). However, subsequent purchasing decisions are influenced by consumers' previous experiences with the eating quality of similar products or varieties (Shapiro, 1983).

We focus on college students, the millennial generation, because their preferences will shape future demand for products and services (Fromm and Garton, 2013). Changing lifestyles, changing eating habits, and the possibility of expanding food choices are believed to influence consumer expectations for food, in general, but especially among younger generations (Szczepanski, 2016). Such expectations are fueled by the desire for fresh, exciting flavors; the need for convenience; the pursuit of health and wellness; and demand for transparency and authenticity (Szczepanski, 2016).

While scholars have conducted abundant market research on the general characteristics of millennials (Fromm and Garton, 2013; Howe and Strauss, 2009; Greenberg and Weber, 2008), scant research addresses Latin American millennials, especially in those Latin American countries classified as emerging, such as Peru. Peru's population grew at an average rate of 6.1% between 2005 and 2014 (World Bank, 2015), and 35% of the total population are millennials (Perú Instituto Nacional de Estadistica e Informatica, 2015). Peru's millennials are also educated: approximately 80% of Peruvian millennials have completed higher education (De la Cruz, 2016), implying that this group will have more disposable income to fuel the demands of the future middle class and influence lifestyle trends for the decades to come. Peru's growing middle class, with their increasing purchasing power, appears to be more open than previously to new and

high-quality food products. This is reflected in an emerging trend: Goods with high nutritional and health value are becoming more popular among Peruvian consumers (Foreign Affairs and International Trade Canada, 2011). Despite using a sample of millennials, we do not aim to make generalizations about Peruvian millennials' preferences for fresh fruits; rather, we hope to understand how a segment of this group (represented by college students) perceptions of the intensity of quality attributes impact WTP and whether knowing the country of origin of the food product affects this valuation.

Fresh Apple Consumption in Peru

In many countries—including Peru—there is concern that low rates of fruit and vegetable consumption among some population sectors will lead to future public health problems (El Peruano, 2015). In 2016, Peru produced a total of 158 thousand metric tons of apples on 9.7 thousand hectares, with a productivity rate of 16 t/ha (Perú Ministerio de Agricultura y Riego, 2018). In 2013, consumption of fresh apples was 5.6 kg/person/year (FAOSTAT 2018b). Average apple consumption in Peru is lower than in other countries with similar gross domestic products ($5,500–$6,500 per capita, in 2010 U.S. dollars) such as China (21.2 kg/person/year), Iran (18.6 kg/person/year), Turkmenistan (8.6 kg/person/year), and Azerbaijan (14.1 kg/person/year) (FAOSTAT, 2018b, World Bank, 2017).

Peru has traditionally imported apples from Chile, but the United States has recently increased its market share in the Peruvian apple market. Chile is a major—by volume—producer of apples in the Southern Hemisphere. In 2016, 36,063 ha were dedicated to apple production, yielding 1.76 million tons of apples (FAOSTAT, 2018a). In 2016, Chile exported 764 thousand tons of apples (United Nations, 2018). The United States is the second-largest producer—by volume—of apples in the world, after only China, producing 4.65 million tons in 2016 (FAOSTAT, 2018a). In 2016, the United States exported 1,069.67 thousand tons of apples (United Nations, 2018). In 2016, Chile exported 47.9 thousand tons of apples to Peru, while the United States exported 4.8 thousand tons (United Nations, 2018).

This international transit of food has been fostered by the emergence and expansion of trade agreements, in which Peru, Chile, and the United States have been involved. In 1991, the United States enacted the Andean Trade Preference Act, eliminating tariffs on a number of products from Bolivia, Ecuador, Colombia, and Peru. In 2006, the United States and Peru signed a bilateral Trade Promotion Agreement, effective in 2009, which eliminated most tariffs on exports in both countries (Perú Ministerio de Comercio Exterior y Turismo, 2016). Peru also has a history of trade agreements with Chile. In 1998, the two countries signed an Economic Complementation Agreement developed as part of the Latin American Integration Association. In 2009, a Free Trade Agreement was put into effect between the two countries, with a scheme of progressive trade tariff elimination to be completed in July 2016 (Perú Ministerio de Comercio Exterior y Turismo, 2016).

Literature Review

A large body of literature in the sensory science discipline has analyzed consumer preferences for apple quality attributes (see, e.g.,, Daillant-Spinnler et al. 1996; Jaeger et al., 1998; Cliff, Sanford, and Johnston, 1999; Hampson et al., 2000; Hampson and Kemp, 2003; Harker, Gunson, and Jaeger, 2003; Jesionkowska and Konopacka, 2006; Harker et al., 2008; Dinis, Simoes, and Moreira, 2011; and Cliff, Stanich, and Hampson, 2014). A common finding across these studies is that textural (e.g., firmness and crispness) and flavor (e.g., sweetness, acidity, balance between sweetness and acidity) quality characteristics impact consumers' preferences for fresh apples.

A branch of literature in the applied economics discipline centers on estimating the value that consumers place on or their WTP for different fresh apple quality characteristics. Studies vary in the empirical approaches used, ranging from hedonic price models (Kajikawa, 1998; Carew, 2000), conjoint analyses (Manalo, 1990; Choi et al., 2017) and contingent valuation (McCluskey et al., 2007 and McCluskey et al., 2013) to experimental auctions (Lund et al., 2006; Yue et al., 2007; Yue and Tong, 2011; Costanigro et al., 2014; Zhang and Vickers, 2014; Seppa et al., 2015; Gallardo et al., 2017). These studies concur with the sensory science literature, finding that perceived superior textural (e.g., firmness and crispness) and flavor (e.g., sweetness, acidity, balance between sweetness and acidity) quality characteristics positively impact consumers' WTP.

In this study, our goal is to elicit the value that individuals posit on inherent apple quality attributes and investigate whether disclosing the name of the apple variety and its associated country of origin influenced WTP. We used three apple varieties, typically sold in the Peruvian marketplace: U.S. imported 'Fuji', Chilean imported 'Royal Gala', and locally grown 'Delicia'. Locally grown 'Delicia' represented 60% of all apples sold in the main wholesale fruit market in Lima in 2014 (Perú Ministerio de Agricultura y Riego, 2018). The most-demanded imported apple varieties in Peru are 'Fuji', 'Royal Gala', 'Granny Smith', and 'Red Delicious' (Fresh Plaza, 2016).

Fresh food eating quality is often examined at a conceptual level, given that product tasting is not often incorporated into protocols (Harker, Gunson, and Jaeger. 2003). A limitation is that fresh foods are perishable (i.e., quality attributes change throughout the marketing season), and consumer perceptions could therefore change throughout the year. This is evident when comparing different varieties, which are often harvested at different times. Other difficulties include procuring a representative sample of individuals to participate in the taste test and the fact that the facilities where tastings take place are likely to be different from the typical contextual associated with fruit purchase (Harker, Gunson, and Jaeger, 2003).

We attempted to mitigate these potential difficulties by mimicking as closely as possible a routine grocery shopping experience. Participants were presented with three apple varieties with which they were familiar and that were being sold at most grocery stores at the time the study took place. Moreover, we used incentive-compatible experimental actions to elicit values. In experimental auctions, participants are involved in an active market environment, exposed to market feedback, and face real economic consequences to their responses (Lusk and Shogren 2007). Due to the significant advantages over other value elicitation methods, experimental

auctions have become increasingly popular for valuing quality and information attributes of agricultural products (e.g., Alfnes and Rickertsen, 2003; Groote et al., 2011; Melton et al., 1996; Rozan, Stenger, and Willinger, 2004; Yue and Tong, 2011; Groote et al., 2016). In addition, the fact that the study took place in a laboratory setting enabled us to control for potential external factors that could influence preference.

We used a second-price auction format in which each participant submits a sealed bid; the individual submitting the highest bid wins the auction and must pay the second-highest bid for the product. We chose this mechanism because it is demand revealing, is relatively simple to explain to participants, and exhibits an endogenous market-clearing price. Detractors of the second-price auction argue that there is a risk that individuals will overbid and lose interest in multiple bidding rounds, especially for low-value bidding individuals (Colson, Huffman, and Rousu, 2011). The random *n*th-price auction offers an alternative, but the literature does not provide any conclusive evidence indicating which auction mechanism is superior. Lusk and Shogren (2007) claimed that second-price auctions are better for individuals whose valuations are close to the market value and that random *n*th-price auctions are better for individuals whose valuations are far below the market price. We underscore the ease of implementation of the second-price auction and the evidence that participants without prior training and without a thorough understanding of the auction mechanism could systematically bias auction results (Corrigan and Rousu, 2008).

Methods

Data Collection

We conducted the experimental auctions and sensory taste tests in June 2015 at the facilities of the Universidad Nacional Agraria la Molina in Lima, Peru. One hundred college students were recruited 2 weeks in advance by flyers posted around campus. We used the standard sample size of 100 individuals for a sensory evaluation in a central location (Meilgaard, Civille, and Carr, 1999). Sensory science practitioners concur that the correct number of consumers to be enrolled in a sensory test depends on the complexity of the sensory task to be performed (Mammasse and Schlich, 2010). We justify our choice of 100 individuals using claims made by Mammasse and Schlich (2010) and Chambers and Baker Wolf (2005) stating that the number of panelists to be enrolled in a hedonic sensory evaluation should range from 50 to at least 100, if no preference segmentation is sought.

To participate in the study, individuals had to have eaten apples in the last 3 months. We acknowledge that using student pools is often questioned. In principle, the goal of this paper is not to generalize about Peruvian consumers' preferences for fresh apple varieties but to investigate whether attribute bundles are valued equally across different apple varieties and whether disclosing the name of the apple variety and its associated country of origin influence WTP. Logistically, recruiting college students was more convenient and less costly than recruiting a nationally representative sample of individuals. Nalley, Hudson, and Parkhurst (2006) argue that students perform similarly to other groups in economic experiments. Moreover, Smith, Suchanek, and Williams (1988) conclude that experienced and inexperienced subjects exhibit similar forecasting behaviors.

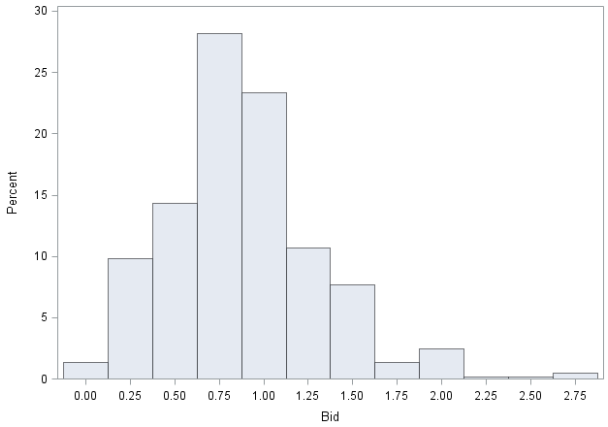
The experiment was conducted in two different sessions, each hosting 50 individuals. Each participant was given S/. 20 (nuevos soles, the Peruvian currency) (the equivalent of $6.3 U.S. dollars) as compensation for their time and as an initial endowment for the experimental auctions. As of June 18, 2015, $1 was equivalent to S/. 3.16 (Banco Central de Reserva del Perú, 2015). At the beginning of each session, the moderator explained the study goals. Then, the moderator explained the sensory taste test and the experimental auction. A practice auction using pencils was performed to familiarize participants with the experimental auction procedure. The moderator emphasized that an actual payment would be required from the winner of the auction. Next, the moderator explained each sensory quality attribute included in the questionnaire (e.g., crispness or acidity).

The experiment consisted of two rounds. The first round included the sensory evaluation of each apple sample and bid elicitation without any information about the name of the variety or its country of origin. The second round was the same as the first, but the name of the variety and associated country of origin were disclosed.

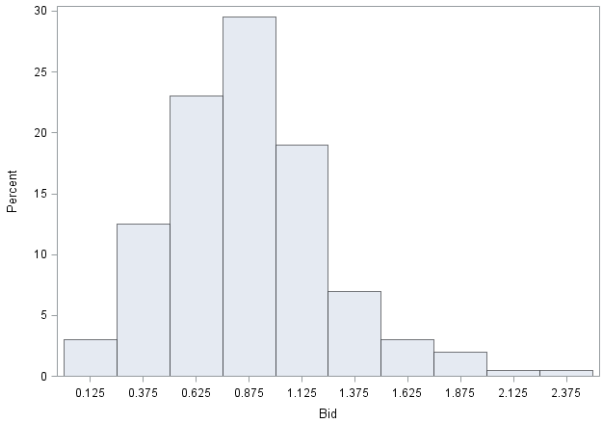
During the first round, each participant was presented with three apple samples, each from a different variety, identified with letters D, N, and S. First, participants evaluated the samples visually. Appearance attributes included the perceived presence of external defects, color, shape, and size. Next, participants rated each sample on a 9-point scale (where 1 = dislike extremely, …, 9 = like extremely) to indicate how much they liked the appearance, size, color and shape of each sample. Next, researchers cut each participant's apple sample in half and asked participants to measure the transverse diameter of each apple sample with a ruler and record its size in the questionnaire. They were also asked to assess the presence of defects using a 9-point scale (1 = no defects, …, 9 = abundant defects). Next, participants were asked to smell the apple, bite, and taste, rinsing their mouths with water between tasting each sample. Then they rated several attributes—aroma, crispness, firmness, juiciness, flavor, sweetness, and acidity—using a 9-point scale (1 = dislike extremely, …, 9 = like extremely). They were also asked to rate the perceived intensity of each attribute on a 9-point scale (1 = not intense, …, 9 = extremely intense). Once most participants had signaled that they had finished responding to the questionnaire, they submitted a bid in nuevos soles per kilo for each of the apple samples evaluated. The bids were organized in ascending order, and the first- and second-highest bids were identified along with the panelists submitting those bids. Researchers recorded the winning bids; that is, bids were not revealed to participants after the first round of bids, in order to avoid the possibility of influencing subsequent bids.

During the second round of the experiment, researchers revealed the name of the apple sample variety and associated country of origin, and participants subsequently submitted a second round of bids. The same procedure was repeated: Bids were organized in ascending order, and the first- and second-highest bids were identified along with the panelists submitting those bids. After the second round of bids, the moderator randomly chose a binding apple sample and a binding bid round, identifying a single winner for the session. Finally, participants responded to a questionnaire about apple fruit consumption, purchasing habits, and sociodemographic information.

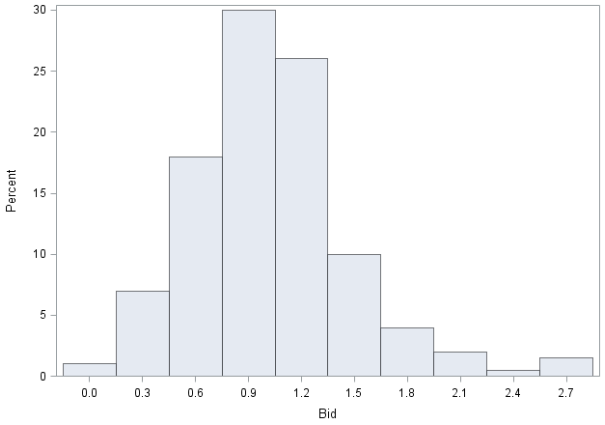
Empirical Model



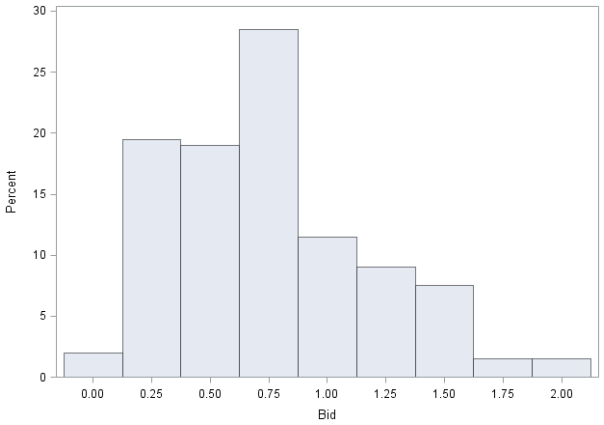
Distribution of Bids for all Apple Varieties



Distribution of Bids for 'Delicia'



Distribution of Bids for 'Royal Gala'



Distribution of Bids for 'Fuji'

Figure 1. Histogram of Bid Distributions

Given that participants often bid zero values, we use censored models to analyze the experimental auction bid data. In our sample, 1% of bids (6 out of 600) were zeroes. Figure 1 showed that the bid distribution leans to the left, or positive skewness. Results from a skewness test show a positive non-zero value.[1] Skewness values for all bids are 0.83, for 'Delicia' apple bids 0.81, for 'Royal Gala' 0.87, and for 'Fuji' 0.72. We use a Tobit model to explain the variation in bids for the different apple samples. In censored models, the latent unobserved variable bids, y^*, are represented by y, the bid actually observed. We consider our bids to be left censored, following Greene (2008):

[1] The formula to estimate skewness is $\frac{n}{(n-1)(n-2)}\sum_{i=1}^{n} w_i^{3/2}\left(\frac{x_i-\bar{x}_w}{s_w}\right)^3$, where n is the number of non-missing values for a variable, x_i is the ith value of the variable, $\bar{x}_w$ is the sample average, s is the standard deviation, and w_i is the weight associated with the ith value of the variable.

$$y_1^* = \mathbf{X}_i\beta + \varepsilon_{ij}$$
$$y^* = 0 \text{ if } y_i^* \leq 0 \quad (1)$$
$$y^* = y_i^* \text{ if } y_i^* > 0$$

where $\mathbf{X}_i$ is the vector of explanatory variables for individual i's preference ratings for apple quality attributes (including appearance, taste, and texture) and ε_{ij} is the error term assumed with mean 0 and variance σ^2. The parameter estimates are obtained by maximizing the likelihood function, L, which is represented by

$$L = \prod_{i=1}^{N} \left(\frac{1}{\sigma}\phi\left(\frac{y_i - \mathbf{X_i}\beta}{\sigma}\right)^{UC_i}\right) \Phi\left(\frac{-\mathbf{X_i}\beta}{\sigma}\right)^{LC_i}, \quad (2)$$

where UC_i and LC_i are indicator variables representing uncensored and left-censored bids and Φ represents the cumulative standard normal distribution (Lusk and Shogren, 2007).

Recall that we elicited ratings for how much individuals liked the quality attributes of each apple sample and for the intensity perceived for the same quality attributes. A Pearson correlation test (Table 4) demonstrates that all preference ratings and perceived-intensity ratings are correlated. Therefore, we conduct separate regressions using either preference or intensity ratings as explanatory variables. We use different measures of goodness of fit to investigate which regression—that using preference ratings or that using perceived intensity ratings—offered better explanatory power. We used the Akaike Information Criterion (AIC), which evaluates the likelihood function relative to the number of parameters in the empirical formulations. We also used the Bayesian Information Criterion (BIC), which includes different prior probabilities according to the number of the candidate model (Greene, 2008). Further, we compared the adjusted R^2 and the log-likelihood functions. All measures of goodness of fit indicated that using preference ratings as explanatory variables offered better explanatory power than using intensity ratings (Table 1). Therefore, we only present the results of the parameter estimates in equation (2) using preference ratings as explanatory variables.

Table 1. Measures of Goodness of Fit Comparing Models Having Preference Ratings versus Perceived Intensity Ratings

	'Delicia'		**'Royal Gala'**		**'Fuji'**	
Goodness of Fit	**Preference**	**Intensity**	**Preference**	**Intensity**	**Preference**	**Intensity**
Adjusted R^2	0.082	0.115	0.108	0.049	0.146	0.064
AIC[a]	210.800	201.300	290.100	307.400	243.700	259.900
BIC[a]	214.000	204.500	293.300	310.600	246.900	263.100
Log-likelihood	−99.650	−104.400	−144.050	−152.700	−120.850	−128.950

[a] Akaike Information Criterion.
[b] Bayesian Information Criterion.

We elicited bids for samples of three apple varieties. We conduct an *F*-test to infer whether conducting separate regressions for each apple sample offers superior explanatory power compared to conducting a single regression using pooled data. Results from the *F*-test (*F* statistic

= 2.31, *F* critical value (22, 559) = 1.56) suggest that separate regressions for each sample offer better explanatory power than a single regression using pooled data. Data were analyzed using SAS® v. 9.2.

Results

Summary Statistics

Compared to the 2014 population estimates from the Peruvian Instituto Nacional de Estadistica e Informatica, our sample had fewer household members (3 vs. 5) and was younger (21 vs. 25) than the general Peruvian population. There were more females than males in our sample (61% vs. 50%), and more of our sample had achieved higher education than the general population (90% vs. 31% with more than high school). A much larger portion of our panelists (74%) were born in Lima, compared to 31% of the total Peruvian population. Our sample also overrepresented the upper-tier neighborhoods of Lima, with 31% of panelists living in upper-tier neighborhoods, compared to 3% of the total population in Lima; the middle tier was closely represented (17% vs. 15%), and the lower tier was underrepresented (51% vs. 82%). The median income of our sample panelists was higher than for the general Peruvian population (S/. 3,000 /month vs. S/. 1,555 /month) (Table 2).

Table 2. Summary Statistics of Survey Respondent and Census Demographics

	Panelists	**Peru General Population**
Size of household	3	5.4
Average age	21.26	25.5
Gender (% female)	61	49.9
Education (% with more than high school)	90	31.3
Born in Lima (%)	74	31.3
District of Lima		
Upper tier (%)	31	3.4
Medium (%)	17	14.6
Low tier (%)	51	82
Median income (nuevo sol/month)	S/. 3,000	S/. 1,555
($US/month)	($949)	($492)

Source: Peru, Institute of Statistics and Informatics (2015).

With respect to purchasing habits, panelists considered price to be an important factor when buying apples (average of 5, "important," on a 7-point scale, where 1 = extremely unimportant, …, 7 = extremely important). In general, panelist bought apples once a month and bought 5 apples at each purchasing opportunity. If we consider that the average household size of our panelists is 3 and assume that each apple weighs 0.26 kg, then the per capita consumption of apples of our sample of panelists is 5.10 kg/person/year, relatively close to the 5.6 kg/person/year reported by FAOSTAT (2018). Most panelists in our study (40%) buy apples at traditional/artisan markets in the district (Table 3).

Table 3. Summary Statistics of Purchasing Habits

Purchase Habit	Average/Percentage Responses per Category
Importance of price when purchasing apples (1= extremely unimportant to 7=extremely important)	5
Frequency of apple purchase	Once a month
Number of apples bought when purchasing	5
Where do you most often buy apples?	% Responses
Wholesale producers market	24
Supermarket	11
District market	40
Private market	3
Small store	13
Kiosk	7
Other	2

Considering preference ratings for each apple sample variety presented, participants assigned higher preference scores for appearance attributes, such as external appearance and fruit size, to 'Royal Gala', followed by 'Fuji' and 'Delicia'. Lack of state-of-the-art postharvest handling is reflected in the poor external appearance of Peruvian-grown 'Delicia' apples (M. Silva, personal communication, 2015). Considering textural quality attributes (crispness, firmness, and juiciness), participants assigned consistently higher preference scores to 'Royal Gala', followed by 'Fuji' and 'Delicia'. When considering flavor quality attributes, participants' preference ratings were mixed. For apple-like flavor and sweetness, participants assigned higher scores to 'Royal Gala' followed by 'Delicia' and 'Fuji'. For aroma, higher scores were observed for 'Delicia', followed by 'Fuji' and 'Royal Gala'; for acidity, higher scores were assigned to 'Delicia', followed by 'Royal Gala' and 'Fuji'. Table 4 reports these ratings as well as perceived intensity ratings. Across the three varieties, perceived defects and preference for external appearance are negatively correlated. Preference ratings for fruit size, aroma, crispness, juiciness, apple flavor, sweetness, and acidity are positively and statistically significant correlated with perceived intensity; that is, higher perceived intensity correlates with higher preference ratings. The exception is firmness, for which the correlation between preference and perceived intensity was negative for 'Delicia' and 'Royal Gala', with no evidence of statistically significant correlation for 'Fuji'.

Table 5 lists bids for each variety in rounds 1 and 2, and a pairwise comparison of bids across varieties and across rounds within each variety. In general, bids for 'Royal Gala' were statistically significantly higher compared to 'Delicia' and 'Fuji'. Within the same variety, there were no statistically significant differences between bid 1 and bid 2, implying that knowing the apple variety and the location where it was grown did not significantly affect the amount bid.

Table 4. Summary Statistics of Preference and Perceived Intensity Ratings for Quality Characteristics for 'Delicia', 'Royal Gala' and 'Fuji' Apples

	Preference Rating		Intensity Rating			
Quality Attributes	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Pearson Correlation**	***p*-value**
'Delicia'						
Ext. app./defects	5.340	1.655	4.630	1.983	−0.341	0.001
Size	6.000	1.598	7.928	0.329	0.120	0.092
Aroma	6.530	1.588	5.830	1.411	0.462	0.001
Crispness	6.380	1.712	5.690	1.676	0.770	0.001
Firmness	6.030	1.972	5.570	1.749	−0.439	0.001
Juiciness	5.630	1.916	4.940	1.775	0.711	0.001
Apple flavor	6.290	1.697	6.030	1.470	0.818	0.001
Sweetness	6.250	1.562	5.210	1.377	0.705	0.001
Acidity	5.860	1.737	4.540	1.834	0.371	0.001
'Royal Gala'						
Ext. app./defects	6.680	1.610	2.890	1.677	−0.214	0.002
Size	7.242	1.193	7.355	0.281	0.169	0.017
Aroma	4.590	1.794	3.150	1.686	0.615	0.001
Crispness	7.250	1.594	6.870	1.884	0.767	0.001
Firmness	6.879	1.700	5.320	2.034	−0.104	0.146
Juiciness	7.384	1.472	7.100	1.607	0.807	0.001
Apple flavor	6.680	1.979	6.350	1.779	0.820	0.001
Sweetness	6.600	1.684	6.400	1.672	0.661	0.001
Acidity	5.800	1.854	3.960	2.010	0.397	0.001
'Fuji'						
Ext. app./defects	6.380	1.927	2.590	1.876	−0.157	0.027
Size	6.710	1.516	6.999	0.286	0.136	0.056
Aroma	5.430	2.142	4.850	2.445	0.847	0.001
Crispness	6.690	1.825	7.000	1.653	0.673	0.001
Firmness	6.545	1.758	4.828	2.311	0.092	0.197
Juiciness	6.687	1.942	6.810	1.769	0.697	0.001
Apple flavor	4.080	2.204	4.370	2.199	0.840	0.001
Sweetness	4.170	2.103	4.000	2.312	0.765	0.001
Acidity	4.350	1.946	3.400	2.055	0.327	0.001

Table 5. Summary Statistics and Pairwise Comparison of Bids for 'Delicia', 'Royal Gala' and 'Fuji' Apples

	'Delicia'		'Royal Gala'		'Fuji'	
	Mean	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
Bid – round 1						
Peruvian nuevo sol	2.68[a]	1.24	3.28[b]	1.47	2.36[c]	1.35
U.S. dollar	0.85	0.39	1.04	0.47	0.75	0.43
Bid – round 2						
Peruvian nuevo sol	2.79[a]	1.69	3.22[b]	1.55	2.34[c]	1.33
U.S. dollar	0.88	0.53	1.02	0.49	0.74	0.42

Notes: Bids across apple sample varieties were statistically significantly different after a pairwise comparison test, while bids for the same variety in rounds 1 and 2 were not.

Willingness to Pay

In relation to external appearance quality attributes, parameter estimates are positive and statistically significant for size preference for 'Royal Gala' and 'Fuji' but not statistically significant for 'Delicia'. Parameter estimates for external appearance preference were not statistically significant for any of the three varieties. This finding supports Cliff, Sanford, and Johnston (1999), who reported that consumers value large fruit size. That study did not include preference for external appearance.

In relation to textural quality attributes across all varieties, parameter estimates for crispness were positive and statistically significant, signalling that participants were homogeneous in their preferences and valuation for crisper apples. However, preferences for firmness and juiciness were mixed across varieties. The parameter estimate for firmness was negative and statistically significant for 'Royal Gala' but not statistically significant for the other two varieties. Juiciness was negative and statistically significant for 'Delicia', positive for 'Royal Gala', and not statistically significant for 'Fuji'.

Results for flavor quality attributes were different across varieties. Parameter estimates for aroma preference were positive and statistically significant for 'Delicia' but not statistically significant for the other two varieties. Parameter estimates for apple flavor preference were positive and statistically significant for 'Fuji' but not statistically significant for the other two varieties. Parameter estimates for sweetness and acidity were not statistically significant for any variety. In sum, we found no conclusive indication of what flavor attributes impact WTP (Table 6).

Daillant-Spinnler et al. (1996) and Cliff, Stanich, and Hampson (2014) found that apple consumers can be divided into two groups: one that likes a sweet, hard apple, and a second that prefers a juicy, less sweet, more acidic apple. Harker, Gunson, and Jaeger (2003) concluded that the target for textural and flavor attributes differs across individuals, suggesting that a cultivar must be considered in relation to a specific market niche. In other words, a specific group of consumers would positively respond to a particular bundle of sensory attributes. In this study, we faced the challenge of conducting a study in a country where apple varieties offered in the marketplace at any given time have not necessarily been harvested in the same season or under

Table 6. Parameter Estimates for the Tobit Model Explaining Variations in Bids Across Three Apple Sample Varieties 'Delicia', 'Royal Gala', and 'Fuji' ($N = 200$)

	'Delicia'			'Royal Gala'			'Fuji'		
Variable	Parameter Est.	Std. Err.	*p*-Value	Parameter Est.	Std. Err.	*p*-Value	Parameter Est.	Std. Err.	*p*-Value
Intercept	0.321	0.164	0.051	−0.019	0.265	0.943	−0.072	0.183	0.696
Ext. app.	0.016	0.017	0.325	0.028	0.026	0.278	−0.008	0.017	0.649
Size	−0.009	0.018	0.592	0.086	0.032	0.007	0.048	0.021	0.022
Aroma	0.038	0.018	0.036	−0.023	0.020	0.259	0.004	0.014	0.767
Crispness	0.030	0.018	0.097	0.070	0.035	0.042	0.039	0.020	0.055
Firmness	−0.024	0.017	0.159	−0.071	0.031	0.021	0.007	0.021	0.719
Juiciness	−0.055	0.018	0.003	0.071	0.035	0.046	−0.005	0.019	0.808
Flavor	0.028	0.023	0.227	−0.018	0.029	0.548	0.055	0.022	0.011
Sweetness	0.025	0.023	0.282	−0.004	0.033	0.901	0.014	0.022	0.529
Acidity	0.030	0.018	0.108	−0.009	0.021	0.692	−0.009	0.017	0.592
Information	0.031	0.049	0.529	−0.021	0.063	0.743	−0.006	0.055	0.911
Sigma	0.346	0.017	0.001	0.439	0.022	0.001	0.385	0.020	0.001
Log-likelihood	−71.290			−118.155			−93.689		
AIC[a]	166.580			260.309			211.379		
BIC[b]	206.160			299.647			250.716		

[a] Akaike Information Criterion.
[b] Bayesian Information Criterion.

similar conditions. We acknowledge that the varieties evaluated in this study might have differed in their ripeness. Harker, Gunson, and Jaeger (2003) warned that "care needs to be taken to ensure consumer preferences attributed to different cultivars are not actually driven by preferences in the ripeness of each cultivar" (p. 340). Nonetheless, we argue that this study reflects the reality faced by Peruvian consumers in the marketplace, hence the challenge to identify a cluster of preferred attributes or attribute levels. Moreover, our findings support those of Combris et al. (2009), who claim that consumers use simple heuristics to select or eliminate products from their choice set based on a few salient quality characteristics. It is evident that crispnesss was salient among our sample of participants, but flavor attributes were not.

Furthermore, we acknowledge that the external appearance cues of each variety could potentially influence how panelists perceived external and internal characteristics. We designed the experiment this way for two reasons: First, because we were interested in inferring the preferred external appearance of apples, presence of external defects, and size. Second, because we assumed that the general Peruvian consumer is not familiar with the country of origin of the food products they consume (Spillan Antúnez de Mayolo, and Kucukemiroglu, 2007), especially fresh apples. Hence, they might not have a solid idea of the name of the variety or the country of origin of the apples presented to them before this information was disclosed.

In relation to the effect of information on the WTP, we found no evidence that disclosing information about the name of the variety and its associated country of origin affected bids, as the parameter estimate for this information was not statistically significant.

Summary and Conclusions

Investigating the drivers of food choice is a complex task. Literature suggests that using elements from various disciplines could help improve the understanding of food choice. In this study, we combine sensory evaluation techniques with experimental auctions to elicit the preferences and values that individuals posit on inherent apple quality attributes and determine whether attribute bundles are valued equally across apple varieties. In addition, we investigate whether disclosing the name of the apple variety and its associated country of origin influenced WTP. We conducted the experiment in two rounds. In the first, panelists evaluated the fruit, filled out a questionnaire on their perceptions, and submitted bids for each variety. In the second round, researchers revealed the name of the cultivar and its associated country of origin and panelists submitted bids again.

Participants in our study signaled a positive WTP for larger fruit sizes, an appearance attribute, and higher crispness, a textural attribute. However, no conclusive evidence was found with respect to flavor attributes. Also, revealing the name of the apple variety and its associated country of origin did not impact the WTP for each variety.

Determining key external and internal quality attributes that drive preferences and WTP for fresh fruits such as apples remains challenging. The tendency persists to consider consumers as a homogeneous group from a physiological standpoint or to characterize them by their sociodemographic information. However, as research has shown, consumer preferences are based on many factors, including familiarity with the product, socioeconomic status, age, gender, culture, and social norms (Lyman, 1989).

We acknowledge this study's pitfalls: limited control over the time of harvest and postharvest handling and the relatively small participant sample. Our findings underscore the importance of appearance and eating quality for the sample of participants, as the name of the variety and its associated country of origin did not change overall preferences or WTP for the apple samples. This information, although not representative of the general Peruvian population, could indicate the factors deemed most important to individuals when choosing to consume a fruit product. Fruit quality expectations—expressed in terms of external appearance and internal quality, taste, and texture—surpass credence expectations such as variety name and associated country of origin.

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