Local, Organic, Conventional—
Asymmetric Effects of Information and Taste on Label Preferences in an Experimental Auction

Marco Costanigro
Stephan Kroll
Dawn Thilmany
Department of Agricultural and Resource Economics
Colorado State University

Marisa Bunning
Department of Food Science and Human Nutrition
Colorado State University

Abstract:
We endowed consumers with conventional apples and auctioned local, organic and organic-local apples to elicit consumers' valuation and the response to two experimental treatments: scientific information and taste. For both labels, which participants valued as partial substitutes, positive WTP is conditional on distrusting the governmental food agencies. Information documenting the inconclusive scientific evidence in favor of organic and local production has little effect; while participants with positive valuation reacted to organoleptic characteristics only when the new information favored the labeled apples. The observed behavior is more consistent with polarization against conventional products, rather than in favor of local and organic.

Funding of this research project by USDA/CSREES NRI grant #2008-35400-18693 and the Colorado Experiment Station is gratefully acknowledged. We thank Cathy Thomas, Wenjing Hu, Oana Deselnicu, Sarah Blandon and Gretchen Nurse who helped conduct the experiment and participants at the AAEA meetings in Denver for helpful comments.

1. Introduction

Acknowledging a strong consumer interest in knowing more about the food they eat, the food industry has embraced the provision of information as an instrument to differentiate products, segment consumer demand, and realize prices above marginal cost. Marketing efforts have been shifting from the promotion of food products to the promotion of food attributes (Caswell and Mojduszka, 1996) so that information on what food contains, how it is produced, and where it comes from is increasingly available.

As the number of food labels continues to expand, understanding how consumers process label information and use it in purchase decisions has become more and more complex. Positive willingness to pay (WTP) for differentiating labels has been estimated for a vast number of product-label combinations and recently researchers have become interested in studying how two or more distinct label criteria may interact in determining WTP and consumer food choices. For example, Bernard and Bernard (2009) examined the case of organic, rBST-free, and no-antibiotics labels in milk, and found evidence of diminishing marginal utility of additional attributes.

The present study is similarly aimed at understanding how two labels with more distinct but potentially complementary characteristics, local and organic, interact. It is part of a larger national consumer research project examining the relationship of organic, local, and food-mile labels using survey data (Onozaka and Thilmany, 2011), in-store auctions (Costanigro et al., 2011), and laboratory auctions with sequential release of information (this study) to address several questions on a common theme. The entire project's focus is on local and organic because of the proliferation of local marketing innovations (farmers' markets, "Community Supported Agriculture" subscription programs, regional food hubs), the considerable government (USDA) involvement in the certification of credence-based attributes ("National Organic Program," various process-based verification programs), and significant investments in domestic promotional efforts (state-based "Buy Local" programs and the USDA "Know Your Farmer, Know Your Neighbor" initiative), which have influenced both the organic and local segments.

Three principal research questions are addressed in this article. First, as in other studies, we obtain estimates of the WTP premia for a specific local, organic, and local-organic food item (apples). Furthermore, we investigate whether the organic and local labels interact as complements or substitutes, and measure the extent to which the labels may convey overlapping information or quality cues. Second, we examine whether the provision of scientific information highlighting tradeoffs between conventional, organic and locally produced food changes WTP. That is, we test the hypothesis that consumers' valuation is, at least in part, owed to incomplete knowledge, which potentially could be mitigated by information provision (Rousu et al., 2007 find significant information effects on valuation of GM foods). Finally, we take advantage of the controlled laboratory environment to investigate how taste (an intrinsic experience attribute) may influence the valuation of the labels (which certify extrinsic credence attributes) and the choice between conventional, local and organic products. In the rest of the introduction, we provide further context and motivations for each of the hypotheses we investigate.

Research hypotheses and motivations

H_0^1: The product attributes certified by local and organic map into a distinct set of consumer values; and the valuation of local and organic is additive when both labels are present.

Unlike the relative similarity of the milk labels considered in Bernard and Bernard, organic and local certify a completely different set of product attributes: put simply, one refers to *how* the food is produced, the other to *where* it was produced. If consumers value the labels and the attributes they certify *per se*, as it is commonly assumed in standard random-utility models, then the prior is that average valuation for the two labels should be roughly additive. Lusk and Briggeman (2009), however, emphasize how consumers may not value the attributes themselves, but rather the (real or perceived) outcomes they signal, which may resonate with their values and preferences. This idea is consistent with the means-end chain literature in marketing (e.g., Zeithaml, 1988), in which product attributes map into consumers' values, which become ever more general and abstract as one follows the chain of associations up to the final measure of value/utility. In Lusk and Briggeman, WTP for organic products is found to be larger for consumers who value "nutrition," "naturalness," "environment," and "fairness" more than the average consumer. Similarly, local foods have been linked to a perception of better social and environmental outcomes, and some consumers infer that the shorter supply chain allows for fresher and better tasting products (Pearson et al., 2011). In short, if local and organic are perceived to provide somewhat overlapping outcomes, then we should observe some level of substitutability between the two labels.

H_0^2: Valuation of local and organic does not change when participants are informed of existing scientific evidence regarding outcomes associated with local and organic food products. That is, valuation is not a result of misconceptions and cannot be mitigated with additional information.

Organic foods were officially introduced in the US in 1990, when the Organic Foods Production Act (OFPA) required certification through approved production and handling plans. Food companies' marketing and promotional messages, however, have been strongly focused on more far-reaching, hypothesized outcomes (e.g., “better for you, better for the environment”). After more than three decades the evidence regarding such outcomes remains mixed: a recent scientific status summary (Winter and Davis, 2006) of the existing body of research comparing organic and conventional products found that “while many studies demonstrate [these] qualitative differences between organic and conventional foods, it is premature to conclude that either food system is superior to the other with respect to safety or nutritional composition.”

In the case of local products, the situation is even more confused, as a single definition of the attributes defining local production is lacking. Hand and Martinez (2010) recently summarized the findings from the existing body of consumer research on local products, and reported that interpretations of “local” vary from geographic boundaries, to distance traveled by the food or “food miles,” or even some *ad hoc* restrictions on the length of the supply chain. Given how recent and imprecise the definition appears to be, the only scientific information on which we could communicate research-based findings for local food relates to the relative impact of food miles (a rather small marginal change) on the carbon emissions associated with food production (Weber and Matthews, 2008).

H_0^3: Adding taste information, be it positive or negative, changes the ex-ante valuation of the local and organic labels significantly.

It is known that taste ranks very high in the list of consumers’ priorities when they make food choices. In their list of nine food values, Lusk and Briggeman rank taste as the third-most important among consumers (after safety and nutrition, but before price). Costanigro et al. (2011) report a similarly ranked list and emphasize how all privately appropriated values (taste, healthfulness, good value, convenience) are, on average, ranked above public-good values (environmental impact, preserve farmland, social fairness), while in an experimental auction Melton et al. (1996) showed that consumers are very much willing to change preferences and bids to follow their taste buds.

Since at least one study reports that consumers perceive organic products have better taste (Davies, Titterington and Cochrane, 1995), it is possible that valuation without accounting for taste may be misleading. For products that are frequently purchased, label valuation may change significantly after consumption if WTP for local and organic is, at least in part, owed to experience rather than credence attributes. Two other studies examined the relationship between taste and labels (Nalley et al., 2006, for sweet potatoes, and Combris et al., 2009, for wine) and found that WTP for the food products changed when location of origin and taste information were made available. The fundamental difference of this study is that we explicitly model how differences in taste change WTP for the organic and/or local *label*, rather than the product itself.

In the following section we describe how the laboratory experiment was conducted. Section 3 presents the data, descriptive statistics, and a preliminary investigation of participants' beliefs via multivariate analysis. In Section 4, we first present a conceptual model incorporating consumers' beliefs and experimental treatments in the WTP for each label, and then use it to develop a consistent econometric framework under which survey and multi-stage auction data can be incorporated in the estimation of WTP. To be succinct, some details of this methodological contribution for econometric practitioners are relegated to the Appendix. Section 5 presents our econometric results and their implications for the investigated hypotheses, and Section 6 offers the conclusions of the study, highlighting some limitations and directions for future research.

2. Experimental Design

Participants were recruited through ads in newsletters distributed across Colorado State University students and staff, indicating that they would participate in a research study examining preferences for apples. The resulting sample was composed of a mix of students and non-students (mostly staff members). We conducted a 5th-price Vickrey auction (see chapter 5.4 in Lusk and Shogren, 2007, the standard reference for experimental methods in valuation studies), in which participants were endowed with conventional apples and bid for upgrades to organic non-local (ON), non-organic local (NL) and organic local (OL) apples. After a practice auction, homegrown values were elicited in Auction I. The effect of scientific and taste information were recorded in Auction II and Auction III, respectively. As in most studies of this kind, we did not reveal winners, 5th prices, and the binding auction until the final phase of the experiment. The experimental design consists of eight main parts, numbered from 1 to 8, described briefly below (with a full set of instructions in Appendix A).

***Part 1*: Demographics questionnaire**. Subjects were welcomed and seated, received an ID number and an envelope with show-up money ($22), then were asked to read and sign a consent form, and completed a sheet with demographic questions about age, income, etc. (Table 2).

***Part 2*: Elicitation of Food Values**. In Part 2, participants read six statements on perceptions of local and/or organic food, which they had to evaluate on a nine-point Likert Scale (see Appendix B. The statements and summary statistics are presented in Table 3).

***Part 3*: Practice auction**. As is standard in evaluations of goods through experimental auctions (Lusk and Shogren, 2007), we first conducted practice auctions with candy bars to familiarize the participants with the auction format. Mirroring the design of the actual apple auctions, participants were endowed with a candy bar and bid to "upgrade" to other candy bars in three consecutive rounds of a 5th-price auction. The binding round was then randomly determined, and auction winners paid for the upgraded candy.

***Part 4*: Blind Sensory Evaluation.** After the practice auctions in Part 3, members of the research team brought in four slices of Gala apples for each participant; all apples had been procured in a similar manner (through planned wholesale purchases from a retail outlet partner). Participants were asked to blind-taste these apples, to rate their appearance, flavor, texture, and overall acceptability using a 9-point hedonic scale and to rank them (see the Work Sheet in Appendix C). In addition, soluble solids content was measured with a digital refractometer and quantitatively assessed texture with a TA-XT2 Texture Analyzer immediately before each experimental session.[1]

***Part 5:* Auction I, Homegrown Values.** After participants finished the blind-tasting and filled out the Score Sheet, they were endowed with a one-pound bag of non-organic, non-local Gala apples and read definitions of the terms "organic" and "local" (see Part 5 of Appendix A). Then the first set of three simultaneous auctions for upgrades to bags with organic non-local, non-organic local and organic local apples was conducted. To avoid possible affiliation effects we did not write the winning bids and the IDs of winning bidders on the board in front of the room.

***Part 6:* Auction II, Scientific Information.** After the first auction, scientific environmental information about the carbon footprint of local and non-local apples (from Weber and Matthews, 2008) and pesticide use for organic and non-organic apples (from Winter and Davis, 2006) was distributed and read aloud, followed by the second set of auctions.

---

[1] A detailed analysis of the correlation between subjective and objective measures is conducted in a poster and companion working paper targeted at the food and nutrition field (Bunning et al., 2010).

It should be noted that the studies summarized found that carbon savings from local foods are quite small; and while organic fruits and vegetables have been found to be less contaminated with pesticides and chemicals, they were found to also be more likely to be contaminated by hazardous microbes or natural toxins (see Part 6 of Appendix A for more details on the distributed information).

Part 7: **Auction III Sensory Information**. Identities of the four apples from the blind-tasting in Part 4 were revealed and subjects had their score sheets returned as a reminder, followed by the third and final set of auctions for upgrades.

Part 8**: Binding Auction Determined and Payment.** After the binding auction was randomly determined, auction losers were allowed to leave with their endowments of money, candy bar and apples; winners of either auction paid their bids and exchanged their candy bars and bags of apples for the respective upgrades.

3. Data Overview, Descriptive Statistics and Preliminary Analysis

Table 2 indicates that the 109 participants in the sample, while younger than the Colorado population (average age of 27 vs. 34 for the state), were more highly educated (58% with at least an undergraduate degree vs. 36% for Colorado). The sample did have lower incomes than Colorado residents (52% of participants had an annual gross income of $35,000 or more compared to 74% statewide). 83% of participants indicated that they are the primary shopper in their respective households.

Table 3 summarizes how much participants agreed/disagreed with a series of statements designed to capture participants' perceptions of organic, local and the food system. Sample means suggest that, in general, consumers agree more strongly with the statements endorsing organic (statements 1 and 2) and local (statements 3 and 4) than those endorsing the government agencies responsible for monitoring food safety and pesticide levels in the agricultural and food system, including conventional products (statements 5 and 6). The large standard errors imply a considerable level of heterogeneity in participants' responses, suggesting a more detailed analysis of the variance structure is warranted.

Specifically, we are interested in knowing whether some common patterns in the Likert-scale questionnaire can be established for consumers endorsing local and/or organic products. We investigate the matter by decomposing the full matrix of answers into its principal components (presented in the last six columns in Table 3), and assess whether local and organic labels signal somewhat overlapping information about quality and/or outcomes.

The first principal component, accounting for 33% of variation about the mean response, could be labeled as a "distrust" variable: participants who endorse local and organic more than the average consumer tend to trust the governmental institutions regulating food safety and pesticides residues in the agricultural system less. The second principal component (21% of variation) suggests that those participants who do trust the government food institutions are more likely to carry the perception that local and organic may benefit the environment rather than reduce health risks. Thus, we label this component as "trust and environmentally concerned." The remaining principal components are essentially contrasts between pairs of statements, or directly load into a specific question; and they do not seem to provide much further insight.

Table 4 presents the general summary of the subjective sensory rankings from Part 4, the blind-tasting experiment. On average, all apples were considered acceptable (with a score of 6, "Slightly Acceptable," or higher), but the initially endowed conventional apples turned out to be the least popular. Based on average rank, the participants preferred the organic non-local (ON) the most, followed by the organic local (OL), and finally the non-organic local (NL). Interestingly, paired t-tests reveal that differences in subjective score and rankings are statistically significant, yet objective tests measuring texture and sugar content did not reveal many significant differences across the four apple choices.

Mean estimates from auction I (Table 5) provide a measure of the average valuation of the organic attribute in the whole sample ($0.68 per pound) and within the niche of consumers who have a positive valuation of the attribute ($0.93 per pound). The analogous estimates for the local attribute are $0.61 and $0.87 per pound; and for the joint organic-local combinations, the participants were willing to pay $1.18 and $1.30, respectively. Even though these estimates appear reasonable, we make no claim regarding their external validity, referring the reader interested in precise WTP estimates to the many studies based on larger samples (e.g., Onozaka and Thilmany, 2011). The primary interest here is testing the three aforementioned hypotheses, and we see no reason to expect that unique sample characteristics may interfere with the relevant tests.

Table 6 also displays descriptive statistics for the bids over the three rounds, and simulated market shares under two scenarios (see Lusk and Shogren, 2007, pp.112): Scenario I simulates the case of equal prices for all apples, labeled and conventional, under the assumption that all participants will make a purchase. Clearly, the majority of participants were willing to pay a premium for local and organic attributes: at parity of market price, 71% of the participants would prefer the OL apples, and only 8% would buy conventional. In Scenario II, we set the differences in market price between ON, NL, OL versus conventional apples to the estimated average WTP premia, generating a market in which conventional apples capture a share of 50%, and the rest of the market is split between ON (12 percent), NL (26 percent) and OL apples (12 percent).

Table 6 shows that the willingness to pay for OL apples is, on average, larger than the WTP for ON and NL apples, but smaller than the sum of the two, which indicates some degree of substitutability between local and organic attributes. Substitutability is limited when considering the whole population of consumers (only 9 percent of the label value), a result consistent with what was found by Onozaka and Thilmany (2011) in a conjoint study with a larger, representative sample. However, when only the relevant niche of consumers is considered (i.e., those with positive valuation), we find that a substantial share of the value (28%) is lost when organic and local labels are bundled. While this finding is quite robust and qualitatively unaltered across all auctions, the rationale for such substitutability between local and organic remains to be explained.

A casual inspection of the other result for Auction II and II in Table 5 suggests that valuations changed little after the provision of scientific information, while taste had a rather large effect (e.g., the share of organic increases from 12% to 24%). In the following section we turn our attention to a more formal analysis of these results.

4. Econometric Models and Empirical Specification

Here we briefly introduce the empirical and econometric model, illustrated with a schematization in Figure 1. The reader interested in a more formal presentation of how consumers' beliefs and experimental treatments affect WTP for each label, and the ensuing methodological/econometric implications is referred to Appendix D.

Our modeling objective is to determine how beliefs and food values may influence WTP in Auction I and how the experimental treatments in Auction II and III may affect the original homegrown valuation. We estimate two models: Heckman's sample selection model (Heckman, 1979), and a two-part model (Cragg, 1971). The sample selection model allows us to determine whether or not some participants had negative valuation for a label (especially after the scientific information and taste treatments) and hence correct for censoring. Both approaches allow modeling whether or not a consumer values a specific label (step one) separately from the process determining the magnitude of WTP (step two). In the two-part model, we estimate both the conditional mean (obtained via OLS) and the conditional median in the second step, which is less sensitive to extreme bids (obtained via quantile regression; see Koenker and Bassett, 1978).

Letting $\Phi(.)$ represent the normal cumulative distribution function and defining $\mathbf{x}_{1ij}$ as a vector of regressors capturing the beliefs associated by consumer *i* to label *j*, and $\mathbf{x}_{2ij}$ as the augmented vector $\mathbf{x}_{2ij} = \left[\mathbf{x}_{1ij} \mid Inc_i\right]$, the two-step, semi-parametric variant of Heckman's approach models the probability that consumer *i* participates in the auction via the Probit model

(1) $$P\left(\mathbf{I}_{ij}^{p} = 1\right) = \Phi\left(\gamma_{1j} + \mathbf{x}_{1ij}^{'}\boldsymbol{\beta}_{1j}\right);$$

where $\mathbf{I}_{ij}^{p}$ is a participation dummy variable indicating non-zero bids. Once an estimate $\Phi\left(\hat{\gamma}_{1j} + \mathbf{x}_{1ij}^{'}\hat{\boldsymbol{\beta}}_{1j}\right)$ is obtained, the second part of the model is estimated via OLS regression of the augmented model

(2) $$bid_{ijt} = \gamma_{2j} + \mathbf{x}_{2ij}^{'}\boldsymbol{\beta}_{2j} + \lambda_j \Lambda\left(\hat{\gamma}_1 + \mathbf{x}_{1ij}^{'}\hat{\boldsymbol{\beta}}_{1j}\right) + \nu_{ij},$$

where $\Lambda\left(\mathbf{x}_{1ij}^{'}\hat{\boldsymbol{\beta}}_{1j}\right)=\frac{\varphi\left(\mathbf{x}_{1ij}^{'}\hat{\boldsymbol{\beta}}_{1j}\right)}{\Phi\left(\mathbf{x}_{1ij}^{'}\hat{\boldsymbol{\beta}}_{1j}\right)}$ is the inverse Mills ratio, λ is a parameter capturing the covariance between ε_1 and ε_2, and ν_{ij} is an error term uncorrelated with ε_1.

Auction I

To estimate equations 1) and 2), we need to populate $\mathbf{x}_{1ij}$ and $\mathbf{x}_{2ij}$ with a set of proxies capturing participants' beliefs on organic and local produce. We do so by leveraging the information obtained in part 2 and the ensuing principal component analysis (Table 3). Letting $F_i^{q1},...,F_i^{q6}$ represent the level of agreement to statements 1,…,6; and F_i^{p1},F_i^{p2} be the first and second principal component score for the i[th] participant, we specify the first set of regressors $\mathbf{x}_{1i(j=ON)}=\left[F_i^{q1},F_i^{q2},F_i^{q5},F_i^{q6}\right]$; $\mathbf{x}_{1i(j=NL)}=\left[F_i^{q3},F_i^{q4},F_i^{q5},F_i^{q6}\right]$ and $\mathbf{x}_{1i(j=OL)}=\left[F_i^{q1},F_i^{q2},F_i^{q3},F_i^{q4},F_i^{q5},F_i^{q6}\right]$; and $\mathbf{x}_{2ij}=\left[F_i^{p1},F_i^{p2},inc_i\right]$ for $j=ON,NL,OL$. In addition to attenuating possible collinearity issues (see Leung and Yu, 2000), the use of principal components scores accounts for the fact that variation in beliefs/values and their effect on valuation may not occur independently (as in Lusk, 2011), but rather in "bundles of beliefs" typical of specific personality traits. All regressors are standardized (by variable) to allow an immediate interpretation of the intercept.

Auction II and III: treatment effects.

Consider now the experimental treatments in auction II and III on participants' WTP for local and organic. The change in WTP from Auction I to Auction II can be represented by the first-difference $\Delta WTP_{ij}^{(II-I)}=WTP_{ij}^{II}-WTP_{ij}^{I}$. This change in WTP is a stochastic function of ϑ, the effect of the first information treatment, and an error term v_{ij}: $\Delta WTP_{ij}^{(II-I)}=\vartheta_j+v_{ij}$. The observed counterpart of this construct, the random variable $\Delta bid_{ij}^{(II-I)} = bid_{ij}^{II} - bid_{ij}^{I}$, is censored at $-bid_{ij}^{I}$. As all participants received the same information treatment, for Auction II we have

$$\begin{aligned}\Delta bid_{ij}^{(II-I)} &= \mathbf{I}_{ij\left\{\Delta WTP_{ij} > -bid_{ij}^{I}\right\}}^{p} \Delta WTP_{ij}^{(II-I)} \\ &= \mathbf{I}_{ij\left\{\Delta WTP_{ij} > -bid_{ij}^{I}\right\}}^{p} \left(\vartheta_j + v_{ij}\right)\end{aligned} ; \tag{3}$$

where $\mathbf{I}_{ij\{\ \}}^{p} = 1$ when the condition in brackets holds, and $\mathbf{I}_{ij\{\ \}}^{p} = 0$ otherwise. For Auction II, the participation equation analogous to equation (1) is estimated by specifying $\mathbf{x}_{1ij} = \left[bid_{ij}^{I}\right]$. That is, a label-specific intercept captures the treatment effect, while the regressor controls for the fact that censoring is less likely when participants had a high a-priori valuation in Auction I. The induced change in WTP is estimated by replacing $\Delta bid_{ij}^{(II-I)}$ as the dependent variable in (2), and estimating three label-specific intercepts γ_{2j} ($j = ON, NL, OL$) with no other regressors than the Mills' ratio (for the Heckman model only). Again, regressors are standardized by the variable to allow an interpretation of the intercepts.

The model for Auction III is quite similar, except that the information treatment is a subjective, participant-specific visual and tasting experience. This yields a much richer parameterization, with

$$\begin{aligned}\Delta bid_{ij}^{(III-II)} &= \mathbf{I}_{ij\left\{\Delta WTP_{ij}^{(III-II)} > -bid_{ij}^{II}\right\}}^{p} \Delta WTP_{ij}^{(III-II)} \\ &= \mathbf{I}_{ij\left\{\Delta WTP_{ij}^{(III-II)} > -bid_{ij}^{II}\right\}}^{p} \left(\mathbf{x}_{ij}{}'\boldsymbol{\tau}_j + v_{ij}\right)\end{aligned} \tag{4}$$

where $\mathbf{x}_{ij}$ is a vector of subjective acceptability scores from the sensory experience, and $\boldsymbol{\tau}_j$ a set of parameters to be estimated. The central idea driving the specification of this model is that any change in WTP should be based on a perceived sensory difference between the endowed and the auctioned apples. In the organic non-local case, with Δsc_i^{j-NN} as the difference in overall score between apple *j* and the endowed apple *NN*, the covariates in modeling the censoring equation (analogous to equation 1) are $\mathbf{x}_{1i(j=ON)} = \left[bid_{ON}^{II}, \Delta sc_i^{ON-NN} \right]$. In the second stage (equation 2) the dependent variable is $\Delta bid_{ij}^{(III-II)}$ and the explanatory variables are

$$\mathbf{x}_{2i(j=ON)} = \begin{bmatrix} LikeON = I_{\left\{\Delta sc_i^{ON-NN} > 0\right\}} \left(\Delta sc_i^{ON-NN} \right), DislikeON = I_{\left\{\Delta s_i^{ON-NN} < 0\right\}} \left(\Delta sc_i^{ON-NN} \right) * (-1), \\ \Delta sc_i^{NL-NN}, \Delta sc_i^{OL-NN} \end{bmatrix}.$$

The interaction of the own-taste variable with the positive/negative dummy variable in the latter equation allows testing for an asymmetric reward/punishment for good/bad organoleptic characteristics of the auctioned apple;[2] and the inclusion of own and cross taste variables allows testing for substitution across labels in response to taste and visual information. The covariates $\mathbf{x}_{1i(j=NL)}$, $\mathbf{x}_{2i(j=NL)}$ and $\mathbf{x}_{1i(j=OL)}$, $\mathbf{x}_{2i(j=OL)}$ in the models of the non-organic local and organic local apples are defined analogously.

5. Results

Tables 6-12 display results from the estimation of the two-part and Heckman models for all three auctions (the first step, the Probit estimation, is common for the two models). For the second stage of the two-part model we provide two sets of estimates: one relative to the conditional mean (obtained via OLS) and one relative to the conditional median.

Out of nine models estimated with Heckman's corrections, the Mills' ratio is significant in only one. Overall, there seems to be little evidence of negative label valuation, even after the

---

[2] If participants discount bad tasting apples, multiplying $I_{\left\{\Delta s_i^{ON-NN} < 0\right\}} \left(\Delta sc_i^{ON-NN} \right)$ by (-1) makes the associated coefficients negative, and the tables of estimates more intuitive.

experimental treatments. Rather, it seems likely that zero bids are true expression of a participant's WTP, and not a result of censoring. A starker contrast is provided by the comparison between OLS and quantile regression estimates, suggesting that high-valuation bidders (i.e., outliers) have a sizable influence on conditional mean estimates.

Auction 1

Table 6 reports the estimates for the Probit model of auction I. First, we note the rather sparse statistical significance: only the regression for the OL apples is jointly significant, and suggests that consumers with positive valuation share a stronger belief that both organic and local signal better environmental outcomes. Results are somewhat more robust in the second step of the model (Table 7), where the principal component scores, our proxies for general patterns of beliefs, are used as regressors.[3]

With standardized independent variables, the intercepts can be interpreted as the expected WTP conditional on having an average vector of beliefs and income, and are qualitatively consistent to their unconditional counterparts presented in Table 5. Again, the premium for OL is higher than the premium for either ON or NL, but smaller than the sum of the two, which reiterates the idea that organic and local labels are partial substitutes: the differentiating traits conveyed by the organic and local labels overlap for approximately 25-30% of their value.

A surprising result, at least at first, is that when we control for food values we find an insignificant effect of income on valuation. This is in contrast with previous findings in the organic literature, where income is found to be positively correlated with WTP for organic (Onozaka and Thilmany, 2011; Dettmann and Dimitri, 2009; Zhang et al., 2008). An increase in the "distrust" principal component increases average and median WTP for ON, NL, and OL

[3] In a regression including all six principal component scores, the sixth principal component significantly decreased the valuation of local apples, while all other coefficients were non-significant.

apples, while the "trust and environmentally conscious" principal component score is consistently positive only for the OL apples, but non-significant for all three labels.

Auction II

The negative and significant intercept in the Probit estimates for ON apples (Table 8) indicates an increase in the probability of censoring following the scientific information (note from Table 5 that the number of zero bids increases from 29 in auction I to 38 in auction II), while the treatment has no significant effect for the other auctions. The original valuation (lagged bid from auction I) is, unsurprisingly, a very strong predictor of whether or not $\Delta WTP_{ij}^{(II-I)}$ is observed. The effect of the scientific information is reversed in the WTP regression (Table 9): while the median change in WTP is zero, we detect a significant increase in the average bid of about 10 cents, consistent across the three labels. This increase cannot be the result of bid affiliation since winning bids were not posted until the end of the third auction. A more convincing hypothesis is that, in response to the scientific information, participants who originally had a low (close to zero) valuation of the labels reduced their bid to zero, while some high valuation participants responded to the scientific information by increasing their bid.[4]

Auction III

Tables 10-12 present the estimates for the auction III models. Overall, bidders responded to their sensory preferences quite strongly. For the selection equation (Table 10) the null hypothesis that all coefficients are zero is rejected in all estimated equations. In addition to the positive effect of the previous valuation (auction II), we find that participants who preferred the auctioned apples over the endowed ones were significantly more likely to participate in the auction. A more interesting set of results arises from the WTP regressions (Tables 11 and 12). First, all tests of

[4] Quantile regressions runs at 15th and 80th quantiles support this hypothesis.

model significance reject the null (Table 11), and only two (for the organic-local) of the nine constant terms estimated are statistically different from zero. In these regressions, we specify a functional form allowing for a non-symmetrical effect related to liking or disliking the auctioned apples. As one would expect, participants who found the auctioned apples to be better tasting than the endowed one, increased their previous (Auction II) bids. Based on the OLS estimates, the estimated "good taste" premium is about 12 cents for ON, 15 cents for NL and 48 cents for OL per point of (positive) difference in tasting score. In contrast with the previous substitutability finding, the combination of good sensory performance and multiple labels induces a more-than-proportional increase in valuation. Conditional median estimates are also positive and significant, but smaller in magnitude, indicating that some participants must have reacted to their perceptions of taste quite strongly.

Interestingly, when the endowed apples tasted better than the auctioned ones, participants did not punish the labeled apples in a symmetric way (if at all). While mostly negative in sign, all estimates capturing the "bad taste" effect are smaller than their "good taste" counterparts, and they are not significant. Standard errors are also larger, indicating increased heterogeneity in the response. What about substitution across labeled apples? The estimates in Table 12 indicate that migration of bids from one label to another in response to taste differential does occur: all cross-taste effects, when significant, have the expected negative sign. In substance, for consumers with positive valuation, good taste enhances the value of the differentiating label, whether it is local or organic, and dominates over the specific preference for local or organic. This is consistent with two themes of this research: (1) that private benefits (good taste) dominate public concerns, and, (2) there is partial substitutability between local and organic. Taste, however, does not trump the label when the information favors the conventional apples.

6. Discussion and Conclusions

We conduct a three-step auction of local, organic and organic-local apples to investigate 1) whether local and organic are substitutes or complements; 2) whether WTP for local and organic may be linked to misconceptions regarding the outcomes the labels signal; and 3) whether experience attributes (taste information) dominate the ex-ante valuation of the credence labels.

Regarding the first hypothesis, even though the labels certify dissimilar product attributes, our study shows that local and organic are perceived as partial substitutes. We consistently find that point estimates for the valuation of local and organic labels are sub-additive when both attributes are present. Moreover, the principal-component analysis reveals that consumers strongly associating local and organic labels to desirable environmental and food safety outcomes also tend to share a sense of distrust for the government agencies responsible for monitoring food safety and pesticide levels in the broader food system. This particular combination of beliefs is also the most important predictor of WTP for both labels when no sensory/experience information is available. Yet, believing that organic and local induce better environmental outcomes, absent the distrust in the food institutions, did not significantly influence willingness to pay. It is therefore possible that a stigma against the conventional food supply chain induces a WTP premium for any label providing an alternative to conventional produce, be it real or perceived. Indeed, this "alternative" connotation may be the shared attribute accountable for the substitutability of local and organic products.

Turning to the second hypothesis, we find that the provision of scientific information on demonstrated benefits and tradeoffs of local and organic production induced minimal and contrasting changes in valuation. In other words, there is no convincing evidence that an unknown or misconceived link between labeled processes and hypothesized outcomes is at the source of consumers' WTP for local and organic. This may be attributable to the ambiguity (for organic) and incompleteness (especially for local) of the statements, which intentionally highlighted pros and cons but lacked clear-cut support for either conventional or alternative production methods.

Apparently, participants interpret the statements in a subjective way: high-valuation participants pay more attention to the pros, while low-valuation ones focus on the cons. This behavior is consistent with Chaiken and Durairaj (1994), who found that ambiguous messages may induce biased processing of information, drawing from the psychology theory of cognitive dissonance (see Heiman and Lowengart, 2011). The short statements summarizing and referencing the available scientific evidence may be a poor vehicle to communicate with the general public, and may simply reinforce pre-existing beliefs rather than informing.

Unlike the scientific information treatment, differences in taste induce rather large, but asymmetrical changes in WTP for upgrades from conventional to organic, local, and organic-local. Conditional on having a positive WTP for the differentiating labels, taste comparisons with the conventional apples augment WTP when the taste of local and organic apples are revealed as favorable, while unfavorable comparisons are more or less disregarded. In contrast, substitution in response to taste differentials across the three available choices of labeled apples does occur. The implication here is that participants internalized the taste tradeoffs between local, organic and organic-local, but some segment of consumers might not consider conventional Gala apples to be as close of substitutes, or an acceptable option, for the labeled counterparts.

The common thread between the results of this study is that a subpopulation of consumers displays polarized preferences (borrowing a term from Hurley et al., 2011) in favor of local and organic or against conventional apples. Polarization *per se* is not problematic. However, the observed behavior does raise the question of why some people will not compare apples to apples. We propose two explanations, the first is consistent with polarized preferences *for* local and organic produce, and the second implies polarized preferences *against* conventional.

One possibility is that some consumers may use the sustainable labels as simplifying "rules of thumb" to guide their choices among the myriad of market-based signals and alternatives. In a recent study, Heiman and Lowengart (2011) found that, in everyday shopping, most consumers economize on the cognitive effort by using simple rules based on taste and value for the money. This idea is consistent with the previous discussion on the hierarchy of food values, but adds the notion that we cannot expect consumers to rigorously compare food attributes each and every time they add a product in their shopping cart. For some consumers, labels such as organic or local may provide a rule of thumb alternative to taste and value considerations. The current practice of labeling production processes (e.g., organic), rather than their outcomes (e.g., pesticides residues), concurrently with the use of binary labels (organic vs. not organic; local vs. all other sources), is particularly well suited for a simple (if Manichaeistic) classification of the available alternatives into "good choices" and "bad choices."

The unconvincing part of this "quick-choice" explanation is that, in our experimental environment, participants were specifically focused on the task of comparing apple alternatives, with plenty of time to evaluate tradeoffs and virtually no distractions. Unless rules of thumb become entrenched, dogmatic habits over time, it is reasonable for us to expect articulated choice processes based on attribute comparisons in experiments. Again, the role of trust in the food system seems to play a pivotal role. If, as our analysis of consumers' motivations suggests, some consumers perceive conventional food as unsafe to eat, then it makes sense to disregard poor taste; after all, safety tops the list of all food values presented in Lusk and Briggeman. Under this scenario, disillusioned consumers are polarized against conventional products and willing to pay a premium for non-conventional alternatives, when organoleptic quality differences would suggest otherwise.

From a policy standpoint, the distinction between *polarization for* (local and organic) and *polarization against* (conventional) is less trivial than it may seem. In the first case, policy makers interested in increasing consumer surplus would have to compare the benefits accruing to the niche of consumers valuing the labels with the cost of making them available. In the case of polarization against conventional foods, an additional strategy becomes available: one could improve monitoring and information flow in the broader food system, and benefit most (if not all) consumers. A more transparent conventional food supply chain would decrease the need for alternatives. The costs of collecting and delivering this information in an effective way may be very well be large or even prohibitive; but shifting the focus of labeling policy (and therefore producers' differentiation strategies) from processes to outcomes has the potential for equally large benefits.

References

Bernard, J. C. and Bernard, D. J. (2009). What is it about organic milk? An experimental analysis. *American Journal of Agricultural Economics* 91/3: 826-836.

Bunning, M., G. Wall, A. Fouladkhah, S. Blandon, and D. Thilmany-McFadden. "Effects of growing location and agricultural methods on sensory and quality attributes of Gala apples." Poster presented at the International Food Technologist Annual meetings. July 2010. Chicago, IL.

Caswell, J.A. and Mojduszka, E.M. (1996). Using informational labeling to influence the market for quality in food products. *American Journal of Agricultural Economics* 78: 1248-1253.

Chaiken, S. and D. Maheswaran (1994). Heuristic processing can bias systematic processing: effects of source credibility, argument ambiguity, and task importance on attitude judgment. *Journal of Personality and Social Psychology* 66: 460-473

Combris, P., Bazoche, P., Giraud-Héraud, E. and Issanchou, S. (2009). Food choices: What do we learn from combining sensory and economic experiments? *Food Quality and Preference* 20/8: 550-557.

Costanigro, M., Kroll, S., Thilmany McFadden, D. and Nurse, G. (2011). An in-store valuation of local and organic apples and the role of social desirability. *Agribusiness: An International Journal* 27/4: 465-477.

Cragg, J. G. (1971). Some statistical models for limited dependent variables with application to the demand for durable goods. *Econometrica* 39/5: 829-844.

Davies, A., Titterington, A.J. and Cochrane, C. (1995). Who buys organic food? A profile of the purchasers of organic food in Northern Ireland. *British Food Journal* 97/10: 17-23.

Dettmann, R. and Dimitri C. (2009). Who's buying organic vegetables? Demographic characteristics of U.S. consumers. *Journal of Food Products Marketing* 16/1: 79-91.

Hand, M. and Martinez, S. (2010). Just what does local mean? *Choices* 25/1: article 108.

Heckman, J. J. (1979). Sample selection bias as a specification error. *Econometrica* 47/1: 153-161.

Heiman A. and Lowengart, O. (2011). The effects of information about health hazards in food and consumers' choice process. *Journal of Econometrics*. 162/1:140-147

Hurley, T.M., Yue, C. and Anderson, N.O. (2011). Polarized preferences in homegrown value auctions. 2011 Annual Meeting, July 24-26, 2011, Pittsburgh, Pennsylvania, Agricultural and Applied Economics Association.

Koenker, R. and Bassett, G. (1978). Regression quantiles. *Econometrica* 46/1: 33-50.

Leung, S. F. and Yu, S. (2000). Collinearity and two-step estimation of sample selection models: Problems, origins, and remedies. *Computational Economics* 15/1: 173-199.

Lusk, J. L. (2011). External validity of the food values scale. *Food Quality and Preference* 22/5: 452-462.

Lusk, J. L. and Briggeman, B. C. (2009). Food values. *American Journal of Agricultural Economics* 91/1: 184-196.

Lusk, J. L. and Shogren, J. F. (2007). *Experimental Auctions. Methods and Applications in Economic and Marketing Research.* Cambridge, MA: Cambridge University Press.

Melton, B.E., Huffman, W.E., Shogren, J.F. and Fox, J.A. 1996. Consumer preferences for fresh food items with multiple quality attributes: Evidence from an experimental auction of pork chops. *American Journal of Agricultural Economics* 78/4: 916-923.

Nalley, L.L., Hudson, D. and Parkhurst, G. (2006). Consistency of consumer valuation under different information sets: An experimental auction with sweet potatoes. *Journal of Food Distribution Research* 37: 56-67.

Onozaka, Y. and Thilmany McFadden, D. (2011). Does local labeling complement or compete with other sustainable labels? A conjoint analysis of direct and joint values for fresh produce claims. *American Journal of Agricultural Economics* 93/3: 693-706.

Pearson, D., Henryks, J., Trott, A., Jones, P., Parker, G., Dumaresq, D. and Dyball, R. (2011). Local food: Understanding consumer motivations in innovative retail formats. *British Food Journal* 113/7: 886-899.

Rousu, M., Huffman, W.E., Shogren, J.F. and Tegene, A. (2007). Effects and value of verifiable information in a controversial market: Evidence from lab auctions of genetically modified food. *Economic Inquiry* 45/3: 409-432.

Weber, C.L. and Matthews, H.S. (2008). Food-miles and the relative climate impacts of food choices in the United States. *Environmental Science & Technology* 42: 3508-3513.

Winter, C.K. and Davis, S.F. (2006). Scientific status summary—Organic foods. *Journal of Food Science* 71/9: R117-R124.

Zeithaml, V.A. (1988). Consumer perceptions of price, quality, and value: A means-end model and synthesis of evidence. *Journal of Marketing* 52/3: 2-22.

Zhang, F., Huang, C.L., Lin B.H. and Epperson, J.E. (2008). Modeling fresh organic produce consumption with scanner data: A generalized double hurdle model approach. *Agribusiness: An International Journal* 24: 510-522.

Table 1: Sequence of Events in the Economic Experiment

Experimental step	Task	Instrument
Part 1	Participants Demographics	Questionnaire
Part 2	Elicitation of Food Values	Likert Scale (1-9)
Part 3	Practice Auction	5th price Auction
Part 4	Sensory Evaluation	Sensory Score Sheets
Part 5	Auction I: Homegrown Values	5th Price Auction
Part 6	Auction II: Scientific Information	5th Price Auction
Part 7	Auction III: Sensory Information	5th Price Auction
Part 8	Binding Auction Determined	Random Drawing

Table 2: Summary Statistics for Demographic Variables

Number or participants	109
Median age (years)	27
Male	23%
Female	77%
Education (highest level)	
High School diploma	8%
Some college	34%
Bachelor’s degree	19%
Some graduate school	21%
Advanced or graduate degree	18%
Household income (in 2009)	
Less than $20,000	39%
$20,000-$34,999	16%
$35,000-$49,999	11%
$50,000-$74,999	15%
$75,000-$100,000	15%
$100,000-$150,000	3%
Greater than $150,000	2%
Race/ethnicity	
White, non-Hispanic	81%
Black	4%
Hispanic	2%
Other	13%
Lived in Colorado	
for less than 1 year	9%
for 1-5 years	19%
for 5-10 years	10%
for 10-25 years	34%
for more than 25 years	12%
their entire lives	15%
Primary shopper in household	
Yes	84%
No	16%

Table 3: Food System Perception Questions (1 = Strongly Disagree; 9 = Strongly Agree) and Principal Component Analysis[a,b]

Statement	Definition	Mean	Principal Components 1	2	3	4	5	6
1	The environmental impact of fruit and vegetables is greater for conventional than for organic produce.	5.95 (2.20)[a]	**0.41**	0.36	-0.35	0.01	**0.74**	0.16
2	Eating organic fruits and vegetables represents a lesser health risk than eating conventional fruits and vegetables.	6.27 (2.23)	**0.47**	0.19	0.12	**0.7**	-0.37	0.31
3	Locally-grown produce represents a lower risk to climate change because the carbon footprint from transportation of the produce is lower.	6.87 (2.03)	0.38	**0.42**	-0.26	**-0.58**	**-0.52**	-0.04
4	There are more credible assurances about produce safety direct from local farmers than for other stakeholders in the food system (US govt. agencies, food distributors, retailers).	5.28 (2.03)	**0.41**	0.06	**0.81**	-0.2	0.2	-0.29
5	I trust the government agencies responsible for food safety in the United States.	5.21 (2.07)	-0.33	**0.65**	-0.02	0.31	-0.01	**-0.61**
6	Pesticide residues on fruits and vegetables are at a safe level if they meet US government standards.	4.39 (2.04)	**-0.43**	**0.48**	0.37	-0.17	0.03	0.65
% var			0.33	0.21	0.14	0.12	0.12	0.08
Eigenval			2	1.25	0.84	0.72	0.7	0.5

[a] Numbers in parentheses are standard deviations

[b] Coefficients with absolute values greater than 0.4 are in bold

Table 4: Blind-taste Rankings of Gala Apples

Variety (Brand, State of Origin)	**Average overall acceptability** (9 = Highly Acceptable, 1 = Highly Unacceptable)	**Average rank** (1 = best, 4 = worst)
Non-local, organic (Rainier, Washington)	7.64	2.08
Local, organic (Ela, Colorado)	7.35	2.36
Local, non-organic (TomTom, Colorado)	7.19	2.57
Non-local, non-organic (Sage, Washington)	6.74	2.98

Table 5: Descriptive Statistics[a]: Aggregate Bids for Upgrades from Non-organic, Non-local.

	Sample Average	Number of "0s" (out of 109)	Average of bids larger than 0	Market Shares Scenario I	Market Shares Scenario II
Auction I: Labels only					
Org[b]	.68 (0.11)	29	.93 (0.14)	8%	12%
Local	.61 (0.08)	32	.87 (0.10)	12%	26%
Org/Local	1.18 (0.16)	10	1.30 (0.17)	71%	12%
Conventional	-		-	8%	50%
Decrease[c]	9%		28%		
Auction II: Sci. Info.					
Org	.69 (0.12)	38	1.06 (0.16)	8%	12%
Local	.73 (0.11	25	.94 (0.13)	17%	26%
Org/Local	1.34 (0.24)	12	1.51 (0.26)	67%	16%
Conventional	-		-	8%	46%
Decrease	6%		41%		
Auction III: Taste					
Org	.89 (0.14)	31	1.25 (0.18)	24%	24%
Local	.74 (0.13)	39	1.15 (0.19)	15%	17%
Org/Local	1.24 (0.25)	28	1.66 (0.32)	49%	16%
Conventional	-		-	12%	44%
Decrease	24%		31%		

[a] N=109.
[b] Org = Organic and non-local, Local = Non-organic and local; Org/Local = Organic and local. Standard errors in parentheses.
[c] Decrease = decrease from sum of average bids for Org and Local to average bid for Org/Local.

Table 6: Auction I Probit Model[a]

Variable		Organic	Mar. Eff.	Local	Mar. Eff.	Organic and Local	Mar. Eff.
Fq1	Organic 1	0.043	0.014			**0.372**	0.042
		(0.132)	(0.043)			(0.198)	(0.022)
		0.745				0.060	
Fq2	Organic 2	0.198	0.064			0.073	0.008
		(0.135)	(0.044)			(0.194)	(0.022)
		0.142				0.708	0.705
Fq3	Local 1			0.161	0.055	**0.372**	0.042
				(0.129)	(0.044)	(0.184)	(0.021)
				0.211		0.043	
Fq4	Local 2			-0.052	-0.018	-0.219	-0.025
				(0.132)	(0.045)	(0.192)	(0.023)
				0.694		0.255	
Fq5	Trust 1	**0.241**	0.078	-0.002	-0.001	-0.242	-0.027
		(0.146)	(0.047)	(0.144)	(0.049)	(0.234)	(0.026)
		0.100		0.991		0.301	
Fq6	Trust 2	-0.055	-0.018	-0.046	-0.016	0.073	0.008
		(0.153)	(0.049)	(0.144)	(0.049)	(0.217)	(0.025)
		0.721		0.749		0.735	
	_cons	**0.652**		**0.551**		**1.589**	
		(0.133)		(0.128)		(0.233)	
		0.000		0.000		0.000	
	chi2	5.694		1.793		**12.135**	
	p	0.223		0.774		0.059	

a: coefficients, marginal effects, standard errors (in parentheses), p-values

Table 7: Auction I WTP Model[a]

Labels		Organic			Local			Organic Local		
		Heck	OLS	Qreg p=0.5	Heck	OLS	Qreg p=0.5	Heck	OLS	Qreg p=0.5
Inc	Income	-0.057	-0.059	-0.107	-0.038	-0.031	-0.092	-0.031	-0.032	-0.059
		(.086)	(.09)	(.077)	(.177)	(.079)	(.059)	(.097)	(.1)	(.147)
		0.508	0.515	0.169	0.829	0.698	0.121	0.748	0.751	0.690
Fp1	Distrust	**0.164**	**0.176**	**0.240**	0.038	**0.134**	**0.150**	**0.293**	**0.278**	0.214
		(.086)	(.082)	(.071)	(.229)	(.072)	(.051)	(.116)	(.094)	(.138)
		0.057	0.036	0.001	0.869	0.069	0.004	0.012	0.004	0.124
Fp2	Trust and	-0.011	0.012	-0.075	-0.010	0.028	0.060	0.099	0.089	0.101
	Environment	(.107)	(.09)	(.077)	(.206)	(.072)	(.053)	(.106)	(.097)	(.145)
		0.916	0.897	0.332	0.962	0.698	0.262	0.352	0.362	0.488
	_cons	**0.862**	**0.749**	**0.563**	1.752	**0.756**	**0.654**	**1.083**	**1.110**	**0.899**
		(.317)	(.082)	(.072)	(1.25)	(.074)	(.055)	(.161)	(.097)	(.142)
		0.007	0.000	0.000	0.161	0.000	0.000	0.000	0.000	0.000
	Mills	-0.242			-1.953			0.161		
		(.658)			(2.395)			(.771)		
		0.713			0.415			0.834		
	rho	-0.355			-1.000			0.185		
	chi2,F	3.93	1.55	**4.39**	0.08	1.28	**4.14**	**6.41**	**3.16**	0.97
	p	0.27	0.21	0.01	0.99	0.29	0.01	0.09	0.03	0.41

a: coefficients, standard errors (in parentheses) and p-values

Table 8: Auction II Probit Model[a]

	Organic		Local		Organic and Local	
		Mar. Eff.		Mar. Eff.		Mar. Eff.
Bid^I	**1.671**	0.480	**3.056**	0.257	**2.457**	0.012
	(0.353)	(0.077)	(0.670)	(0.111)	(0.696)	(0.021)
	0.000		0.000		0.000	
_cons	**-0.331**		-0.108		0.070	
	(0.185)		(0.195)		(0.277)	
	0.074		0.579		0.801	
chi2	34.121		42.318		29.575	
p	0.000		0.000		0.000	

a: coefficients, marginal effects, standard errors (in parentheses) and p-values

Table 9: Auction II WTP Measures

Variable	Organic Heck	OLS	Qreg p=0.5	Local Heck	OLS	Qreg p=0.5	Organic Local Heck	OLS	Qreg p=0.5
_cons	**0.124**	**0.097**	0.000	0.041	**0.101**	0.000	**0.079**	**0.100**	0.000
	(.065)	(.039)		(.039)	(.029)		(.041)	(.035)	
	0.058	0.001		0.290	0.000		0.055	0.000	
Mills	-0.064			**0.239**			0.159		
	(.122)			(.089)			(.163)		
	0.602			0.007			0.328		
Rho	-0.19			0.86			0.47		
chi2	0.14			315.28			833.25		
P	0.71			0.00			0.00		

Table 10: Auction Round III Probit Model[a]

	Organic		Local		Organic and Local	
	Coeff	Mar. Eff.	Coeff	Mar. Eff.	Coeff	Mar. Eff.
Bid^{II}	**0.512**	0.163	**0.633**	0.231	**0.330**	0.082
	(0.185)	(0.056)	(0.190)	(0.068)	(0.170)	(0.039)
	0.006		0.001		0.052	
Δsc_i^{ON-NN}	**0.146**	0.046				
	(0.068)	(0.022)				
	0.032					
Δsc_i^{NL-NN}			**0.137**	0.050		
			(0.058)	(0.021)		
			0.017			
Δsc_i^{OL-NN}					**0.399**	0.100
					(0.085)	(0.022)
					0.000	
_cons	0.175		-0.097		0.258	
	(0.166)		(0.173)		(0.228)	
	0.291		0.574		0.259	
chi2	15.208	15.208	18.496	18.496	38.378	38.378
P	0.000	0.000	0.000	0.000	0.000	0.000

a: coefficients, marginal effects, standard errors (in parentheses) and p-values

Table 11: Auction III WTP measures. First Set of Results: Own-Taste Response and Model Significance[a]

	Organic			Local			Organic Local		
Variable	Heck	OLS	Qreg	Heck	OLS	Qreg	Heck	OLS	Qreg
LikeON	**0.140**	**0.125**	**0.106**						
	(.054)	(.051)	(.038)						
	0.009	0.018	0.006						
DislikeON **(*)**	-0.105	-0.078	-0.036						
	(.105)	(.106)	(.086)						
	0.320	0.465	0.678						
LikeNL				**0.189**	**0.159**	**0.048**			
				(.079)	(.075)	(.016)			
				0.016	0.039	0.004			
DislikeNL **(*)**				-0.119	-0.101	-0.025			
				(.083)	(.085)	(.018)			
				0.154	0.239	0.167			
LikeOL							**0.638**	**0.484**	**0.019**
							(.221)	(.114)	(.008)
							0.004	0.000	0.015
DislikeOL **(*)**							-0.404	0.036	-0.008
							(.492)	(.263)	(.016)
							0.411	0.891	0.623
_cons	0.153	**0.316**	**0.157**	-0.223	0.125	0.025	-1.091	-0.375	-0.012
	(.228)	(.096)	(.074)	(.345)	(.14)	(.031)	(.7)	(.19)	(.013)
	0.501	0.002	0.038	0.518	0.375	0.418	0.119	0.052	0.367
chi2,F	**16.78**	**3.73**	**3.30**	**12.78**	**2.91**	**3.56**	**10.42**	**6.28**	**2.80**
P	0.00	0.01	0.02	0.01	0.03	0.01	0.03	0.00	0.03

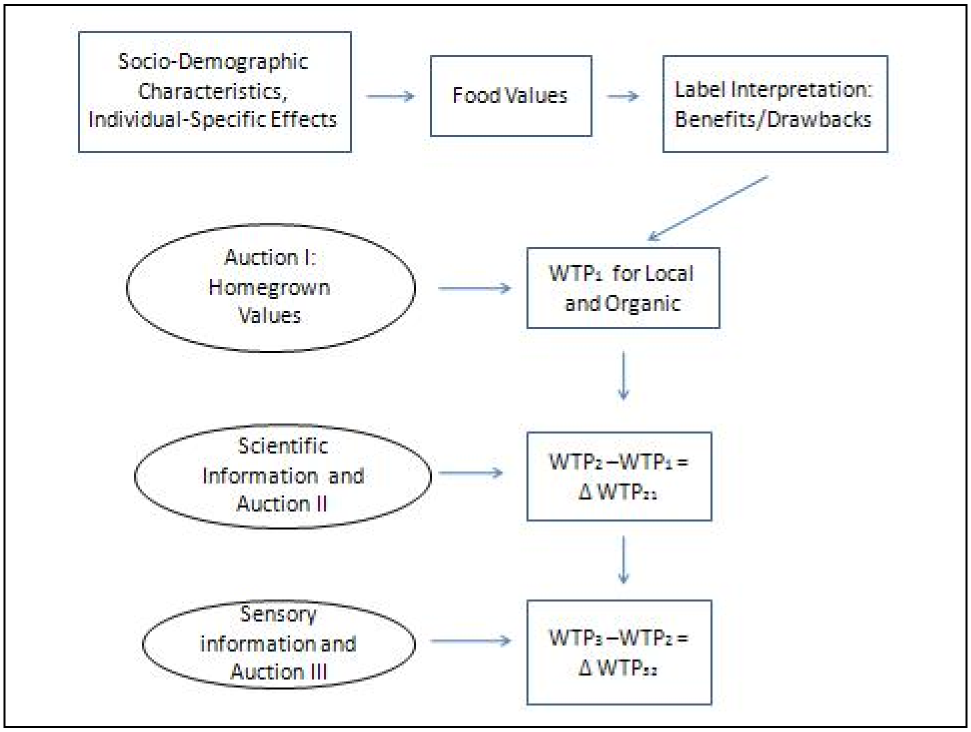
a: coefficients, standard errors (in parentheses) and p-values

(*): multiplied by (-1)

Table 12: Auction III WTP measures. Second Set of Results: Cross-Taste Response

	Organic			Local			Organic Local		
Variable	Heck	OLS	Qreg	Heck	OLS	Qreg	Heck	OLS	Qreg
Δsc_i^{ON-NN}				**-0.139**	**-0.139**	**-0.030**	**-0.315**	**-0.311**	0.001
				(.055)	(.058)	(.0120)	(.137)	(.090)	(.005)
				0.012	0.020	0.020	0.021	0.001	0.826
Δsc_i^{NL-NN}	**-0.074**	**-0.074**	-0.043				0.087	0.079	-0.007
	(.040)	(.042)	(.033)				(.127)	(.084)	(.005)
	0.063	0.080	0.197				0.493	0.351	0.193
Δsc_i^{OL-NN}	**-0.082**	**-0.085**	**-0.067**	0.049	0.030	-0.013			
	(.038)	(.040)	(.029)	(.057)	(.059)	(.0120)			
	0.031	0.038	0.024	0.393	0.615	0.260			
Mills	0.325			0.563			1.867		
	(.411)			(.507)			(1.567)		
	0.429			0.266			0.234		
Rho	0.570			0.738			1.000		

Figure 1. A schematization of the conceptual model.



Appendix A: Full Set of Instructions

Note that the different parts of the instructions were handed out sequentially, not as one set.

Instructions

Thank you for agreeing to participate in today's session. As you entered the room, you should have been given $22. A packet with an ID number in the upper right hand corner is lying on your table. During the experiment we will ask you to take sheets out of the folder and put sheets you don't turn in to our team and instructions you don't need any more back in the folder.

Before we begin, I want to emphasize that your participation in this session is completely voluntary. If you do not wish to participate in the experiment, please say so at any time. Non-participants will not be penalized in any way. I want to assure you that the information you provide will be kept strictly confidential and used only for the purposes of this research.

This experiment consists of seven parts, and we are ultimately interested in your preferences for several different types of apples. But before we get to the apples, we want to collect some other information on you and your behavior.

Part 1:

In this Part 1, you can win money in addition to the original $22. After reading the instructions for this part, we will ask you to take out Sheet 1 (printed on **blue** paper). On Sheet 1, you will see a table, with ten decision scenarios. Each decision is a choice between two lotteries shown as Option A and Option B. You must make a choice in <u>each</u> of the ten scenarios. The table is shown below:

Decision	Option A	Option B
1	□ **10%** chance of **$10.00**, **90%** chance of **$8.00** (1-10) (11-100)	□ **10%** chance of **$19.00**, **90%** chance of **$1.00** (1-10) (11-100)
2	□ **20%** chance of **$10.00**, **80%** chance of **$8.00** (1-20) (21-100)	□ **20%** chance of **$19.00**, **80%** chance of **$1.00** (1-20) (21-100)
3	□ **30%** chance of **$10.00**, **70%** chance of **$8.00** (1-30) (31-100)	□ **30%** chance of **$19.00**, **70%** chance of **$1.00** (1-30) (31-100)
4	□ **40%** chance of **$10.00**, **60%** chance of **$8.00** (1-40) (41-100)	□ **40%** chance of **$19.00**, **60%** chance of **$1.00** (1-40) (41-100)
5	□ **50%** chance of **$10.00**, **50%** chance of **$8.00** (1-50) (51-100)	□ **50%** chance of **$19.00**, **50%** chance of **$1.00** (1-50) (51-100)
6	□ **60%** chance of **$10.00**, **40%** chance of **$8.00** (1-60) (61-100)	□ **60%** chance of **$19.00**, **40%** chance of **$1.00** (1-60) (61-100)
7	□ **70%** chance of **$10.00**, **30%** chance of **$8.00** (1-70) (71-100)	□ **70%** chance of **$19.00**, **30%** chance of **$1.00** (1-70) (71-100)
8	□ **80%** chance of **$10.00**, **20%** chance of **$8.00** (1-80) (81-100)	□ **80%** chance of **$19.00**, **20%** chance of **$1.00** (1-80) (81-100)
9	□ **90%** chance of **$10.00**, **10%** chance of **$8.00** (1-90) (91-100)	□ **90%** chance of **$19.00**, **10%** chance of **$1.00** (1-90) (91-100)
10	□ **100%** chance of **$10.00**, **0%** chance of **$8.00** (1-100)	□ **100%** chance of **$19.00**, **0%** chance of **$1.00** (1-100)

After you have made all ten choices in Table 1, we collect your decision sheets. Then we will pick two random numbers:

- The first random number is between 1 and 10 and chooses one of the ten decision scenarios. Even though you will make ten decisions, only one of these will end up affecting your earnings, but you will not know in advance which decision scenario will be used. Note that each decision scenario has an equal chance of being used.

- The second random number is between 1 and 100 and decides the outcome of the lottery you chose in the relevant decision scenario. If this second random number is smaller than the chance of the outcome happening, you end up with the first outcome of the lottery; if the random number is larger than the chance of the outcome happening, you end up with the second outcome of the lottery. Note that the numbers in parentheses are the winning numbers: for example, in decision 6, if the random number is between 1 and 60 you win the higher amount for the option you choose, and if the random number is between 61 and 100 you win the lower amount.

The following example might clarify the situation. Note that the numbers are different than the ones we actually use in the experiment:

Decision	Option A	Option B
1	√ **10%** chance of **$13.00**, **90%** chance of **$6.00** (1-10) (11-100)	**10%** chance of **$15.00**, **90%** chance of **$1.00** (1-10) (11-100)
2	√ **20%** chance of **$13.00**, **80%** chance of **$6.00** (1-20) (21-100)	**20%** chance of **$15.00**, **80%** chance of **$1.00** (1-20) (21-100)
3	√ **30%** chance of **$13.00**, **70%** chance of **$6.00** (1-30) (31-100)	**30%** chance of **$15.00**, **70%** chance of **$1.00** (1-30) (31-100)
4	√ **40%** chance of **$13.00**, **60%** chance of **$6.00** (1-40) (41-100)	**40%** chance of **$15.00**, **60%** chance of **$1.00** (1-40) (41-100)
5	**50%** chance of **$13.00**, **50%** chance of **$6.00** (1-50) (51-100)	√ **50%** chance of **$15.00**, **50%** chance of **$1.00** (1-50) (51-100)
6	**60%** chance of **$13.00**, **40%** chance of **$6.00** (1-60) (61-100)	√ **60%** chance of **$15.00**, **40%** chance of **$1.00** (1-60) (61-100)
7	**70%** chance of **$13.00**, **30%** chance of **$6.00** (1-70) (71-100)	√ **70%** chance of **$15.00**, **30%** chance of **$1.00** (1-70) (71-100)
8	**80%** chance of **$13.00**, **20%** chance of **$6.00** (1-80) (81-100)	√ **80%** chance of **$15.00**, **20%** chance of **$1.00** (1-80) (81-100)
9	**90%** chance of **$13.00**, **10%** chance of **$6.00** (1-90) (91-100)	√ **90%** chance of **$15.00**, **10%** chance of **$1.00** (1-90) (91-100)
10	**100%** chance of **$13.00**, **0%** chance of **$6.00** (1-100)	√ **100%** chance of **$15.00**, **0%** chance of **$1.00** (1-100)

Assume that in this example you choose Option A for Decisions 1, 2, 3 and 4; and you choose Option B for Decisions 5, 6, 7, 8, 9, and 10 (see the √ signs in the table).

Assume now that the first random number we pick is 1. You prefer Option A for Decision 1. That means that if the second random number is between 1 and 10, you get $13.00 in this example; if the random number is between 11 and 100, you get $6.00.

What if the first random number is 8 instead of 1? In that case, you prefer Option B—if the second random number is 80 or below, you receive $15.00, and if it is larger than 80, you receive $1.00.

The other decisions (and the decisions in the real table on Sheet 1) are similar. Note that as you move down the table, the chances of the higher payoff for each option increase. In fact, for Decision 10 in the bottom row, the second random number does not matter since each option pays the highest payoff for sure, so your choice here is not between two lotteries, but between $13.00 and $15.00 in this example, and between $10.00 and $19.00 in the real table.

To summarize, you will make ten choices: for each decision scenario you will have to choose between two lotteries. You may choose Option A for some decision rows and Option B for other rows, and you may change your decisions at any time before the random numbers are chosen, and make the decisions in any order.

Part 2:

In this part we would like to get some information about you and your perceptions of food. Remember that all information you provide will not be linked to your name.

Please take Sheet 2 (printed on **green**) out of your packet and answer the questions. For each of the six statements, mark one response on the scale, which ranges from 1 if you Strongly Disagree to 9 if you Strongly Agree. Choose your box on the scale noting that the closer you are to 1, the more strongly you disagree with the given statement; and the closer you are to 9 the more strongly you agree with the given statement.

Part 3: Auction for candy bars.

There should be a small Butterfinger bar at your seat. This small Butterfinger bar is yours to keep, but please do not eat it just yet. Here in the front of the room, we have other candy bars: four large Butterfingers, four Doves and four Luna LemonZests. We are interested in your preferences for upgrading your small Butterfinger to each of the three other candy bars.

We will now conduct an auction for each of the upgrades, where you will have the opportunity to win *one* of the three other candy bars in exchange for your small Butterfinger and additional money. In a moment, you will be asked to indicate the *most* you are willing to pay (if anything) to purchase each of the upgrades to the other candy bars by writing bids on the enclosed bid sheet and slip. Let me explain how the auction will proceed.

1) First, each of you has been given a bid sheet (Sheet 3, on yellow paper) in your packet with three additional slips. There are three auction rounds. On the sheet and on a slip you will, in a moment and only for Round 1, write the **most** you are willing to pay for each of the following: a) an upgrade from the small Butterfinger to the large Butterfinger, b) an upgrade from the small Butterfinger to the Dove bar, and c) an upgrade from the small Butterfinger to the Luna LemonZest bar. Note: in each of the three rounds (which means, on each slip) you will write three bids, one for each candy bar upgrade. Your bids are private information and should not be shared with anyone.
2) After you have finished writing your bids on the Sheet and on the slip for the respective round, a person from the team will go around the room and collect the bid slips. You keep the Sheet. Make sure that the bids on your Sheet and on the slips are identical.
3) In the front of the room, bids will be ranked from highest to lowest for each candy bar upgrade.
4) The people with the *four highest* bids for each candy bar upgrade will win the auction and pay the ***5^th^*** *highest* bid amount for that upgrade. In the case of ties between, for example, the 4^{th} and 5^{th} highest bidder, we will randomly choose one of the two as auction winner.
5) For each candy bar upgrade we will write the winning bidder numbers and the winning price on the chalkboard for everyone to see.
6) After posting the price, we will re-conduct the auction for two additional rounds.
7) At the completion of the 3^{rd} round, we will randomly draw a number between 1 and 3 to determine the winning round. For example, if we randomly draw the number 2, then we will ignore outcomes in all other rounds and only focus on the winning bidders and price in round 2. It is important to note that all three rounds are equally likely to be drawn.
8) After the binding round has been determined, we will randomly draw a number 1 through 3 to determine which candy bar upgrade to actually auction (either the upgrade form the small Butterfinger to the larger Butterfinger (1), to the Dove bar (2), or to the Luna LemonZest (3)). For example, if we draw the number 1, we will focus on bids for upgrades from the small Butterfinger to the large Butterfinger, and we will ignore bids for the other two candy bar upgrades. Importantly, all candy bar upgrades have an equally likely chance of being drawn.
9) Once the binding round and candy bar upgrade have been randomly determined (step 7 and 8), we will write down the winning four bidders who at the end of today's experiment will be asked to pay the 5^{th} highest bid amount and receive the winning candy bar in exchange for the small Butterfinger. All other participants will leave with the small Butterfinger.

Important notes

- You will have the opportunity to win an auction for only ***one*** candy bar upgrade. Because we randomly draw a binding round and binding candy bar, you *cannot* win more than one candy bar upgrade. That is, under no bidding scenario will you take home more than one candy bar from this experiment.

- The winning bidders ***will actually pay money*** and return the small Butterfinger to obtain the winning candy bar. This procedure is **not** hypothetical.
- In this auction, the best strategy is to bid ***exactly*** what it is worth to you to obtain each of the upgrades to the three other candy bars. Consider the following: if you bid *more* than an upgrade to another candy bar is worth to you, you may end up having to buy a candy bar upgrade for more than you really want to pay. Conversely, if you bid *less* than the candy bar upgrade is worth to you, you may end up not winning the auction even though you could have bought an upgrade at a price you were actually willing to pay. Thus, your best strategy is to bid *exactly* what each candy bar upgrade is worth to you.
- It is acceptable to bid $0.00 for any candy bar upgrade in any round.

Example
Suppose there were six people participating in an auction just like the one you are about to participate in. Suppose that these individuals participated in three auction rounds, as you will, and that the 3rd round was randomly selected to be binding. Also, assume that the upgrade to a Dove bar was randomly selected to be the binding candy bar upgrade. Now, suppose in round 3, participant #1 bid $0.00 for the upgrade, participant #2 bid $0.10, participant #3 bid $0.25, participant #4 bid $0.40, participant #5 bid $0.50 and participant #6 bid $0.60.

Who would win the auction? Participants #3-6 would win the auction because they bid the highest amounts. How much would they have to pay for the upgrade to the Dove bar? They would pay the 5th highest bid amount, which was $0.10 (plus hand in their small Butterfingers). Thus, we would write down the ID numbers of participants #3-6, and the end of the experiment we would receive $0.10 and the small Butterfinger from each of them and give them each a Dove bar. Participants #1 and #2 would pay nothing and would leave with the small Butterfinger.

Note: these dollar amounts were used for illustrative purposes only and should not in any way reflect what the candy bar upgrades may be worth to you.

Do you have any questions before we begin?

Please use the **yellow** bid sheet with the bid slips, marked “Sheet 3: Candy Bar Auction.”

Part 4: Blind-tasting of four slices of apples with subsequent ranking.

We now ask you to take Sheet #4, printed on **gray** paper, out of your packet.

You will be given four samples of fresh apple and a score sheet to complete. Please eat at least one piece of each sample and cleanse your palate with water and crackers between samples.

Taste each of the numbered samples and check the box that best describes your evaluation of each sample for appearance, flavor, texture, and overall acceptability. You can also refer to the whole apples displayed on the cart for evaluating the appearance. Please list specific comments about each sample, such as sweetness, off-flavor, mouthfeel, aftertaste, and anything else you liked or did not like.

After tasting all samples, please rank the samples in order of your preference. If you have any questions, please ask.

Part 5: Apple Auction Set 1.

Now that you have had the chance to learn how the auction will work, we are interested in your preferences for four different kinds of Gala apples—non-organic/non-local apples; non-organic/local apples; organic/non-local apples; organic/local apples.

Certified (USDA) Organic		This product meets the USDA federal requirement and is certified as organic. Foreign products sold in U.S. as certified organic are subject to USDA regulation.
Locally Grown	No Seal	This product was grown within 300 miles and a 6 hour drive of where it was purchased.

At the end of today's experiment, each of you will leave with a bag of non-organic/non-local apples unless you win an auction to upgrade to one of the three other kinds. We will now hand each of you a bag of non-organic/non-local apples. Then we will give you the opportunity to participate in an auction to purchase *one* upgrade. We have four bags of each of the three other kinds of apples. Everybody except for the winners of the auction will take home a bag of non-organic/non-local apples. The winners of the auction will take home one of the other three bags. Other than differences in the labeled characteristics, the apple bags are the same weight, packaging, etc.

	Non-Local	**Locally Grown**
Non-Organic	What you have right now.	Upgrade 2
Certified Organic	Upgrade 1	Upgrade 3

In a moment, you will be asked to indicate the *most* you are willing to pay (if anything) for each of the upgrades by writing bids on the enclosed bid sheets and the corresponding slips for each of three rounds. The procedures for this auction are exactly the same as the candy bar auction, except that this time we will not write down the winning bid and the winning bidders on the board.

To refresh your memory as to how the auction works, I will briefly go through the instructions again:

1) First, each of you has been given a bid sheet in your packet (Sheet 5). On this sheet you will, in a moment and only for Round 1, write the ***most*** you are willing to pay for each of the three upgrades. Note: in each round you will write three bids, one for each upgrade, on your sheet and on the slip. Your bids are private information and should not be shared with anyone.
2) All bids will be ranked from highest to lowest for each upgrade.
3) The people with the *four highest* bids for each upgrade will win the auction and pay the *5^{th} highest* bid amount for the upgrade. As before, ties will be broken randomly.
4) The main difference to the candy bar auctions: we will not post the prices for each round. There will be three rounds as was the case with the candy bar auction.
5) At the completion of the 3^{rd} round, we will randomly draw a number between 1 and 3 to determine the binding round. Importantly, all rounds have an equally likely chance of being binding.
6) After the binding round has been determined, we will randomly draw a number 1 through 3 to determine which upgrade to actually auction. Importantly, all upgrades have an equally likely chance of being binding.
7) Once the binding round and upgrade have been determined, we will write down the winning bidders' ID numbers, and at the end of today's experiment, those participants will pay the 5^{th} highest bid amount in that round and obtain the upgraded bag of apples in exchange for the non-

local/non-organic apples. All other bidders will pay nothing and receive their original bag of non-organic/non-local apples.

Important notes:

- You will have the opportunity to win an auction for only *one* upgrade. Because we randomly draw a binding round and binding upgrade, you *cannot* win more than one auction. That is, under no bidding scenario will you take home more than one bag of apples.
- The winning bidders ***will actually pay money*** to obtain the upgrade. This procedure is **not** hypothetical.
- As in the candy bar auction, the best strategy is to bid **exactly** what each upgrade is worth to you. Consider the following: if you bid *more* than the upgrade is worth to you, you may end up having to buy an upgrade for more than you really want to pay. Conversely, if you bid *less* than the upgrade is really worth to you, you may end up not winning the auction even though you could have bought an upgrade at a price you were actually willing to pay. Thus, your best strategy is to bid *exactly* what the upgrade is worth to you.0
- It is acceptable to bid $0.00 for any upgrade in any round.

Do you have any questions before we begin?
Please use the bid sheet and clips marked “Sheet 5: Apples Auction” (printed on **white** paper).

Part 6: Apple Auction Set 2.

We just finished the first auction round; before we proceed with additional auction rounds, we would like to give you some information about the four different kinds of apples to help you make an informed bid.

Non-local vs. Local produce

1. *Carbon footprint of Washington apples*
   Apples transported from Washington to Colorado travel about 1500 miles, and carbon footprints level from transportation account for about 39% of total carbon emissions.[5] This is equivalent to 50 to 55 grams of carbon emission levels per pound of product from transportation so the total footprint is 120 grams per pound of apples.

2. *Carbon footprint of locally grown apples*
   Locally grown apples produced in Colorado travel approximately 300 miles from the farm gate to the consumer. Since the carbon footprint from transportation accounts for about 39% of total carbon emissions, and the average apple travels 1500 miles, locally grown apples <u>reduce</u> carbon emission levels from 120 grams per pound to between 80-95 grams per pound.

   As a way to compare this difference, note that driving a mid-size car for one mile produces about 320 grams carbon dioxide.

Conventional vs. Organic produce

1. *Pesticides residues and conventional vs. organic*[6]
   Results from four independent studies suggest that conventional produce contain pesticides residues at least 3 to 4 times higher than organic produce. Also, organic produce have been shown to possess lower nitrates residues (a toxic contaminant from chemical fertilizers). However, no evident threat to consumers' health from consumption of conventional produce has been documented. Occupational exposure to pesticides (for farm workers) is a much greater health risk than consumers' exposure to pesticides from conventional produce.

2. *Nutrients, naturally occurring toxins and microbiological safety*[7]
   Several studies have shown that organic produce may contain higher levels of beneficial plant secondary metabolites (antioxidants), but also may have higher content of naturally occurring toxins. Some studies also suggested potentially increased microbiological hazards (*E. coli* and *Salmonella*) from organic produce.

---

[5] Weber C. and Matthews S.,2008. Food-Miles and the Relative Climate Impacts of Food Choices in the United States. *Environmental Science & Technology* / Vol. 42, No. 10, 3508-3513.

[6] Winter C. and Davis S, 2006. Scientific Status Summary—Organic Foods. *Journal of Food Science* —Vol. 71, Nr. 9, 2006.

[7] Winter C. and Davis S, 2006. Scientific Status Summary—Organic Foods. *Journal of Food Science* —Vol. 71, Nr. 9, 2006.

Part 7: Apple Auction Set 3.

Before we conduct the last auction round, we would like to remind you of your blind-tasting before we started the auction. We will now reveal which apple is which. Please take out Sheet 4 **(gray)** with your ranking again.

Apple ___ is non-organic/non-local.
Apple ___ is organic/non-local.
Apple ___ is non-organic/local.
Apple ___ is organic/local.

Appendix B: Elicitation of Food Values and Perceptions

Please rate each of the following items on a scale of 1 to 9, where 1 means "I strongly disagree" and 9 means "I strongly agree."

1. The environmental impact of fruit and vegetables is greater for conventional than for organic produce.

Strongly Disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 Strongly Agree

2. Eating organic fruits and vegetables represents a lesser health risk than eating conventional fruits and vegetables.

Strongly Disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 Strongly Agree

3. Locally-grown produce represents a lower risk to climate change because the carbon footprint from transportation of the produce is lower.

Strongly Disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 Strongly Agree

4. There are more credible assurances about produce safety direct from local farmers than for other stakeholders in the food system (US govt. agencies, food distributors, retailers).

Strongly Disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 Strongly Agree

5. I trust the government agencies responsible for food safety in the United States.

Strongly Disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 Strongly Agree

6. Pesticide residues on fruits and vegetables are at a safe level if they meet US government standards.

Strongly Disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 Strongly Agree

Appendix C:
Score Sheet for Fresh Apples

Please eat the entire sample and cleanse palate with water and crackers between samples. Under the corresponding sample number, please check the box that best describes your evaluation of each sample for appearance, flavor, texture, and overall acceptability.

APPEARANCE					FLAVOR				
	Sample Number					Sample Number			
	187	926	445	603		187	926	445	603
Highly Acceptable	☐	☐	☐	☐	Highly Acceptable	☐	☐	☐	☐
Acceptable	☐	☐	☐	☐	Acceptable	☐	☐	☐	☐
Moderately Acceptable	☐	☐	☐	☐	Moderately Acceptable	☐	☐	☐	☐
Slightly Acceptable	☐	☐	☐	☐	Slightly Acceptable	☐	☐	☐	☐
Neither Acceptable nor Unacceptable	☐	☐	☐	☐	Neither Acceptable nor Unacceptable	☐	☐	☐	☐
Slightly Unacceptable	☐	☐	☐	☐	Slightly Unacceptable	☐	☐	☐	☐
Moderately Unacceptable	☐	☐	☐	☐	Moderately Unacceptable	☐	☐	☐	☐
Unacceptable	☐	☐	☐	☐	Unacceptable	☐	☐	☐	☐
Highly Unacceptable	☐	☐	☐	☐	Highly Unacceptable	☐	☐	☐	☐

TEXTURE					OVERALL ACCEPTABILITY				
	Sample Number					Sample Number			
	187	926	445	603		187	926	445	603
Highly Acceptable	☐	☐	☐	☐	Highly Acceptable	☐	☐	☐	☐
Acceptable	☐	☐	☐	☐	Acceptable	☐	☐	☐	☐
Moderately Acceptable	☐	☐	☐	☐	Moderately Acceptable	☐	☐	☐	☐
Slightly Acceptable	☐	☐	☐	☐	Slightly Acceptable	☐	☐	☐	☐
Neither Acceptable nor Unacceptable	☐	☐	☐	☐	Neither Acceptable nor Unacceptable	☐	☐	☐	☐
Slightly Unacceptable	☐	☐	☐	☐	Slightly Unacceptable	☐	☐	☐	☐
Moderately Unacceptable	☐	☐	☐	☐	Moderately Unacceptable	☐	☐	☐	☐
Unacceptable	☐	☐	☐	☐	Unacceptable	☐	☐	☐	☐
Highly Unacceptable	☐	☐	☐	☐	Highly Unacceptable	☐	☐	☐	☐

Please write in the sample number in the space provided by ranking the samples in order of your preference (1 = Liked most; 4 = Liked least):

1) ________ 2) _________ 3) _________ 4) ________

Please provide specific comments for each sample (i.e. sweetness, crispness, mouthfeel, what you liked or did not like)

187____

926____

445____

603____

(Methodological) Appendix D:

Conceptual and Econometric Models, and Empirical Specification

In this section we formally introduce the behavioral and empirical model that we will use to carry out a more detailed analysis of the data obtained in the experiment. While Lusk (2011) developed a framework to introduce food values in demand estimation with scanner data, our purpose here is to show an application to the framework to multi-round auctions.

Participants enter the lab with their own homegrown food values and beliefs, which may vary according to personal experience, socio-demographic status or other factors, with f_i indicating the food values of consumer *i*. We elicit these values in part 2 of our experiment (see Table 3), and jointly determine how consumer *i* perceives label *j*: $F_{ij} = f_i(j)$, with j = ON (organic, non-local), NL (not organic, local) or OL (organic, local). Define then u_{ij} as the utility increment/decrement associated by consumer *i* to label *j*, $u_{ij} = u\left(F_{ij}\right)$. WTP for a label depends on the utility change induced by the label (compared to the baseline with no label), and perhaps income, which might act as a shifter or a multiplier of WTP given a set of label perceptions. That is, $WTP_{ij}^{I} = w\left(u\left(F_{ij}\right), inc_i\right)$, where the superscript indicates the homegrown valuation elicited in auction I.

Before auction II and auction III (Parts 6 and 7), we provide participants with additional information about the product. We indicate these treatments as ϑ, the scientific information, and τ, the taste information. If scientific information on local and organic changes how the label is perceived, then $WTP_{ij}^{II} = w\left(u\left(F_{ij}, \vartheta\right), inc_i\right)$. After observing and tasting the apples, participants can use this organoleptic information to update their perception and WTP for the label, implying $WTP_{ij}^{III} = w\left(u\left(F_{ij}, \vartheta, \tau\right), inc_i\right)$.

Auction I: homegrown values

We now consider the corresponding econometric model, where we use asterisks to distinguish latent variables from observed ones. First, assume that $E\left(u_{ij}^{*} \mid \mathbf{x}_{1ijt}\right)$ and $E\left(WTP^{*}_{ij} \mid \mathbf{x}_{2ij}\right)$ are linear functions of their respective vectors of regressors yielding $u_{ij}^{*} = \gamma_1 + \mathbf{x}_{1ij}^{'}\boldsymbol{\beta}_{1j} + \varepsilon_{1i}$ and $WTP_{ij}^{*} = \gamma_2 + \mathbf{x}_{2ij}^{'}\boldsymbol{\beta}_{2j} + \varepsilon_{2ij}$, where ε_{1i} and ε_{2ij} are two error terms, likely correlated across *i*. Based on our conceptual model, $\mathbf{x}_{1ij}$ is a vector of regressors capturing the beliefs associated by consumer *i* to label *j*, and $\mathbf{x}_{2ij}$ is the augmented vector $\mathbf{x}_{2ij} = \left[\mathbf{x}_{1ij} \mid Inc_i\right]$. The first empirical challenge in estimating this model is that participants' bids are censored at zero: we observe a participant's WTP for a given label only when the presence of the label increases a participant's utility. Defining the "auction participation" indicator variable as $\mathbf{I}^{p}_{\left\{u_{ij}^{*}>0\right\}}$, the observed bid of consumer *i* for label *j* is $bid_{ij} = \mathbf{I}^{p}_{\left\{u_{ij}^{*}>0\right\}} WTP_{ij}^{*}$.

Because of censoring, we know that estimating the model $bid_{ij} = \gamma_2 + \mathbf{x}_{2ij}^{'}\boldsymbol{\beta}_{2j} + \varepsilon_{2ijt}$ will produce biased and inconsistent estimates. Three well-known approaches are widely used in the economic literature to amend the problem: the Tobit model (Tobin, 1958), the Heckman's sample selection model (Heckman, 1979), and the two-part models (Cragg, 1971). The Tobit approach focuses on obtaining consistent estimates of $E\left(WTP^{*}_{ij} \mid \mathbf{x}_{2ij}\right)$, the willingness to pay for a label in the whole population of consumers, and it is particularly relevant when considering the welfare implications of a ban or imposition of a label, but its reliance on normal distributions led us to explore the other options. Heckman's approach focuses on achieving a consistent estimation of $E\left(WTP^{*}_{ij} \mid \mathbf{x}_{2ij}, u_{ij}^{*} > 0\right)$, the conditional expectation of those who value label *j*, and introduces an explicit model of the censoring mechanism. Letting $\Phi(.)$ represent the normal cumulative distribution function, the two-step semi-parametric variant of Heckman's approach models the probability that consumer *i* participates in the auction via a Probit model

$$(1) \qquad P\left(\mathbf{I}_{ij}^{p}=1\right)=\Phi\left(\gamma_{1j}+\mathbf{x}_{1ij}^{'}\boldsymbol{\beta}_{1j}\right)$$

Once an estimate $\Phi\left(\hat{\gamma}_{1j}+\mathbf{x}_{1ij}^{'}\hat{\boldsymbol{\beta}}_{1j}\right)$ is obtained, $E\left(WTP^{*}{}_{ij}\mid\mathbf{x}_{2ij},u_{ij}^{*}>0\right)$ is estimated via OLS regression of the augmented model

$$(2) \qquad bid_{ijt}=\gamma_{2j}+\mathbf{x}_{2ij}^{'}\boldsymbol{\beta}_{2j}+\lambda_{j}\Lambda\left(\hat{\gamma}_{1}+\mathbf{x}_{1ij}^{'}\hat{\boldsymbol{\beta}}_{1j}\right)+\nu_{ij},$$

where $\Lambda\left(\mathbf{x}_{1ij}^{'}\hat{\boldsymbol{\beta}}_{1j}\right)=\dfrac{\varphi\left(\mathbf{x}_{1ij}^{'}\hat{\boldsymbol{\beta}}_{1j}\right)}{\Phi\left(\mathbf{x}_{1ij}^{'}\hat{\boldsymbol{\beta}}_{1j}\right)}$ is the inverse Mills ratio, λ is a parameter capturing the covariance between ε_1 and ε_2, and ν_{ij} is an error term uncorrelated with ε_1.[8]

Two-part models are widely used in the healthcare expenditure literature (e.g., Buntin and Zaslavsky, 2004) and are applicable when zero bids are a true expression of a participant's WTP. Thus, if $u_{ij}^{*}=0$ or $u_{ij}^{*}>0$ for most consumers, then $P\left(\mathbf{I}_{ij}^{p}=1\right)=\Phi\left(\gamma_{1j}+\mathbf{x}_{1ij}^{'}\boldsymbol{\beta}_{1j}\right)$ and $E\left(WTP^{*}{}_{ij}\mid\mathbf{x}_{2ij},u_{ij}^{*}>0\right)=\gamma_{2j}+\mathbf{x}_{2ijt}^{'}\boldsymbol{\beta}_{2jt}$ can be estimated separately without correcting for censoring. While negative valuations have been documented for certain controversial food labels, such as genetically modified food products (Huffman et al., 2003), there is no clear evidence that a segment of the consumer population may discount the local or organic version of a given apple cultivar. In summary, the choice between Heckman's and a two-part model is an

[8] Consistent estimation of the model parameters is obtained provided that ε_2 can be decomposed as $\varepsilon_2=\gamma\varepsilon_1+\xi$, where ξ is independent of ε_1. This will be necessarily the case if the two error terms have a joint bivariate normal distribution, yet the assumption of bivariate normality, *per se*, is not strictly necessary (see Cameron and Trivedi, 2005, p. 549).

empirical one in our application, and we therefore estimate both Heckman's and a two-part model.

To estimate equations 1) and 2), we need to populate $\mathbf{x}_{1ij}$ and $\mathbf{x}_{2ij}$ with a set of proxies capturing participants' beliefs on organic and local produce. We do so by leveraging the information obtained in part 2 and the ensuing principal component analysis (Table 3). When the same regressors appear in the selection and regression equations (i.e., $\mathbf{x}_{1ij} = \mathbf{x}_{2ij}$), identification in the Heckman model may be fragile (see, for example, Leung and Yu, 2000). With this in mind, and letting $F_i^{q1},...,F_i^{q6}$ represent the level of agreement to statements 1,…,6; and F_i^{p1}, F_i^{p2} be the first and second principal component score for the i^th^ participant, we specify the first set of regressors $\mathbf{x}_{1i(j=ON)} = \left[F_i^{q1}, F_i^{q2}, F_i^{q5}, F_i^{q6}\right]$; $\mathbf{x}_{1i(j=NL)} = \left[F_i^{q3}, F_i^{q4}, F_i^{q5}, F_i^{q6}\right]$ and $\mathbf{x}_{1i(j=OL)} = \left[F_i^{q1}, F_i^{q2}, F_i^{q3}, F_i^{q4}, F_i^{q5}, F_i^{q6}\right]$; and $\mathbf{x}_{2ij} = \left[F_i^{p1}, F_i^{p2}, inc_i\right]$ for $j = ON, NL, OL$. While some information is lost when we replace the food value statements with their first two principal components, this reduces collinearity and also allows us to study the effect of prevailing beliefs in our model of WTP. To be precise, the use of principal components scores accounts for the fact that variation in beliefs/values and their effect on valuation may not occur independently (as in Lusk 2011), but rather in "bundles of beliefs" typical of a personality trait. All regressors are standardized (by variable) to allow an immediate interpretation of the intercept.

Auction II and III: treatment effects.

Consider now the effect of the experimental treatments in auction II and III on the participants' WTP for local and organic. The first-difference $\Delta WTP_{ij}^{(II-I)} = WTP_{ij}^{II} - WTP_{ij}^{I}$ allows us to focus on distinguishing the effect of the information treatments rather than consumers' original motivations and other time-invariant characteristics. This change in WTP is a stochastic function of ϑ, the first information treatment: $\Delta WTP_{ij}^{(II-I)} = \vartheta_j + v_{ij}$. Here v_{ij} is an error term capturing the discrepancy between consumer *i*'s reaction and the mean response to the label-specific information treatment ϑ_j (see appendix A, part 6). The observed counterpart of this construct, the random variable $\Delta bid_{ij}^{(II-I)} = bid_{ij}^{II} - bid_{ij}^{I}$, is censored at $-bid_{ij}^{I}$. As all participants received the same information treatment, for Auction II we have

(3)
$$\begin{aligned}\Delta bid_{ij}^{(II-I)} &= \mathbf{I}_{ij\left\{\Delta WTP_{ij} > -bid_{ij}^{I}\right\}}^{p} \Delta WTP_{ij}^{(II-I)} \\ &= \mathbf{I}_{ij\left\{\Delta WTP_{ij} > -bid_{ij}^{I}\right\}}^{p} \left(\vartheta_j + v_{ij}\right)\end{aligned}.$$

For Auction II, the participation equation analogous to equation (1) is estimated by specifying $\mathbf{x}_{1ij} = \left[bid_{ij}^{I}\right]$. That is, a label-specific intercept captures the treatment effect, while the regressor controls for the fact that censoring is less likely when participants had a high a priori valuation in Auction I. The induced change in WTP, if any, is estimated by replacing $\Delta bid_{ij}^{(II-I)}$ as dependent variable in (2), and estimating three label-specific intercepts γ_{2j} ($j = ON, NL, OL$) with no other regressors than the Mills' ratio (for the Heckman model only). Again, regressors are standardized by variable to allow an interpretation of the intercepts.

The model for Auction III is quite similar, except that the information treatment is a subjective, participant-specific visual and tasting experience. This yields a much richer parameterization, with

(4)
$$\begin{aligned}\Delta bid_{ij}^{(III-II)} &= \mathbf{I}_{ij\left\{\Delta WTP_{ij}^{(III-II)} > -bid_{ij}^{II}\right\}}^{p} \Delta WTP_{ij}^{(III-II)} \\ &= \mathbf{I}_{ij\left\{\Delta WTP_{ij}^{(III-II)} > -bid_{ij}^{II}\right\}}^{p} \left(\mathbf{x}_{ij}'\boldsymbol{\tau}_j + v_{ij}\right)\end{aligned}$$

where $\mathbf{x}_{ij}$ is a vector of subjective acceptability scores from the sensory experience (see Table 4), and $\boldsymbol{\tau}_j$ a set of parameters to be estimated. The central idea driving the specification of this model is that any change in WTP should be based on a perceived sensory difference between the endowed and the auctioned apples. Considering the organic non-local case and defining Δsc_i^{j-NN} as the difference in overall score between apple j and the endowed apple NN, the covariates in modeling the censoring equation (analogous to equation 1) are $\mathbf{x}_{1i(j=ON)} = \left[bid_{ON}^{II}, \Delta sc_i^{ON-NN} \right]$. In the second stage (equation 2) the dependent variable is $\Delta bid_{ij}^{(III-II)}$ and the explanatory variables are

$$\mathbf{x}_{2i(j=ON)} = \begin{bmatrix} LikeON = I_{\left\{\Delta sc_i^{ON-NN}>0\right\}}\left(\Delta sc_i^{ON-NN}\right), DislikeON = I_{\left\{\Delta s_i^{ON-NN}<0\right\}}\left(\Delta sc_i^{ON-NN}\right)*(-1), \\ \Delta sc_i^{NL-NN}, \Delta sc_i^{OL-NN} \end{bmatrix}.$$

The interaction of the own-taste variable with the positive/negative dummy variable in the latter equation allows testing for an asymmetric reward/punishment for good/bad organoleptic characteristics of the auctioned apple;[9] and the inclusion of own and cross taste variables allows testing for substitution across labels in response to taste and visual information. The covariates $\mathbf{x}_{1i(j=NL)}$, $\mathbf{x}_{2i(j=NL)}$ and $\mathbf{x}_{1i(j=OL)}$, $\mathbf{x}_{2i(j=OL)}$ in the models of the non-organic local and organic local apples are defined analogously.

[9] If participants discount bad tasting apples, multiplying $I_{\left\{\Delta s_i^{ON-NN}<0\right\}}\left(\Delta sc_i^{ON-NN}\right)$ by (-1) makes the associated coefficients negative, and the tables of estimates more intuitive.

References (for Appendix D only)

Buntin, M. B. and Zaslavsky, A. M. (2004). Too much ado about two-part models and transformation? Comparing methods of modeling Medicar expenditures. *Journal of Health Economics* 23/3: 525-542.

Cameron, A. C. and Trivedi, P. K. (2005). *Microeconometrics: Methods and Applications*. Cambridge, MA: Cambridge University Press.

Cragg, J. G. (1971). Some statistical models for limited dependent variables with application to the demand for durable goods. *Econometrica* 39/5: 829-844.

Heckman, J. J. (1979). Sample selection bias as a specification error. *Econometrica* 47/1: 153-161.

Huffman, W., Shogren, J. F., Rousu, M. and Tegene, A. (2003). Consumer willingness to pay for genetically modified food labels in a market with diverse information: Evidence from experimental auctions. *Journal of Agricultural and Resource Economics* 28/3: 481-502.

Leung, S. F. and Yu, S. (2000). Collinearity and two-step estimation of sample selection models: Problems, origins, and remedies. *Computational Economics* 15/1: 173-199.

Lusk, J. L. (2011). External validity of the food values scale. *Food Quality and Preference* 22/5: 452-462.

Tobin, J. (1958). Estimation of relationships for limited dependent variables. *Econometrica* 26: 24-36.