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

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 the apples with the quality profile of the 'Royal Gala' variety over 'Delicia' and 'Fuji'. Revealing the name of the apple variety and the associated country of origin did not affect willingness to pay. In general, panelists were willing to discount for increased presence of external defects, willing to pay a premium for an increase in the perceived intensity of aroma and crispness, but discount for an increase in the perceived intensity of sweetness. Determining key external and internal quality attributes that drive preferences and willingness to pay for fresh fruits such as apples remains challenging, as consumer preference could be influenced by factors different from external and internal quality attributes and difficult to control.

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

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Introduction

Most research focusing on improving the understanding of food choice has been conducted from the perspective of a single discipline such as, sensory science, economics, nutrition, or psychology. Including the perspectives of different disciplines allows modeling food purchase behavior closer to reality adding reliability to the results compared to what would be achieved using a single discipline (Köster, 2003). Food choice in general is a complex process. A common belief held by economists studying food and non-food decisions is that people 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 in a systematic way, but that simple heuristics are used 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 is to measure if a sample of college students are able to distinguish differences in external and internal quality characteristics of three different fresh apple varieties, Ho: willingness to pay (hereafter WTP) for the three apple varieties are the same. Second, is to investigate if disclosing the name of the apple variety and the association country of origin influenced WTP; Ho: the effect of the information on the name of the variety and associated country of origin on the willingness to pay is zero.

We choose fresh apples because different from other fresh food products, they exhibit external characteristics enabling the consumer to visually differentiate across varieties. In this context, apple varieties act like brand categories, in which members of one category share common characteristics that are different 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- is believed to drive the consumers' first impulse to buy the apple (Shapiro, 1983). However, subsequent purchasing decisions are influenced by consumer's previous experiences with the eating quality of similar products or varieties (Shapiro, 1983).

We focus on college students, the millennial generation, because they are known to be the generation whose preferences would shape future demand for products and services (Fromm and Garton, 2013). It is believed that consumer expectations for food, in general, but especially for younger generations, are influenced by changing lifestyles, changing eating habits, and the possibility of expanding food choices (Szczepanski, 2016). Such expectations are fueled by the desire for fresh, exciting flavors, need for convenience, the pursuit of health and wellness, and demand for transparency and authenticity (Szczepanski, 2016). While there is abundant market research on general characteristics of millennials (Fromm and Garton, 2013; Howe and Strauss, 2009; Greenberg and Weber, 2008), scant research addresses millennials in Latin America, especially in those Latin American countries classified as emerging such as Peru. Growth in this country had been noteworthy, with an average growth rate of 6.1% between 2005 and 2014 (World Bank, 2016). Peru's growing middle-class with increasing purchasing power appears to be more open to new and high-quality food products. This is reflected in an emerging trend in which foods with high nutritional and health value are gaining more popularity among Peruvian consumers (Canada, Foreign Affairs and

International Trade, 2011). Thirty-five percent of the total Peruvian population fall under the millennial category (Peru, Institute of Statistics and Informatics, 2015) and 4 out 5 Peruvian millennials had completed their higher education (De la Cruz, 2016) which implies 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. It is important to note that despite using a sample of millennials, this paper does not aim to give a generalization on Peruvian millennial population preferences for fresh fruits, but an idea of how a segment of this group represented by college students perceived intensity of quality attributes impact willingness to pay, and if knowing the country of origin of the food product affect or not such valuation.

Fresh apple consumption in Peru: In many countries —including Peru—there is concern that low rates of fruit and vegetable consumption by some population sectors will lead to future public health problems (Peru, Official Newspaper El Peruano 2015). In 2013, Peru produced a total of 142 thousand metric tons of apples on 9.4 thousand ha with a productivity rate of 17 t/ha (Peru, Minister of Agriculture and Irrigation, 2016). Aggregate apple consumption for 2013 was estimated at 168 thousand tons. The population estimate for 2013 was 30.5 million people and per capita apple consumption was estimated at 5.6 kg/person/year (Peru Institute of Statistics and Informatics 2015). The average apple consumption in Peru is lower compared to other countries with similar GDPs (between 5,500 and 6,500 per capita measured at 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 2017, 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 (see Figure 1). Chile is a major in by volume producer of apples in the Southern Hemisphere, with 36,000 ha dedicated to apple production (Chile, Office of Agricultural

Studies and Policies 2016). In 2012, Chile produced 1.6 million tons of apples (FAOSTAT 2015). In 2015, total Chilean apple exports amounted 629 thousand tons (U.N. Comtrade 2016). The United States is the second largest producer (by volume) of apples in the World, producing 4.9 million tons in 2015 (U.S. Department of Agriculture, Economic Research Service 2016). In 2015, the United States exported 988.5 thousand tons of apples (U.N. Comtrade 2016). In 2015, Chile exported 43.7 thousand tons of apples to Peru, while the United States exported 5.8 thousand tons (U.N. Comtrade 2016). 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 eliminating most tariffs on exports in both countries (Peru, Minister of International Commerce and Tourism 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 (ALADI). In 2009, the 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 (Peru, Minister of International Commerce and Tourism 2016). Also interesting is to analyze Peruvian college students' reactions to a product whose origin is Chile. The bilateral relations between the two countries have a history of the geopolitical rivalry since the Spanish Colonial period (1500's) until recent years, as in 2014 the International Court of Justice in The Hague solved disputes over maritime space between the two countries (Arteaga, 2015). This study would provide a piece of information if our sample of college students underscore this so-called rivalry among the two countries, or put more emphasis on

quality aspects that would better fulfill their expectations.

Literature review

A number of single discipline-oriented investigations have analyzed consumer preferences and estimated the value consumers place on specific apple fruit attributes including appearance, eating quality, and credence. Abundant research followed a sensory science approach to elicit the drivers for consumer preferences for apples (e.g., Daillant-Spinnler et al., 1996; Jaeger et al., 1998; Cliff et al., 1999; Hampson et al., 2000; Hampson and Kemp, 2003; Harker et al., 2003; Harker et al., 2008; Dinis et al., 2011; and Cliff et al., 2014). These studies concluded that textural and flavor eating quality characteristics were determinant for consumer preference for fresh apples.

Numerous studies in the applied economics discipline also focused on eliciting WTP for fresh apples quality characteristics (Manalo, 1990; Kajikawa, 1998; Jesionkowska and Konopacka, 2006; Lund et al., 2006; McCluskey et al., 2007; Yue et al., 2007; and Yue and Tong, 2011; McCluskey et al., 2013; and Costanigro et al., 2014). Similar to findings in the sensory science literature, investigators emphasized the importance of both flavor and textural eating quality and external appearance attributes on the prices consumers were willing to pay for fresh apples. Fewer studies have compared hedonic panelists' ratings with WTP information. Zhang and Vickers (2014) underscored the impact on the WTP of the order of presenting information related to a product to be sensory evaluated. Seppa et al. (2015) found a positive relationship between perceived pleasantness after tasting an apple and WTP.

Different from other studies, in this study we test two hypotheses, first if college students' preferences and willingness to pay for three apple varieties are different and second if knowing the name of the variety and the country of origin would have any effect on such

preferences. We used three apple varieties: U.S. imported ‘Fuji’, Chilean ‘Royal Gala’, and locally grown ‘Delicia’. These apple varieties are representative of the Peruvian apple market. Locally grown ‘Delicia’ represented 60% of all apples sold in the main wholesale fruit market in Lima in 2014 (Peru, Minister of Agriculture and Irrigation 2016), and the most demanded imported apple varieties in Peru are ‘Fuji’, ‘Royal Gala’, ‘Granny Smith’, and ‘Red Delicious’ (Fresh Plaza 2016). To augment the reliability of our study, we combined a sensory taste test along with an incentive compatible experimental auction.

Eating quality of fresh foods is often examined at a conceptual level, given that product tasting is rarely incorporated into protocols (Harker et al. 2003). A limitation is that fresh foods are perishable, meaning that quality and consumer perceptions change throughout the year. This is evident when comparing different varieties, which are often harvested at different times, especially if produced in different countries. Other difficulties include procuring a representative sample of individuals to participate in the taste test and the fact that the facilities where the tasting takes place are likely to be different from the typical contextual situation associated with fruit purchase (Harker et al. 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 faced 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 et al. 2004, Yue et al. 2011, Groote et al. 2016). In addition, the fact that the study took place in a laboratory setting enabled potential external factors that could influence preference to be controlled. In this auction format, each participant submits a sealed bid; the highest bidder wins the auction and pays the second-highest bid for the product. We chose the second price auction mechanism because of its advantages: being demand revealing, being relatively simple to explain to participants and having an endogenous market-clearing price. Drawbacks of the second price auction include individuals' over-bidding behavior and loss of interest in multiple bidding rounds for low-value bidding individuals (Colson et al., 2011). The random *n*th-price auction offers an alternative to the aforementioned drawbacks; however there is no conclusive evidence indicating which auction mechanism is superior. It is 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 (Lusk and Shogren, 2007). 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

The experimental auctions and sensory taste tests were conducted in June 2015 at the facilities of the Universidad Nacional Agraria La Molina in Lima, Peru. One hundred college students were recruited two weeks in advance by flyers posted around campus. We used the

standard sample size (100 individuals) for a sensory taste test, taking place in a central location such as Lima, Peru (Meilgaard et al., 1999).

To participate in the study, individuals had to have eaten apples in the last three months. We acknowledge that using student pools is often questioned. In principle, the goal of this paper is not to bring general recommendations of Peruvian consumers' preferences for fresh apple varieties, but to investigate if the quality characteristics of three apples varieties are evident to participants, and if knowing the name of the variety and its country of origin would affect WTP. In addition, logistically, recruiting college students was more convenient and less costly than recruiting standard household individuals. Nalley et al. (2006) argue that students perform similarly to other groups in economic experiments. Moreover, findings in Smith et al. (1988) conclude that experienced and non-experienced subjects exhibit similar forecasting behaviors.

The experiment was conducted in two different sessions, each hosting 50 individuals. Each participant was given S/. 20 (twenty nuevos soles) as compensation for their time and as an initial endowment for the experimental auctions. Nuevo sol is the Peruvian currency; as of June 18, 2015, $1 was equivalent to 3.16 nuevos soles (Peru, Central Reserve Bank 2015). At the beginning of each session, the moderator explained the goals of the study. Then, the moderator explained the sensory taste test and the experimental auction. A practice auction using pencils was performed so participants were familiar with the experimental auction procedure. The moderator emphasized that an actual payment was required from the winner of the auction. First, participants were requested to evaluate the three apple samples visually and by tasting; each apple sample was identified with letters D, N, or S. Then they were asked to respond to a questionnaire describing the intensity and how much they like the visual quality attributes of each sample. The moderator explained each sensory quality

attribute included in the questionnaire, for example, the meaning of crispness or acidity. Appearance attributes included the perceived presence of external defects and size. After evaluating appearance attributes, researchers cut each apple sample given to each participant in two halves. To objectively assess apple size, participants were requested to measure the transversal diameter of each apple with a ruler and write that number as a response to the size question in the questionnaire. Next, panelists were asked to rate how much they like the following apple attributes using a 1–9 scale (1 = dislike extremely, …, 9 = like extremely): aroma, crispness, firmness, juiciness, flavor, sweetness, and acidity. They were also requested to rate the perceived intensity of each of the aforementioned attributes using a 1–9 scale (1 = not intense, …, 9 = extremely intense). Once most participants signaled they had finished responding to the questionnaire, they were requested to submit a bid in nuevos soles per kilo. The bids were organized in ascending order, and the first and second highest bid were identified along with the panelists submitting such bids. Researchers kept records of the winning bids that were not revealed to participants in order to avoid any possibly influence of the previous bid in subsequent bids. In the second round of the experiment, researchers revealed the name of the apple sample variety and associated country of origin. Participants were asked to submit the second round of bids after the variety and country of origin information was provided. 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 such bids. After the second round of bids, the moderator chose a binding apple sample and a binding bid round, so it was possible to identify a single winner for the session. Finally, participants were requested to respond to a questionnaire about apple fruit consumption, purchasing habits, and sociodemographic information.

Empirical model

We used a mixed linear model to analyze the data. The advantage of using the mixed linear regression—being a generalization of the linear regression model—allows both fixed and random effects in one specification (Greene, 2008). This enabled us to model bidding behavior varying randomly across participants, not captured by the purchasing habits and sociodemographic characteristics. Being aware of the potential censoring issue of the data, we find little evidence of censoring problem as the incidence of zero bids were less than 1% (6 out 600 observations) of bids in each round. The model specification follows:

$$Bid_{jk} = \alpha_1 X_{jk} + \alpha_2 Z_j + \alpha_3 D_k + u_j + \epsilon_{jk} \quad (1)$$

where Bid_{jk} is the bid submitted by individual *j* (*j*=1, …, 100) for apple sample variety *k* (*k* = American 'Fuji', Chilean 'Royal Gala', or Peruvian 'Delicia'), α_1 is the marginal value for each quality attribute, X_{jk} is the level of intensity of each quality attribute as perceived by panelist *j* for apple sample variety *k*, α_2 is the coefficient estimate for panelists' purchasing habits and sociodemographic characteristics, Z_j represents purchasing habits and sociodemographic characteristics, α_3 is the coefficient estimate for the binary indicator variable for apple sample variety *k, D_k* is the binary variable indicator for apple sample variety *k,* u_j is the random effects depicting variability across panelists *j*, and ϵ_{hjk} is the error term which follows a normal distribution ϵ_{hjk} = N(0, σ_ϵ^2) with mean zero and standard deviation σ_ϵ^2. Two regressions were conducted under specification (1), one regression for each round of bids.

To measure the effect of revealing the name of the apple sample variety being tasted and its associated country of origin on the bidding behavior, we conducted the third regression, following,

$$Bid_{jk} = \beta_1 X_j + \beta_2 Z_j + \beta_3 D + u_j + \lambda information + \epsilon_{jk} \qquad (2)$$

where Bid_{jk} is the stacked bid in round 1 and in round 2 from panelist *j* (*j*=1, …, 100) for apple sample *k* (American 'Fuji', Chilean 'Royal Gala', or Peruvian 'Delicia'), variables *X*, *Z*, *D,* and *u* are similar to expression (1), $\beta_1 - \beta_3$ are the parameters to estimate, λ is the marginal value of the information on the name and country of origin of each sample variety tasted, *information* is the binary variable denoting whether information was given (*information* = 1, 0), and $\epsilon_{jk}$is the error term, which follows a normal distribution ϵ_{jk} = N(0, σ_ϵ^2) with mean zero and standard deviation σ_ϵ^2. Coefficients were estimated in STATA version 13.1.

Results

Summary statistics

Compared to the 2014 population estimates from the Peruvian National Institute of Informatics and Statistics, our sample had fewer members in their households (3 vs. 5), was younger (21 vs. 25). There were more females than males in our sample (61% vs. 50%). Our sample achieved higher education than the general population (90% vs. 31% with more than high school). Seventy-four percent of our panelists were born in Lima, the capital city of Peru, whereas 31% of the total Peruvian population was born in Lima in 2014. With respect to socioeconomic levels, our sample overrepresented the upper tier neighborhoods of Lima, with 31% of panelists living in upper tier neighborhoods, whereas 3% of the total population in Lima live in the upper tier neighborhood; the middle tier was closely represented (17% vs. 15%), and the lower tier was underrepresented (51% vs. 82%). In Peru, the district where

283 people live is an indicator of the socioeconomic level (Peru, Institute of Statistics and
284 Informatics 2015). The median income of our sample panelists was higher than for the
285 general Peruvian population (S/. 3,000 /mo vs. S/. 1,555 /mo) (see Table 1).

286 With respect to purchasing habits, panelists considered price to be an important
287 factor when buying apples (average of 5, which corresponds to important, in a 1–7 scale, 1 =
288 extremely unimportant, 7 = extremely important). In general, panelist bought apples once a
289 month and bought 5 apples at each purchasing opportunity. If we consider that the average
290 household size of our panelists is 3 and assume that each apple weighs 0.26 kg, then the per
291 capita consumption of apples of our sample of panelists is 5.10 kg/person/year, which is
292 relatively close to the 5.6 kg/person/year reported by FAOSTAT (2017). Most panelists in our
293 study (40%) buy apples at the traditional/artisan market in the district (Table 2).

294 We observed a positive correlation between intensity perceived and preferences in
295 fruit aroma, juiciness, flavor, and sweetness (Table 3). Higher perceived intensity of attributes
296 was linked to those attributes being preferred. ‘Delicia’ apples had the largest diameter and
297 highest perceived firmness, although ‘Royal Gala’ was the most liked in both attributes. ‘Fuji’
298 was perceived to have the highest crispness, but ‘Royal Gala’ was the most liked for crispness
299 (Table 3). Panelists rated for likeness and perceived intensity just after tasting the apple
300 sample without knowing the name of the variety and the associated country of origin. Liking
301 scores for apple flavor and texture and liking scores for general appearance led us to reject
302 the null hypothesis that preferences for the three apple varieties were the same, given the
303 higher rating scores for ‘Royal Gala’ compared to ‘Delicia’ and ‘Fuji’.

304 Bid 1 and bid 2 for each apple variety are listed in Table 4. In general—for both bid 1
305 and bid 2—the bid for the ‘Royal Gala’ apple sample was statistically significantly higher

306 compared to ‘Delicia’ and ‘Fuji’. With this we reject the null hypothesis, that willingness to
307 pay for the three apple varieties are the same. Within the same variety there were no
308 statistically significant differences between bid 1 and bid 2, implying that knowing the name
309 of the apple variety and the associated location where it was grown did not significantly
310 affect the amount bid. Hence, we fail to reject the null hypothesis that the effect of the
311 information on the name of the variety and associated country of origin on the willingness to
312 pay is zero. An interesting implication of this result is that our panel of college students
313 placed the quality profile of the apple over the history of geopolitical rivalry between Peru
314 and Chile.

315 *Willingness to pay*

316 When the impact of the quality attributes on the willingness to pay for each apple
317 sample, we observed that for bid 1, when panelists did not know the name of the cultivar and
318 associated country of origin were willing to discount S/. 0.011 /kg for increased presence of
319 external defects, but not for increased size. Different from this study, Cliff et al. (1999)
320 reported that a large fruit size is an important quality attribute to consumers but the study did
321 not consider presence of external defects. Our panelists were willing to pay S/. 0.015/kg for
322 an increase in the perceived intensity of aroma, S/. 0.034/kg for crispness, and discount S/.
323 0.02/kg for sweetness. These results reveal that panelists in this study, preferred crispness in
324 higher levels but sweetness in less perceived levels. Daillant-Spinnler et al. (1996) and Cliff
325 et al. (2014) found apple consumers can be segmented into two groups: one group that liked a
326 sweet, hard apple and a second group that preferred a juicy, less sweet but more acidic apple.
327 Results from this study imply that our panelists belong to the group preferring a juicy apple,
328 less sweet but more acidic apple. Another implication is that sweetness is known to be a
329 horizontal quality attribute, that is, consumers tend to prefer sweetness levels closer to their

ideal rather than in increased perceived intensities (McCluskey et al., 2013).

Panelists who purchased apples more frequently were willing to discount S/. 0.079/kg, and panelists with higher income were willing to pay S/. 0.029/kg more. In general, panelists were willing to pay S/. 0.22/kg more for 'Royal Gala' compared to 'Delicia'. This signals that our sample of Peruvian college students preferred an apple with the quality profile of 'Royal Gala' to the quality profile of 'Delicia'. There was no evidence of statistically significant differences between bids for 'Fuji' and 'Delicia'. We acknowledge that the external appearance cues of each variety could have the potential of influencing how panelists perceived the 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 assume that the general Peruvian consumer is not familiar with the country of origin of the food products they consume (Spillan et al., 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.

Results when panelists knew the name of the cultivar and associated country of origin that is, parameter estimates for the model having bid 2 as dependent variable, were, in general, consistent with estimates for the model having bid 1 as dependent variable. Panelists were willing to discount for increased presence of external defects (S/. 0.017 /kg), they were willing to pay S/. 0.037/kg for an increase in perceived intensity in crispness, and discount S/. 0.018 for an increase in the perceived intensity of sweetness. Panelists who purchased apples more frequently were willing to discount S/. 0.08/kg. Panelists in bid 2 were willing to pay S/. 0.149/kg more for 'Royal Gala' compared to 'Delicia'. This result is slightly lower from bid 1, where panelists were willing to pay S/. 0.222/kg more for 'Royal Gala' compared to

354 'Delicia'. We cannot decouple the effect of variety or country of origin, however by the
355 results obtained one can infer that participants' knowledge that the apples tasted came from
356 Chile did not affect their willingness to pay more for Chilean compared to Peruvian apples.

357 When analyzing stacked bids, coefficient estimates were similar to bid 1 and bid 2 in
358 both magnitude and sign (Table 5). The coefficient estimate for information was not
359 statistically significant, which coincides with results reported in Table 4 where no statistically
360 significant differences were found between bid 1 and bid 2. This leads us to fail to reject the
361 null hypothesis that the effect of the information on the name of the variety and associated
362 country of origin on the willingness to pay is zero. In all three regressions, random effects at
363 the individual level were statistically significant, implying that there is variability in the
364 bidding behavior across individuals, not captured by the purchasing habits and
365 sociodemographic characteristics. Error term standard deviation was also statistically
366 significant different from zero, implying heteroskedastic error terms. In sum, our results
367 emphasize knowing the name of the variety and country of origin did not affect how
368 participants' willingness to pay for the apple samples.

369 **Conclusions**

370 In this study, we tested two hypotheses, first if college students' preferences and
371 willingness to pay for three apple varieties were different (Ho = preferences and willingness
372 to pay for the three apple varieties are the same), and second if knowing the name of the
373 variety and the country of origin would have any effect on the willingness to pay (Ho= the
374 effect of the information on the name of the variety and associated country of origin on the
375 willingness to pay is zero.). We conducted a sensory taste test and incentive-compatible
376 experimental auction to elicit preferences for apple samples 'Delicia', 'Royal Gala', and

377 ‘Fuji’. We conducted the experiment in two rounds. In the first, panelists had the opportunity
378 to evaluate the fruit, fill out a questionnaire on their perceptions, and submit bids for each
379 sample corresponding to each variety. In the second round, researchers revealed the name of
380 the cultivar and the associated country of origin, and panelists were asked to submit bids
381 again.

382 In general there were no stark differences in the parameter estimates of models when
383 knowing and not knowing the name of the variety and associated country of origin
384 information. Results were consistent across three models, that is, in general panelists were
385 willing to discount for increased presence of external defects, but not for increased size. They
386 were willing to pay a premium for an increase in the perceived intensity of aroma and
387 crispness, but discount for an increase in the perceived intensity of sweetness. These results
388 concur with the idea that sweetness is a horizontal quality attribute that consumers tend to
389 prefer in levels closer to their ideal rather than in increased perceived intensities. In general,
390 panelists were willing to pay a price premium for the variety ‘Royal Gala’ compared to ‘Fuji’
391 and ‘Delicia’. Determining key external and internal quality attributes that drive preferences
392 and WTP for fresh fruits such as apples remains challenging. The tendency persists to
393 consider consumers as a homogenous group from a physiological standpoint or to
394 characterize them by their socio-demographic information. However, as research has shown,
395 consumer preference is based on many factors, including familiarity with the product,
396 socioeconomic status, age, gender, culture and social norms (Lyman, 1989).

397 We acknowledge this study’s pitfalls such as the limited control over the time of
398 harvest and postharvest handling and the relatively small sample of participants. Our findings
399 underscore the importance of appearance and eating quality for the sample of participants, as
400 the name of the variety and its associated country of origin did not change the overall

401 preference and willingness to pay for the apple samples. This information, although not
402 representative of the general Peruvian population, could serve as an indication of the factors
403 deemed most important to individuals when choosing to consume a fruit product. Fruit
404 quality expectations, expressed in terms of external appearance and internal quality, taste and
405 texture, surpasses credence expectations such as the name of the variety and associated
406 country of origin.

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562 Table 1. 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 in Nuevo sol/month	S/. 3,000	S/. 1,555
($USD/month)	($949)	($492)

563 Source: Peru, Institute of Statistics and Informatics 2015.

564

565 Table 2. Summary Statistics of Purchasing Habits.

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

566

567

568 Table 3. Summary Statistics of Peruvian Consumers' Liking Rates (1=extremely dislike, …,
569 9=extremely like) and Perception of Intensity (1=not intense, … 9=extremely intense) for
570 Quality Characteristics for Peruvian 'Delicia', Chilean 'Royal Gala' and American 'Fuji'
571 Apples.

	Average Liking Rate (1=extremely dislike, …, 9=extremely like) Average Intensity Rate (1=extremely low, …, 9=extremely high)					
Fruit Quality	'Delicia'		'Royal Gala'		'Fuji'	
Characteristic	Like	Intensity	Like	Intensity	Like	Intensity
Perception of defects	--	4.63 (1.99)	--	2.89 (1.68)	--	2.59 (1.88)
Size	6.00 (1.60)	7.93 (0.33)	7.24 (1.19)	7.35 (0.28)	6.71 (1.52)	6.99 (0.29)
Aroma	6.53 (1.59)	5.83 (1.41)	4.59 (1.79)	3.15 (1.69)	5.43 (2.15)	4.85 (2.45)
Crispness	6.38 (1.72)	5.69 (1.68)	7.25 (1.59)	6.87 (1.89)	6.69 (1.83)	7.00 (1.66)
Firmness	6.03 (1.98)	5.57 (1.75)	6.88 (1.70)	5.32 (2.04)	6.55 (1.76)	4.83 (2.32)
Juiciness	5.63 (1.98)	4.94 (1.78)	7.38 (1.46)	7.10 (1.61)	6.69 (1.95)	6.81 (1.77)
Flavor	6.29 (1.70)	6.03 (1.47)	6.68 (1.98)	6.35 (1.78)	4.08 (2.21)	4.37 (2.20)
Sweetness	6.25 (1.57)	5.21 (1.38)	6.60 (1.69)	6.40 (1.68)	4.17 (2.11)	4.00 (2.32)
Acidity	5.86 (1.74)	4.54 (1.84)	5.80 (1.86)	3.96 (2.01)	4.35 (1.95)	3.40 (2.06)
Apple flavor and texture	6.32 (1.68)	--	6.90 (1.65)	--	4.56 (2.14)	--
General appearance	5.34 (1.66)	--	6.68 (1.61)	--	6.38 (1.93)	--
External color	5.78 (1.77)	--	5.94 (1.78)	--	5.46 (2.17)	--
Shape	5.33 (1.94)	--	7.23 (1.40)	--	6.84 (1.59)	--

572 Notes: Standard deviation in parentheses.
573

574 Table 4. Summary Statistics of Bids (in Peruvian Nuevos Soles/kg) for Peruvian 'Delicia',
575 Chilean 'Royal Gala' and American 'Fuji' Fresh Apples.

	Average Bids (Nuevos Soles/kg)		
	'Delicia'	'Royal Gala'	'Fuji'
Bid 1	2.68	3.28	2.36
	(1.24)	(1.47)	(1.35)
Bid 2	2.79	3.22	2.34[l]
	(1.69)	(1.55)	(1.33)

576

577

Table 5. Coefficient Estimates for the Multilevel Mixed Model Depicting Willingness to Pay for Appearance and Eating Quality Characteristics for Peruvian 'Delicia', Chilean 'Royal Gala' and American 'Fuji' Fresh Apples.

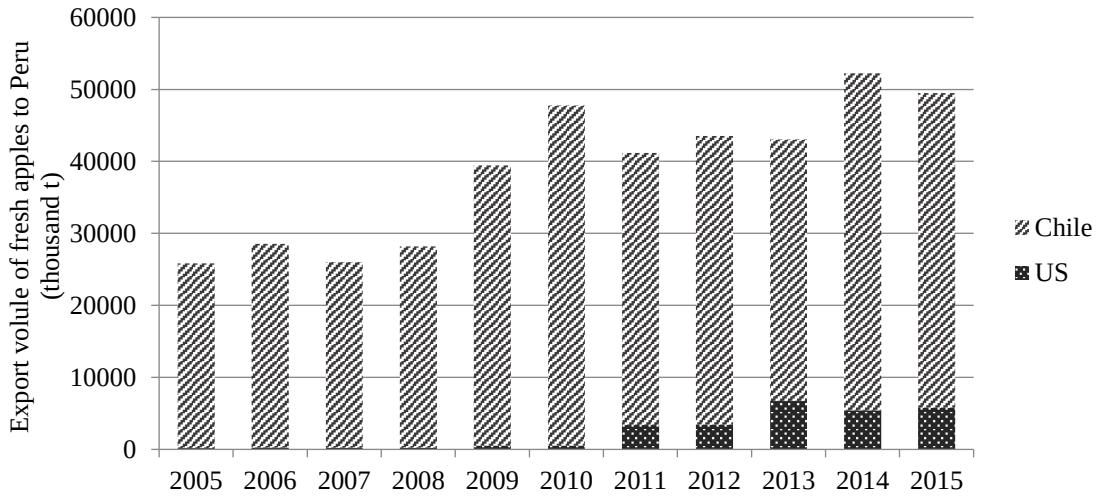
	Bid1	Bid2	Stacked Bid
External defects	-0.011*	-0.017***	-0.014***
	(0.006)	(0.007)	(0.005)
Fruit size	0.048	0.021	0.035
	(0.043)	(0.044)	(0.031)
Aroma intensity	0.015*	0.011	0.013**
	(0.009)	(0.009)	(0.007)
Crispness intensity	0.034***	0.037***	0.037***
	(0.010)	(0.011)	(0.007)
Firmness intensity	0.006	0.001	0.004
	(0.006)	(0.006)	(0.005)
Juiciness intensity	-0.011	-0.011	-0.012
	(0.010)	(0.011)	(0.008)
Flavor intensity	0.012	0.014	0.015
	(0.013)	(0.014)	(0.010)
Sweetness intensity	-0.020*	-0.018*	-0.020***
	(0.010)	(0.011)	(0.008)
Acidity intensity	-0.001	0.007	0.003
	(0.007)	(0.007)	(0.005)
Frequency of apple consumption	-0.079**	-0.080**	-0.080**
	(0.034)	(0.034)	(0.034)
Birth place (Lima=1, 0 otherwise)	0.071	0.038	0.056

	(0.082)	(0.082)	(0.081)
Income	0.029*	0.018	0.024
	(0.016)	(0.016)	(0.016)
‘Royal Gala'	0.222***	0.149***	0.189***
	(0.044)	(0.045)	(0.032)
‘Fuji'	0.035	-0.026	0.007
	(0.054)	(0.056)	(0.039)
Information on name of variety and origin			0.002
			(0.013)
Constant	-0.021	0.409	0.174
	(0.384)	(0.391)	(0.305)
Individual random effects	0.347***	0.344***	0.347***
	(0.026)	(0.026)	(0.025)
Error term standard deviation	0.219***	0.225***	0.222***
	(0.007)	(0.007)	(0.005)
Number of observations	589	590	1179
Log likelihood	-78.905	-91.610	-67.169

581 Notes: Standard errors in parentheses. * p<0.1 ** p<0.05 *** p<0.01

582

583



584

585 Figure 1. Fresh Apple Exports from Chile and the United States to Peru.

586 Source: U.N. Comtrade.

587