Consumer Willingness-to-Pay for Local Produce:

The Case of New York Broccoli

A Thesis

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ABSTRACT

The supply of broccoli has been highly concentrated in the West Coast. Considering the long supply chain from the West Coast to the East Coast and the large volume being shipped, it is beneficial to create a regional supply of broccoli in the East Coast. New varieties of broccoli have been developed recently to address the quality issues of the existing Eastern varieties. The success of the new varieties could accelerate the development of the East Coast broccoli industry. Our study assessed the product attributes of the new varieties and elicited consumer willingness to pay for these products to estimate their market potential. A non-hypothetical experimental auction was used, combined with an information treatment on product origin. Multiple rounds of bidding were designed to identify the effect of taste on consumer willingness to pay. A market share simulation was conducted to draw implications for pricing strategies. The results suggest a strong market potential for one of the Eastern varieties. A potential price premium against the West Coast product could be justified when product origin information is provided and when consumers have the opportunity to taste the product. Market share simulations confirm the potential for the price premium and suggest an optimal price within a range of 25 cents from the West Coast product.

BIOGRAPHICAL SKETCH

Jiayi Dong received her B.S. in Economics and Finance from the Hong Kong University of Science and Technology in 2010. She continued her graduate study at the Dyson School of Applied Economics and Management of Cornell University from 2016 to 2018. Her research interests are in the fields of food supply chain efficiency, food safety, agricultural and food policy.

She worked as a management consultant at OC&C Strategy Consultants from 2010 to 2014 for companies in the consumer goods and retail industry in Asia. In 2015, joined Cargill Investments (China) Ltd as a business analyst for the Starch and Sweetener China business unit. The working experience has equipped her with solid skills in conducting research and inspired her research interests.

Outside of the academics and work, Jiayi enjoys badminton, gardening, and cooking.

To my parents, Xuemei Jin and Jian Dong, who support me unconditionally

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CHAPTER 1

INTRODUCTION

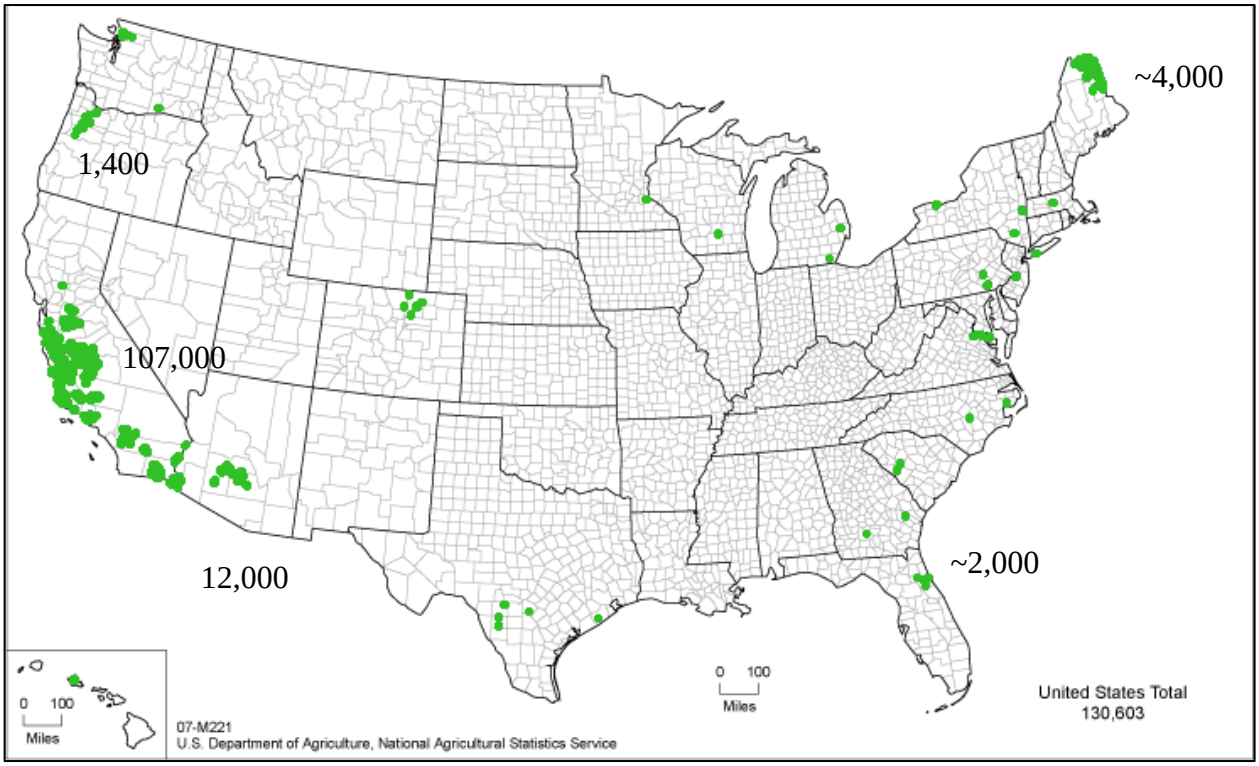
Broccoli, known for its high nutritional content and unique disease-fighting benefit (The World's Healthiest Foods 2018), has grown to be the tenth most consumed fresh vegetables in the US. In contrast to the plateau in consumption of the other major fresh vegetables, broccoli has demonstrated a strong growth of 3.1% per year from 2007 to 2017. Its annual consumption reached 2.3 billion pounds in 2017, accounting for 4.9% of consumers' total fresh vegetable consumption (USDA ERS 2018).

Different from the nationwide consumption of broccoli, its supply is highly concentrated. More than 92% of the domestic broccoli supply is from the West Coast (Figure 1). This concentrated supply implies long distance shipments required for regions far from the place of production. Close to 40% of the U.S. population lives in the East Coast (U.S. Census Bureau 2018), which means that almost 1 billion pounds of broccoli need to be shipped every year from the West Coast to the Eastern market, causing considerable resource waste and pollution. The long supply chain also gives rise to the concern about product quality deterioration and nutrition loss, for example, it usually takes more than one week for the California broccoli to reach the East Coast grocery store shelf.

Being able to supply broccoli regionally along the East Coast would bring multiple benefits. It would increase consumer welfare by providing them with fresher options. It would cut down waste and emissions by significantly reducing the distance traveled. It would benefit the local vegetable growers since broccoli is a relatively high-value crop. Therefore, the USDA Special Crops Initiative has called for the "Developing an Eastern Broccoli Industry" project to realize

year-round supply of Eastern broccoli in the East Coast. The project aims to address issues such as crop characteristic enhancement, economic viability assessment, and regional distribution network creation (Cornell University 2018).

Figure 1: Broccoli production in acres

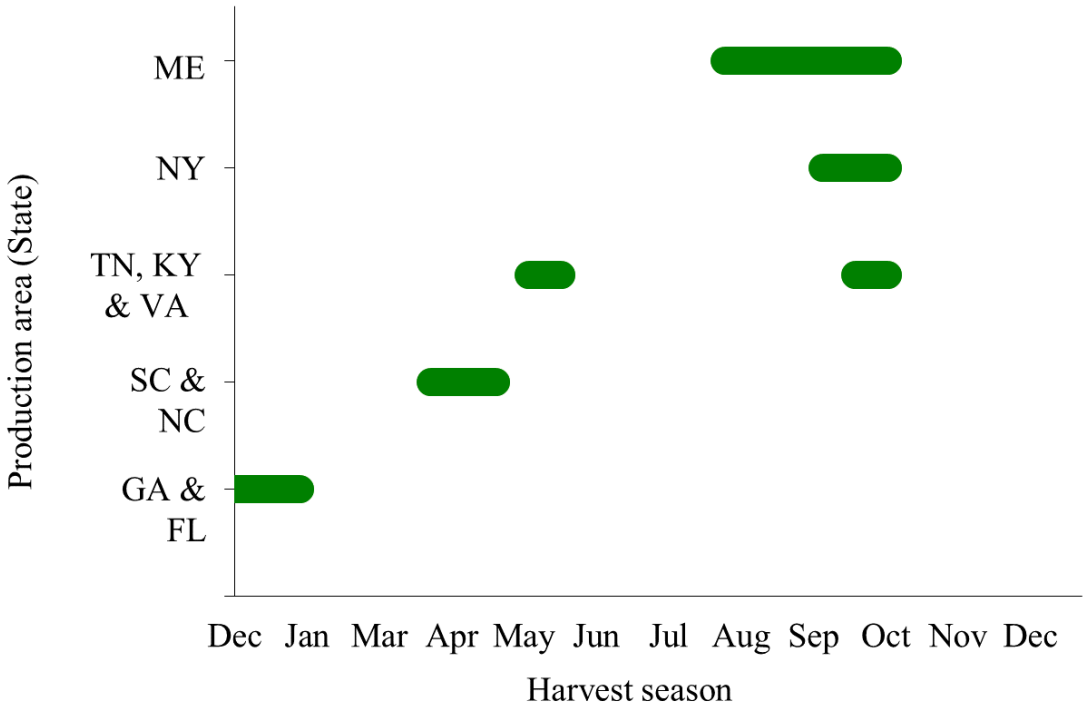


Source: U.S. Department of Agriculture, National Agricultural Statistics Service (USDA NASS)

The biggest challenge to the Eastern broccoli supply is to breed the varieties that adapt well to the growing conditions in the East Coast. The varieties grown in the West Coast could not grow well in the East Coast due to the different weather conditions, resulting in short production windows (Figure 2) and less attractive product characteristics, such as appearance, and taste (Figure 3). With continuous effort, the project team together with the collaborating breeding companies have developed several local varieties suitable for the East Coast weather conditions

and with favorable product attributes that could compete with the existing products in the market. Therefore, we would like to assess the consumer acceptance of the new Eastern varieties.

Figure 2: Broccoli harvest season in the East Coast



Source: The Eastern Broccoli Project

Figure 3: Eastern standard broccoli crop and California broccoli crop

Eastern standard variety

California variety

Source: The Eastern Broccoli Project

Given attractive product attributes, it is also critical to improve the efficiency of broccoli production, handling, and marketing to provide long-term profitability. Correct pricing of the new products at the retail level maximizes the total profit for the stakeholders within the supply chain and attracts more players to take part in the industry. We aim to provide insights into the optimal pricing strategy by quantifying consumer willingness to pay for the Eastern varieties and by discussing implications to the marketing strategy identifying the effect of product taste on consumer willingness to pay.

With the above objectives, we conducted a real-product auction experiment in New York State during its harvest season in 2017. Among all locations in the East Coast that can potentially grow broccoli, NYS could supply during the months of September and October, if the right varieties are identified for the growing conditions. Similar studies could be extended to other locations that have different harvest seasons to generate a year-round picture for the East Coast regional market.

In this study, we compared the product attractiveness of two new NYS varieties with one California variety. We conducted bidding both before and after tasting the products to identify the impact of taste on the willingness to pay and used the information on product origin as a treatment to identify the value of being "locally produced".

The result indicates that the NYS varieties are less preferred in appearance but are competitive in taste. Consumer willingness to pay for the NYS varieties increased relatively to the California variety after product tasting. Product origin information effect was observed for one of the NYS varieties before product tasting. Consumers became more tolerant with the less attractive appearance of the NYS varieties once they learned that they are locally produced. However, no information effect was identified after consumers tasted the products. Based on consumer

willingness to pay for the NYS and California products, we simulated the market share for the NYS varieties and found that the optimal pricing range is likely to lie between $1.89/lb. and $2.48/lb if the California counterpart is priced at $1.99/lb.

CHAPTER 2

LITERATURE REVIEW

Previous studies estimating consumer willingness to pay for fresh produce have used a variety of elicitation methods. Contingent valuation is one of the most widely used methods with different formats. For example, Loureiro et al. (2002) used a hypothetical valuation question[1] with a payment card format. Consumers were asked to choose among bid intervals such as $0, less than 5 cents/lb, between 5-10 cents/lb, etc. to indicate the willingness to pay a price premium for three types of fresh potatoes. They reported a 3.1% premium for organic potatoes and 5.5% premium for Colorado-grown potatoes while price premiums for GMO-free potatoes were not statistically significant. Carpio and Isengildina-Massa (2009) used a dichotomous choice format where consumers were asked to choose to buy or not to buy a product at the stated price. It was shown that South Carolinians were willing to pay an average premium of about 27% for state-grown produce.

Apart from the contingent valuation framework, the hypothetical conjoint analysis is being increasingly used to elicit consumer WTP (Darby, et al. 2008, Hinson and Bruchhaus 2005). Darby et al. (2008) used an in-store conjoint analysis approach to estimate WTP for fresh strawberries with four product attributes, including production location, producer identification, freshness guarantee and price. In the conjoint analysis survey, consumers were prompted to state their preferred product profile among those formulated by a combination of different levels of product attributes. The results demonstrated that the shoppers at the grocery store and direct market

[1] Valuation question: assuming fresh potatoes were priced at $1.00 per pound at your grocery store, how much of premium per pound (in cents), if any, would you be willing to pay for fresh potatoes containing the following characteristics: GMO-Free, Organically Grown and Colorado Grown?

channels (e.g. farmers markets) were willing to pay $0.48 and $0.92 per basket more respectively for "grown in Ohio" compared with "grown in the U.S."

Such hypothetical methods are especially useful for evaluating the market potential of new product attributes. However, it is known that these methods are subject to hypothetical bias and overestimation of WTP (Harrison and Rutström 2008, Lusk, Fox, et al. 2001). For example, using 28 stated preference valuation studies, Murphy et al. (2005) reported a median ratio of hypothetical to actual value of 1.35 and a mean of 2.60.

To minimize the possibility of hypothetical bias, incentive compatible non-hypothetical valuation methods have been increasingly used in several recent studies (Costanigro, et al. 2011, Bi, et al. 2012, Shi, House and Gao 2013). Costanigro et al. (2011) used in-store experiment and elicited consumer WTP by offering a choice between three options: an "upgraded" product with a full set of product attributes, a "base" product combined with a randomly drawn amount of money, and a cash-only gift. Bi et al. (2012) used fifth-price auction combined with sensory analysis to elicit willingness to pay for specific sensory attributes of the existing and new Florida tangerines. The consumers were endowed with a bag of Murcotts and asked to bid for three other tangerines in exchange for Murcotts. They were asked to bid after observing, peeling, and tasting the four products to reflect the effects of external and internal product experiential attributes. Shi et al. (2013) used Becker-DeGroot-Marschak (BDM) auction to investigate willingness to pay for local blueberry products in Pennsylvania and Florida. Consumers were endowed with $7 cash each and displayed with four product samples before they submitted the bids. One of their four bids became binding under random selection.

We followed the non-hypothetical approach and used incentive compatible Becker-DeGroot-Marschak (BDM) auction to elicit consumer willingness to pay for Eastern Broccoli.

Different from the previous studies, we introduced treatment of product origin information, i.e. New York and California, to understand the change in consumer acceptance and WTP due to the additional information. There is not a universally accepted definition of "local" food. (Martinez, et al. 2010). There are studies that focus on the consumer perception of "local" food (Durham, King and Roheim 2009, Zepeda and Leviten-Reid 2004). In this study, we followed the political boundary definition, "grown and available for purchase within a State's borders", which is widely used among the top grocery retailers (Martinez, et al. 2010) and used in many previous studies (Loureiro and Hine 2002, Brown 2003, Carpio and Isengildina-Massa 2009). In this paper, we use "New York grown" or "locally grown" interchangeably.

Apart from the evaluation method, our study took extra effort to identify the effect of product taste on WTP. Previous WTP studies on food have faced challenges of identifying the impact of taste on consumer WTP due to endogeneity issues (Malone and Lusk 2018, Kanter, Messer and Kaiser 2009). Following the multiple rounds of bidding approach by Bi, et al. (2012), we estimated WTP both before and after product tasting. Meanwhile, our experimental approach recognizes that taste preferences could be affected by taste physiology (Duffy and Bartoshuk 2000, Li 2017). Using 6-n-propylthiouracil (PROP) or phenylthiocarbamide (PTC) paper strip test on taste sensitivity, consumers could be classified into "supertasters" and "non-supertasters". In Jerzsa-Latta, Krondl and Coleman (1990), a significant correlation was found between PTC sensitivity and consumption of raw broccoli. Since taste physiology is genetically driven and exogenous to consumer WTP, we decided to use "supertaster" as a potential instrumental variable for taste.

Given the WTP estimates from experimental auctions, Lusk and Shogren (2007) proposed market share forecast methods to simulate market share for new products. Consumer choice is

predicted based on the utility derived from purchasing the products in concern. Bi, et al. (2012) used this approach to derive price elasticities for the four tangerines. We also applied this tool to assess market potential for the New York broccoli varieties.

Our contributions to the literature on the willingness to pay for fresh produce are threefold. We enriched the literature by using the non-hypothetical experimental auction method. We investigated new strategies to identify the effect of taste on WTP and address the endogeneity issue. Finally, we demonstrated how market share simulation can be used to draw implications for product pricing strategy.

CHAPTER 3

EXPERIMENTAL DESIGN

To test the product attractiveness of the New York broccoli varieties, we selected two newly developed cultivars, namely Astroid (NY1) and Burney (NY2) and compared them with a commercial California variety which was the standard variety available in the market. Therefore, three broccoli varieties were examined in this study.

We obtained the New York varieties from Headwater Food Hub, a local food hub from Rochester, New York. We were told that the NY broccoli was harvested less than three days before we conducted the experiment. The California variety was purchased from a local supermarket in Ithaca, New York. Due to the long supply chain, the California products were expected to be harvested at least seven days before we conducted the experiment, i.e. the New York varieties were relatively fresher than the California counterpart. All the products were kept in similar storage conditions since the time purchase. Refrigeration and ice were used to maintain product freshness to simulate the commercial postharvest processes of the product.

Non-student vegetable consumers were recruited for eight lab experimental sessions because it was found that using a student sample might cause additional bias in the estimate (Murphy, et al. 2005). Four sessions were conducted in Geneva, New York on October 26th, 2017. For these sessions, 65 participants were recruited through and university and local community email-list, who came from both within and outside the Cornell University community. Paper-based questionnaires were used for data collection. The other four sessions were conducted in Ithaca, New York on the following day. The Lab for Experimental Economics & Decision Research (LEEDR) was used with a computer-aided survey. Ninety-two participants were recruited through

the lab email list, the majority of whom were staff working at Cornell University. Lab experiment was used instead of in-store experiment considering the complexity of the experimental procedures and the limited amount of time and attention that participants have in field experiments (Costanigro, et al. 2011).

At the beginning of the experiment, the participants were asked to sign a consent form and were instructed about the experimental procedures. They were told that they were endowed with $25 in cash and they would be asked to submit 6 bids during the experiment, among which one would be binding. For the binding round of auction, if their bid was equal to or higher than the randomly drawn market price, they would use the endowed money and purchase one pound of that broccoli product at the market price. The participants did not know which bid would be binding. The binding round was pre-selected and sealed in an envelope and was revealed by one of the participants after all the bids were submitted.

The Becker-DeGroot-Marschak (BDM) auction was used to elicit consumer willingness to pay. The BDM auction is known for its incentive compatibility and is widely used in experimental auctions. To familiarize the participants with this auction method, in the first part of the experiment, we introduced the concept and used one example to explain the mechanism in detail. After the explanation, participants were selected randomly to answer questions regarding the auction mechanism for us to gauge their understanding. Subsequently, two rounds of hypothetical biddings were performed as practice to illustrate the bidding process. One of the practice rounds was bidding for a pen. A random market price was drawn to illustrate how the biddings became binding.

In the second part of the experiment, the three broccoli varieties were displayed side-by-side in a tray and shown to everyone. Broccoli crowns were used to mimic the way that broccoli is displayed at retail outlets (Figure 4). Participants were allowed to observe and touch the products

in the same way as they would do when purchasing at a store. They were asked to give numerical ratings from 1 to 9 to each of the broccoli crowns, reflecting how much they like the appearance of the products. A rating of 9 indicates that the appearance of the product is most favorable, while a rating of 1 indicates that the appearance is least favorable. The participants were then asked to submit one bidding for each product between $0 and $5, representing their maximum willingness to pay for one pound of that product. Three numerical ratings and three biddings were collected in this part. Before subject submitted a bid, they were told that the weight of two small crowns is roughly one pound. The products were displayed in different orders across sessions to reduce potential ordering effect problems on product valuation.

Figure 4: Broccoli samples used in the experiment

Display of broccoli crowns

Samples of broccoli for tasting

In the third part of the experiment, the participants were given three raw broccoli samples for tasting. The samples were labeled in the same way as they were displayed on the tray so that the participants knew which product they were tasting. Raw broccoli was used so that the taste was not affected by the cooking procedure. The participants were asked to taste the three samples in sequence. For each sample, they would first taste the product, then give a numerical rating from 1 to 9 indicating how much they like the taste, and in the end record their maximum willingness to

pay for 1 pound of that product between $0 and $5. Another three numerical ratings and three biddings were collected in this part.

In the fourth part of the experiment, the participants were required to take an N-Propylthiouracil (PROP) taste test. Each participant was given a PROP paper strip and asked to put the paper strip into the mouth for 30 seconds. They would then indicate the intensity of the taste of the paper strip from 0 to 100 based on a standard scale. Eight questions related to their eating and drinking preferences were asked later to compliment the intensity ratings. The paper strip test and the questions have been used to identify "supertasters" among the general population who experience the sense of taste with far greater intensity than average (Hanni 2013). "Supertasters" was tested later as a potential instrumental variable for taste to identify the effect of taste on consumer WTP.

In the last part of the experiment, the participants went through an exit survey to report their demographic information, such as age, gender, education, and household size. Other information that could affect their broccoli purchase preference was collected as well, for example, their broccoli consumption frequency and their price perception of 1lb of broccoli, among others. A summary of the experimental procedure is shown in Table 1.

Table 1: Major experiment procedures

Step	Experiment procedure	Rounds of auctions	Auction type
1	Auction practice	2	Hypothetical
2a	Product appearance assessment		
2b	Bidding for 1lb of broccoli	3 (one for each variety)	Real (from $0-5)
3a	Product taste assessment (tasting)		
3b	Bidding for 1lb of broccoli	3 (one for each variety)	Real (from $0-5)
4	Taste sensitivity test		
5	Exit survey regarding consumer background		

The participants were randomly assigned into two groups. The control group was not given any product information, while the treated group was given the product origin information, i.e. New York or California at the beginning of the sessions. In Ithaca, we had 47 participants in the control group and 45 in the treatment group. In Geneva, we had 45 participants in the control group and 20 in the treatment group.

CHAPTER 4

DATA AND DESCRIPTIVE STATISTICS

After data validation, responses from 152 participants were used in the analysis. Table 2 summarizes selected information of the participants, including demographic characteristics and behaviors related to broccoli purchase and consumption. Detailed survey questions could be found in the appendix.

Table 2: Participant background

Variables	Description	Pooled	Control	Treated
Gender	1 if female; 0 if male	0.73	0.74	0.71
Age	Exact age	43.09	43.73	42.13
Education	Scale from 1 = less than high school to 8 = professional degree	4.88	4.84	4.92
HH_size	No. of people in the household	2.50	2.57	2.40
Primary_ shopper	1 if he/she is the primary shopper in the household; 0 if otherwise	0.80	0.83	0.74
Broccoli_frq	Broccoli consumption frequency per month: scale from 1 = "< 1 time" to 5 = "> 15 times"	2.58	2.64	2.48
Perceived_ price	Cost of 1lb of broccoli based on the previous shopping experience	2.27	2.17	2.41
Organic	1 if >10% of his/her broccoli purchase is organic; 0 if otherwise	0.73	0.71	0.76

Source: Author statistical analysis

In our sample, 73% of participants were female with an average age of 43 years old and average household size of 2.5. The average education level of participants was close to a 4-year college degree. These are in line with the consumer profiles in the in-store experiments in Lusk, Fox, et al. (2001) and Bi et al. (2012). Due to the restrictions on non-student samples, 80% of the participants were the primary shopper of the households and 73% were organic produce shoppers.

The average broccoli consumption frequency of the participants was about once a week. The price for broccoli recalled by the participants was $2.27/lb on average, which is largely consistent with the $1.99/lb actual price on the store shelves at the time of the experiments. These variables were incorporated into our model as control variables.

Table 3: Summary statistics for product ratings and biddings (mean and SD)

	Obs.	**Look**	**Bid1 ($/lb)**	**Taste**	**Bid2 ($/lb)**
Overall	456	6.51	1.99	6.26	1.95
		(2.03)	(1.10)	(2.03)	(1.11)
No Information	**270**	**6.44**	**1.89**	**6.29**	**1.89**
		(2.15)	**(1.07)**	**(2.00)**	**(1.09)**
California	90	7.17	2.01	6.11	1.82
		(1.95)	(1.08)	(2.01)	(1.13)
NY 1	90	6.18	1.83	6.50	1.94
		(2.39)	(1.06)	(1.83)	(1.03)
NY2	90	5.97	1.83	6.24	1.91
		(1.91)	(1.07)	(2.15)	(1.10)
Information	**186**	**6.62**	**2.13**	**6.22**	**2.05**
		(1.85)	**(1.13)**	**(2.08)**	**(1.14)**
California	62	6.79	2.13	6.03	1.95
		(1.71)	(1.11)	(1.92)	(1.11)
NY 1	62	6.56	2.07	5.94	2.03
		(1.71)	(1.14)	(2.13)	(1.12)
NY2	62	6.50	2.19	6.69	2.16
		(2.06)	(1.15)	(2.14)	(1.19)

Source: Author statistical analysis

Each participant submitted three product appearance ratings, three biddings based on product appearance, three product taste ratings and three biddings based on product taste (one for each variety). Therefore, 456 observations were collected for each of these four variables. Table 3 summarizes the mean and standard error of the appearance ratings, first round biddings, taste ratings and second round biddings.

When no product information was provided, the participants rated the appearance of the two NY varieties much lower than the California variety, with a gap in the rating of 0.99 and 1.20 points (recall that the scale ranged from 1 to 9). This corresponds to the lower biddings. In the first round of bidding, the participants were willing to pay $2.01/lb for the California product, similar to the actual price in grocery stores, but they would only pay $1.83/lb for the NY varieties. However, this gap in appearance rating and WTP decreased once product information was provided. The gap in appearance rating reduced to less than 0.30. The WTP for NY2 variety was even slightly higher than that of the California variety. This indicates the existence of information treatment effects.

In terms of taste, the two NY products were rated equally to or slightly higher than the California variety in both the control and treated group. This was not surprising given that the New York products were fresher given the harvest timing. The NY1 variety was most preferred in the control group, while the NY2 variety was best received in the treated group. The second round of bids were consistent with the taste ratings. The participants were willing to pay a slightly higher price for the NY products, ranging from $0.08 to $0.21/lb, or 4% to 11% more than the California product. The California produce became the least preferred in both the control and the treated group after product tasting.

CHAPTER 5

EMPIRICAL SPECIFICATIONS

To compare across the three varieties and identify the information treatment effect, we regressed the four dependent variables, i.e. *Look*, *Bid1*, *Taste, Bid2,* respectively on variety dummies with interaction with information treatment dummy.

We used a reduced-form approach. A random-effects Tobit model was used for the four equations. A random-effects model was used due to the correlation between the product ratings and bids from the same individual. A Tobit model was used due to the truncated nature of the dependent variables. Tobit model has been widely used to study consumer WTP for food products (Grebitus, Lusk and Jr. 2013, Bernard and Bernard 2009, Kanter, Messer and Kaiser 2009).

The definition of variables is shown in Table 4.

Table 4: Variable definition

Variables	Definition
Look	Rating from 1 to 9, truncated
Taste	Rating from 1 to 9, truncated
Bid1	From $0 to $5, truncated
Bid2	From $0 to $5, truncated
Bid_delta	ΔBid = Bid 2 – Bid1
V	Variety, CA = 0; NY 1 = 1; NY2 = 2
I	No product origin information = 0; Yes = 1
C	Control variables, as shown in Table 2
v	Individual effect

Mathematically, we have:

$$Look_{ij} = \alpha^{L} + \beta_j^{L} V_j + \gamma^{L} I + \delta_j^{L} IV_j + \theta^{L} C_i + v_i + \varepsilon_{ij}^{L} \quad (1)$$

$$Bid1_{ij} = \alpha^{B1} + \beta_j^{B1} V_j + \gamma^{B1} I + \delta_j^{B1} IV_j + \theta^{B1} C_i + v_i + \varepsilon_{ij}^{B1} \quad (2)$$

$$Taste_{ij} = \alpha^{T} + \beta_j^{T} V_j + \gamma^{T} I + \delta_j^{T} IV_j + \theta^{T} C_i + v_i + \varepsilon_{ij}^{T} \quad (3)$$

$$Bid2_{ij} = \alpha^{B2} + \beta_j^{B2} V_j + \gamma^{B2} I + \delta_j^{B2} IV_j + \theta^{B2} C_i + v_i + \varepsilon_{ij}^{B2} \quad (4)$$

The subscript i represents one individual and j represents one variety. In equation 1 and equation 3, the intercept α is the average product rating for the California variety when no information about the product origin was provided. The coefficient vector β_j represents the difference in product ratings between the California variety and the NY varieties without information treatment. The coefficient γ represents the information treatment effect for the California product, and the coefficient vector δ_j represents the variation in information treatment effect between the California variety and the NY varieties. C_i is a vector of control variables, as described in Table 2. The term v_i represents the individual random effect to account for the correlation between the observations from the same individual. In equation 1, $Look_{ij} = Look_{ij}^{*}$, if $Look_{ij}^{*}$ falls between 1 and 9, $Look_{ij} = 1$ if $Look_{ij}^{*} \leq 1$, and $Look_{ij} = 9$ if $Look_{ij}^{*} \geq 9$. The same applies to equation 3.

In equation 2 and 4, the explanatory variable specifications are similar to those used in equation 1 and 3, except that variable *Perceived_price* was added to vector C_i to control for its impact on willingness to pay. In equation 2, $Bid1_{ij} = Bid1_{ij}^{*}$, if $Bid1_{ij}^{*}$ falls between \$0 and \$5, $Bid1_{ij} = 0$ if $Bid1_{ij}^{*} \leq 0$, and $Bid1_{ij} = 5$ if $Bid1_{ij}^{*} \geq 5$. The same applies to equation 4.

Apart from product assessment and information treatment effect, we are interested in knowing the effect of taste on consumer willingness to pay. However, we cannot regress *Bid2* directly on *Taste* due to simultaneity. To avoid the endogeneity, we created another variable *Bid_delta* representing the change in WTP before and after tasting the products, as shown in Table 4. Taking the control group samples, we regressed *Bid_delta* on variety dummies as shown in equation 5 to identify the change in difference across varieties. A random-effect Ordinary Least Squares (OLS) model was used to account for within-subject correlation. The subscript *n* represents individuals in the control group. The other explanatory variables are the same as those used in equation 4. Mathematically:

$$Bid\_delta_{nj} = \alpha^{Bid\_delta} + \beta_j^{Bid\_delta} V_j + \theta^{Bid\_delta} * C_n + v_n + \varepsilon_{nj}^{Bid\_delta} \quad (5)$$

Since product tasting was the only action taken between the second and the first round of biddings and no information treatment was introduced in the control group, the change in bidding is expected to be driven by the product taste. The intercept α^{Bid_delta} represents the change of bidding for the California variety between the round 2 and the round 1. The coefficient vector $\beta_j^{Bid\_delta}$ represents the difference in the change of bidding between the NY varieties compared to the California variety.

We also tested the validity of instrumental variable *Supertaster*, which turned out to be a weak IV. We created this dummy variable based on the PROP test result. We followed the method from Tepper, Christensen and Cao (2001). PROP taster status was independently determined by the one-solution test using numerical cutoff scores of 51. *Supertaster* status was determined by the cutoff score generated from the 95% confidence interval around the group means for PROP taste intensity among the PROP tasters. A two-stage least square (2SLS) model was constructed to

check the relevancy of *Supertaster* on *Taste*. After the first-stage regression, a Stock-Yogo identification test was conducted, showing that *Supertaster* is a weak IV for *Taste*. This might be because the variable *Taste* which indicates overall taste satisfaction is too generic and does not link to "*Supertaster*" directly. It is known that "supertasters" are expected to detect a strong bitter flavor in vegetables (Jerzsa-Latta, Krondl and Coleman 1990), however, whether bitterness indicates lower taste satisfaction for broccoli is unclear. Furthermore, taste preference could be highly influenced by eating habits and environmental factors.

Apart from regression models, we also conducted a market share simulation following the approach of Lusk and Shogren (2007). We utilized the utility function for product j $U_{ij} = WTP_{ij} - P_{ij}$ where WTP_{ij} is the maximum willingness to pay for product j and P_{ij} is the price of product j. Consumer choice is determined by "highest utility" rule, i.e. the product which generates the highest utility in the choice set is chosen. Let I_{ij} be an indicator variable that takes value 1 if individual i chooses product j and 0 if not and assume the purchase volume is similar across individuals for simplicity, the market share of product j is calculated as:

$$MS_j = \frac{\sum_{i=1}^{N} I_{ij}}{\sum_{k=1}^{J} \sum_{1}^{N} I_{ik}} \quad (6)$$

CHAPTER 6

RESULTS

The regression results from the models in equation 1-4 are displayed in Table 5.

Table 5: Regression output

Variables	**Look (1)**	**Bid1 (2)**	**Taste (3)**	**Bid2 (4)**	**Bid_delta (5)**
V					
NY1	-1.339***	-0.191*	0.466	0.128	0.288**
NY2	-1.629***	-0.175*	0.161	0.103	0.277*
Interaction *VI*					
NY1 * I	0.928	0.095	-0.603	-0.056	
NY2 * I	1.258**	0.274*	0.738	0.129	
I	-0.453	-0.051	-0.025	-0.057	
_cons	5.722***	0.576***	3.815***	-0.029	-0.572*
V + interaction					
NY1	-0.410	-0.095	-0.137	0.073	
NY2	-0.372	0.098	0.899**	0.232*	
Demographics					
Age	0.019**	0.000	0.013	-0.000	-0.001
Gender	0.510*	0.321*	0.434	0.340**	0.089
Education	-0.008	0.012	0.173*	0.020	-0.015
HH_size	-0.093	-0.075	-0.019	-0.010	0.053
Broccoli_frq	0.367***	0.101	0.362***	0.165**	0.125**
Primary_shopper	0.180	-0.094	-0.172	-0.126	-0.024
Organic	-0.128	0.225	-0.106	0.039	-0.318***
Perceived_price		0.445***		0.549***	0.107**
Censored obs.	*96*	*21*	*70*	*22*	
N =	*450*	*444*	*450*	*444*	*267*

**p < 0.10; **p < 0.05; ***p < 0.01*

In equation 1 and 2, the coefficients for *V* (*Variety*) are both negative and statistically significant. This indicates that without product information, the NY1 and NY2 varieties were rated 1.34 and 1.63 points (on a scale from 1 to 9) lower than the California counterpart, respectively. Results also indicate that the WTP for the NY varieties was lower by $0.19/lb and $0.18/lb. For NY1 and NY2, respectively. This indicates a clear preference for the California product appearance among the consumers.

The coefficient of the interaction terms indicates the information treatment effect on the specified (i.e. information about product origin) NY variety compared with the CA variety. A significant coefficient means that the treatment effect from product information is different between the NY variety and the California variety. The coefficient for the NY2 variety is positive and statistically significant in equation 1, showing that product appearance rating of the NY2 variety increased up by 1.26 point relative to the rating of the California variety when information about product origin was provided. Similarly, in equation 2, consumer WTP for the NY2 variety was raised by $0.27/lb due to information treatment and this WTP is statistically significant. The coefficient for the interaction term for NY1 was insignificant, which means that the information treatment effect for NY1 is not significantly different from that for the California product.

When adding the coefficients of the interaction terms to those of *V*, we can determine the treatment effect of product origin information (the rows under *V* + interaction). For equations 1 and 2, we found that the combined coefficients were insignificant. This indicates that appearance ratings and WTP in the first round of bidding of the two NY varieties are not significantly different than from those of the California variety when product origin information is provided. This suggests that product origin information helped to eliminate the gap in product appearance and the WTP between both NY varieties and the California variety. This implies that there are benefits

from providing consumers with product origin information for the local varieties. Consumers could be more tolerant of the local varieties despite the less attractive product appearance.

None of the coefficients for *V* in equation 3 and equation 4 are significant. This means that the participants did not show a strong preference for the taste of the NY varieties or the California variety under blind tasting. Although the New York varieties were fresher than the California one (i.e. harvested a few days after the California variety), the taste of the California variety may be better accepted by the consumers due to its long prevalence in the market. The results indicate that, after tasting the product, was no statistically significant difference in consumer WTP between the two NY varieties and the CA variety. Considering that consumer WTP was lower for the NY varieties before tasting the product, this indicates an improvement in WTP for the NY varieties after product tasting. We will explore the effect of product taste on consumer WTP below.

The coefficients for the interaction terms between the variety and the information treatment are not significant in equations 3 and 4. However, when adding the coefficients of the interaction terms to those of V (*Variety*), we found significant treatment effect of product origin information for the NY2 variety. Since the coefficient of *V* for the NY2 variety was insignificant without treatment, this shows that providing information about product origin increased the taste rating and the consumer WTP of variety NY2. Specifically, when product origin information was given, the taste rating of the NY2 variety was 0.90 points higher and its WTP was $0.23/lb higher than its CA counterpart. This suggests that the NY2 variety has a potential to receive a price premium if the product origin information was revealed and if the consumers have the opportunity to taste the product. This again demonstrated the value of product information, combined with product tasting, in raising consumer willingness-to-pay.

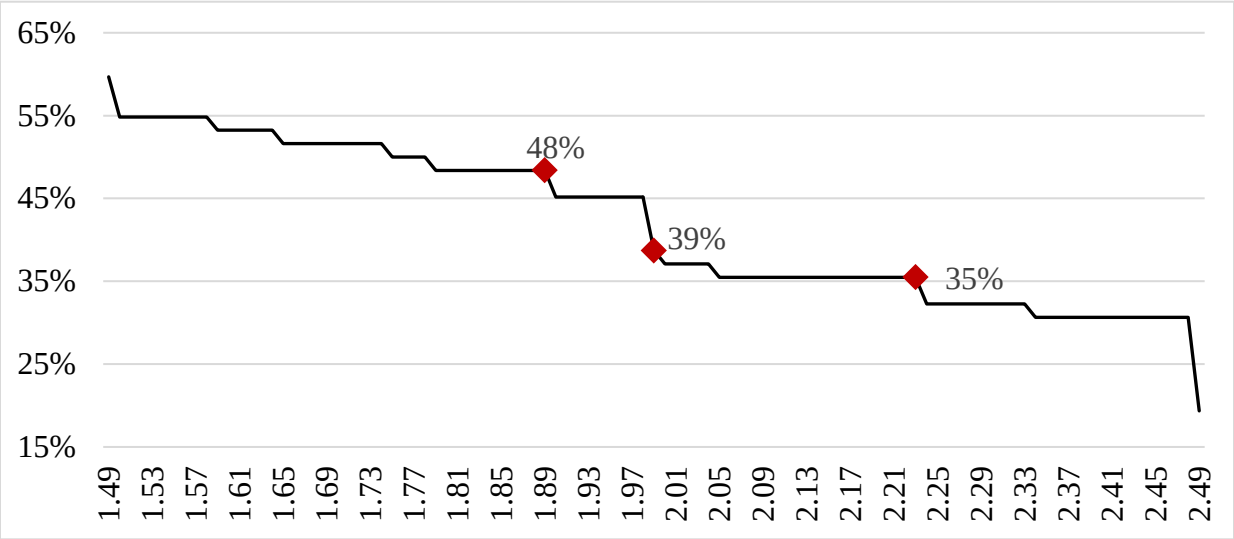
Among the control variables, the coefficients for *Gender* are significant in three of the equations, showing that female could be more tolerant of product attributes and have higher WTP. The coefficients in equation 2 and 4 indicate that the female participants were willing to pay $0.32-$0.34/lb more than the male participants. The coefficients for *Broccoli_frq* are also significant, especially in the product assessment equations. This is reasonable since higher consumption frequency indicates a preference for broccoli in general. The coefficients for *Perceived_price* are highly significant in equation 2 and 4 and relatively large in magnitude, suggesting that the price perception formed from daily shopping experience has a high influence on their bids.

We identified the effect of taste on consumer WTP by looking at the change in bidding before and after product tasting. Column 5 in Table 5 shows the result. The positive coefficient for *V* indicates a relative increase in WTP for the NY varieties compared with the California variety due to higher taste ratings. If we assume that consumer WTP for the California variety does not change after product tasting, the WTP for the NY varieties increased by $0.29/lb and $0.28/lb respectively, which is over 10% over the average price. Although no price premiums for the NY varieties were found compared with the California variety in equation 4, the positive effect of product taste on WTP more than compensates the lower WTP due to lower acceptance of appearance for the NY varieties as indicated by equation 1 and 2. This implies a significant role in the taste attribute in raising consumer WTP for the NY varieties compared to the CA variety.

From the consumer willingness to pay estimates, we could simulate product market share under different pricing scenarios. We assumed that the NY2 variety was introduced to the market which was dominated by the California variety. The price of the California variety was assumed to be fixed at $1.99/lb and the price of NY2 variety was expected to fall between $1.49/lb to $2.49/lb. We also assumed that consumers were given product origin information and that they

would have the chance to taste the products, e.g. through retailer promotion. We calculated the market share of NY2 variety using equation 6 as introduced before. Figure 5 shows the market share evolution at different price levels.

Figure 5: Market share for NY2 variety, with product information and tasting



The market share of NY2 variety drops from 60% to 19% when its price increases from $1.49/lb to $2.49/lb. When priced at the same level as the California product, the NY2 variety could capture about 39% of the market, while the California counterpart only captures 24%.

Taking both the market share and the price into account, we found that the highest revenue would be achieved if NY2 is priced at $1.89/lb. The step-wise decrease of the market share indicates that increasing price beyond certain points would reduce revenues. Revenue remains relatively stable when price changes from $1.99/lb to $2.48/lb, but further increase in price would lead to a sharp decline in market share as shown in Figure 6. The revenue-maximizing price lies at $2.23/lb, i.e. $0.24/lb higher than the California variety for the price range higher than $1.99/lb, this is in line with the price premium we found in the parameter estimates from equation 4.

Figure 6: Revenue for NY2 variety, with product information and tasting

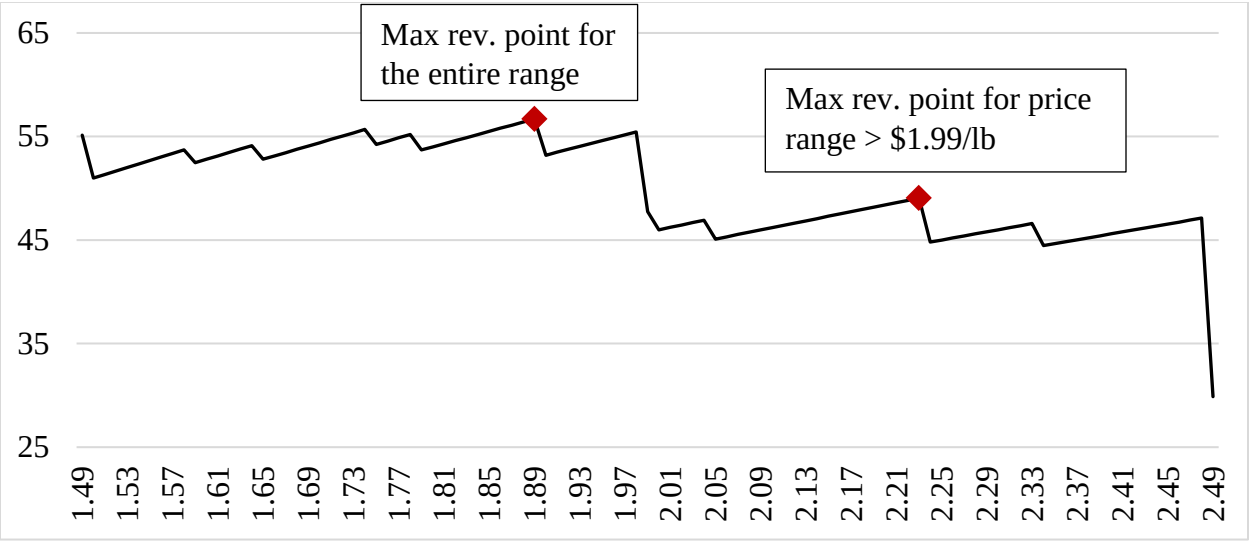
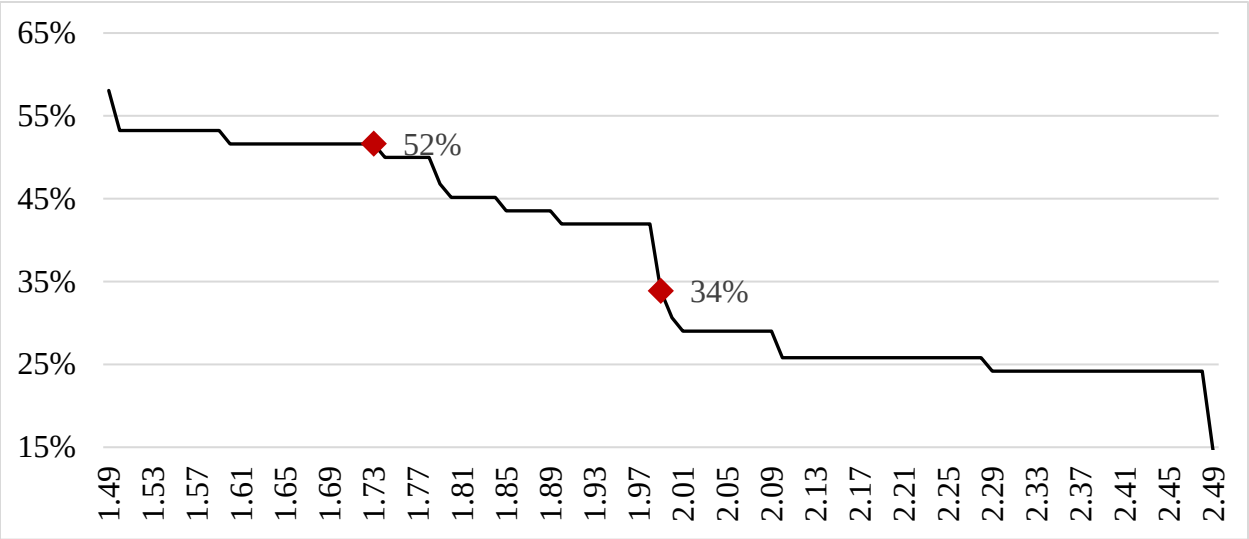


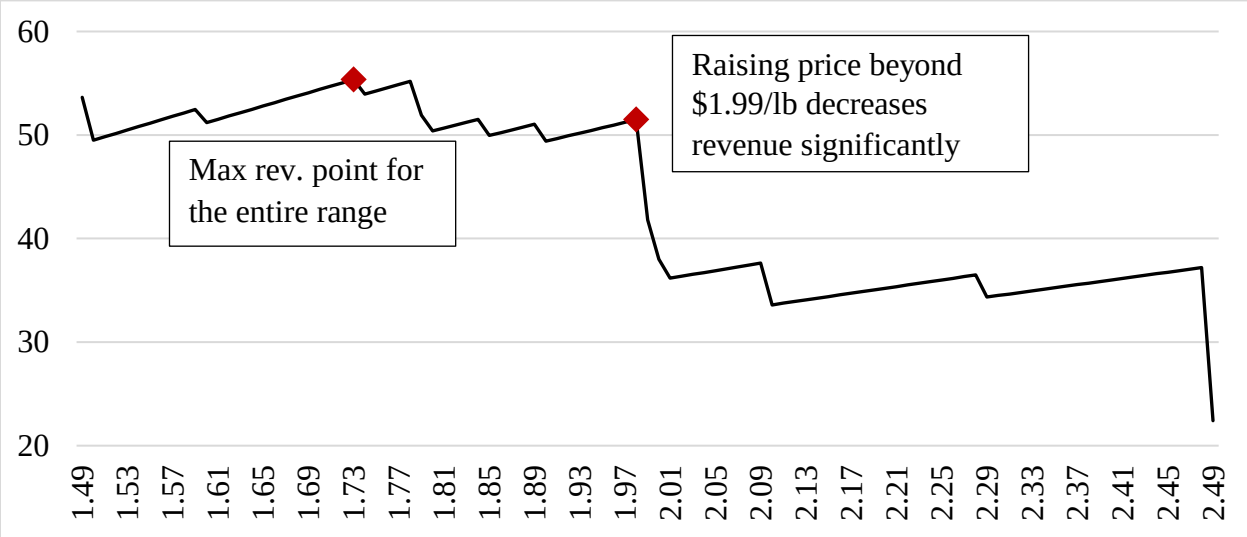
Figure 7: Market share for NY2 variety, with product information and <u>without</u> tasting



When assuming that consumers have not tasted the products, we simulate the market share of the NY2 variety and the CA variety similar to the simulation assuming that consumers tasted the products (Figure 7). Graphically, we observe a faster drop in market share when the NY2 variety is priced equal to or higher than the CA variety, in comparison to the results in Figure 4. This is in line with our finding in regression equation 2 that no price premium was found for the

NY varieties against the CA variety before product tasting. The NY 2 variety could gain a market share of 34% when its price is equal to the CA product. This is 5% point lower than the previous case with product tasting. The revenue maximization point was achieved at $1.73/lb for the entire price range, which is $0.16/lb lower than the previous case. Moreover, raising the price beyond the level of $1.98/lb significantly reduces the revenue (Figure 8). This simulation result implies that the NY broccoli should be priced in line or even lower than the CA variety to gain access to a wider market.

Figure 8: Revenue for NY2 variety, with product information and <u>without</u> tasting



Although the market share simulation is hypothetical and relied on assumptions, it could be a useful tool for the industry practitioners to determine the optimal pricing strategy. Further adjustments could be incorporated, such as using the profit maximization rule considering the purchase costs or product availability window, to tailor the result to retailers' needs.

CHAPTER 7

CONCLUSION

In this study, we assessed the product appearance and taste of two New York broccoli varieties compared with the standard California product and used an experimental auction to elicit consumer WTP. The two NY varieties were initially (i.e. without product tasting and no information about the product origin) not preferred due to less favorable appearance, with lower consumer WTP of about $0.20/lb compared with the CA product. However, the taste of the NY varieties was rated highly by consumers. Using two rounds of bidding, one before and another after product tasting, we identified the effect of taste on consumer WTP. The superior taste of the NY varieties has more than compensated their lower ratings in appearance. After tasting the products, consumers were willing to pay $0.28/lb and $0.29/lb more for the two New York varieties relative to the California variety. The WTP after blind product tasting were similar across the three products. These findings indicate that product sampling at retail outlets could be helpful to promote Eastern grown broccoli varieties.

We introduced information treatment on product origin to investigate the value of being "locally" produced. We found significant and positive treatment effects both before and after product tasting. Knowing that the broccoli products are from New York, the consumers became more tolerant of the product appearance and were willing to pay as much as that for the CA variety before product tasting. After product tasting, consumers were indifferent between the products when no information was given, but a price premium of $0.23/lb for one of the NY variety, the NY2 variety (Burney), was found when product origin was revealed. The difference of performance and consumer WTP between the two NY varieties could be driven by some inherited product attributes that were not further elaborated in this study. Product sensory assessment in

more detail might be helpful to distinguish between the two local varieties. The findings on information treatment effect show the benefit from revealing product origin for the Eastern varieties. Product labeling for the Eastern broccoli products that highlights the product origin could bring additional value to the products.

We also utilized market share simulation as a tool to explore the optimal pricing range for the local varieties. We found that the NY variety should be priced competitively against the CA variety if it is new to the market and consumers have tasted the product. A potential for $0.24/lb price premium could exist if consumers have the opportunity to taste the product. This is in line with the $0.23/lb price premium identified previously. Due to the lack of data such as purchasing and operating costs, we were not able to use profit maximization as the optimization criterion. However, such additional information could be easily incorporated into the analysis to derive the desired simulation results for industry practitioners.

Our study has provided valuable insights for the Eastern broccoli industry stakeholders and policymakers. We confirmed the market potential of the new Eastern varieties and provided practical insights into the marketing and pricing strategy for the Eastern broccoli varieties. Future studies could be conducted in other locations in the East Coast to explore regional heterogeneities on both broccoli varieties and consumers. Further exploration of the optimal pricing strategy might also be useful, for example, natural experiments at retail stores with price manipulation.

APPENDIX

4.A. SURVEY INSTRUMENT

Instructions

Welcome to an experiment in consumer decision making. Please read the instructions carefully and refrain from communicating with other participants. Also, please refrain from using your cell phones during the experiment. As stated in the Consent Form, your participation is voluntary, and you can withdraw from this experiment at any time.

In this experiment, you will be asked to indicate the highest amount of money you would pay for different product options. We will refer to this amount as your 'bid'. Bidding works as follows. Each participant will submit a bid for a product with a specified price range. The bid should represent the highest amount of money that you are willing to pay for the product. Next, we will randomly generate a market price for the product. If your bid is higher than the market price, you will purchase the product and pay the market price, rather than your bid, in return for the product.

In Part A and Part B of the experiment, you will have the chance to familiarize yourself with the bidding process. It is very important that you follow the instructions and ask any questions you may have. Please do **NOT** turn to next page unless advised so.

For Part A of the experiment, there will be one round of hypothetical bidding for cash value. For Part B of the experiment, there will be another round of hypothetical bidding for a pen. You will see how the market price is generated and determine if you purchased the pen.

For Part C of the experiment, you will be asked to bid for 1 pound of broccoli of three different types. The experiment proceeds in two rounds. In Round 1, you will observe the three products, give your ratings on their appearance, and bid for each of the product. In Round 2, you will taste the sample of each product, give your ratings on their taste, and bid for each of the product again. Out of the six bids you submit in the two rounds, one of them will be binding. A market price will be generated randomly after the auctions. For the binding round, you will purchase 1 pound of broccoli at the market price if your bid is higher than or equal to the market price. The binding round is pre-determined and the number is sealed in this envelope. I will randomly choose one of the participants to come up to open the envelope after the auction ends.

In the case that you will purchase the broccoli, you will be given the payment in the form of 1 pound of broccoli plus the balance in cash (i.e. $25 minus the market price for the broccoli you purchase). In the case that you will not purchase the broccoli, you will be given the payment of $25 in cash.

For Part D of the experiment, you will be given a taste test with a PROP paper strip. You will be asked to taste the paper strip and report the result. Next, you will answer some questions regarding your eating and drinking preferences.

After finishing Part D, you will be asked to complete a short survey, and complete a receipt for your payment and/or broccoli. Finally, you will proceed to the administrator to get your payment and/or broccoli.

Please raise your hand if you have any questions.

Part A: bidding for cash value

To explain the auction mechanism, I will use a **hypothetical** auction for a **One Dollar Bill** as an example.

It is important to understand that in order to maximize your earnings you should bid the true value of the One Dollar bill. To do that, you should obviously be willing to pay $1.00 for the one dollar bill, so it is optimal to bid $1.00.

Now, you will participate in a **hypothetical** bidding of a **Five Dollar bill**.

You will be asked to bid your maximum willingness to pay for the Five Dollar bill. You will type your bid (between $0.00 and $10.00) for the Five Dollar bill.

Remember, it is in your best interest to place a bid equal to the value of the product being auctioned!

Please indicate the maximum you would be willing to pay for the Five Dollar bill between $0.00 and $10.00 (with a maximum of 2 decimals) in the box below. Please look up when you are done.

Part B: bidding for a pen

In this part, you will participate in a **hypothetical** bidding for an object. You will bid for a pen shown below. You will submit a bid between $0.00 and $2.00.

Please indicate the maximum you would be willing to pay for the pen between $0.00 and $2.00 in the box below. Please look up when you are done.

Part C: bidding for broccoli

Round 1

We will start to bid for **1 pound** of three different types of broccoli.

We'll now display 3 types of broccoli to you, please have a close look at them. You can touch the product if you wish. Next, you will rate to what extent you like the appearance of each of the three broccoli products. Then, you will be asked to place your bid (between $0.00 and $5.00) for **1 pound** of each broccoli product, indicating the highest amount of money you would pay.

The 3 types of broccoli are labeled as follows:
Broccoli A
Broccoli B
Broccoli C

Please note that any one of the three bids could be binding in the end.

Please rate the **overall appearance** of each broccoli type: (from 1-9, with 9 being most favorable, 5 being indifferent, 1 being unfavorable). Check the columns that correspond to your ratings.

	1	2	3	4	5	6	7	8	9
Broccoli A									
Broccoli B									
Broccoli C									

When you rate the appearance of each product, what are the **most important criteria**? Please indicate the **importance** of the following criteria when you rate the product appearance in the previous question: (from 1-9, with 9 being most important, 5 being somewhat important, 1 being not important). Check the columns that correspond to your ratings.

	1	2	3	4	5	6	7	8	9
Color									
Crown shape									
Bead size (small/big)									
Bead size uniformity									
Bead tightness									
Other:									

Please indicate the **maximum** you would be willing to pay for **1 pound** of each broccoli type between $0.00 and $5.00 (with a maximum of two decimals) by entering the amount in the boxes below:

Broccoli A:	Broccoli B:	Broccoli C:
$	$	$

Round 2

Now, you are going to taste the broccoli samples on your table. They are all prepared in the same way (ready-to-eat and free of additives).

Please proceed from broccoli A to B to C **in sequence**. For each product, you will first taste the sample, rate to what extent you like the taste, and then place your bid (between $0.00 and $5.00) for **1 pound** of that product type, indicating the highest amount of money you would pay.

The 3 types of broccoli are labeled in the same way as in the last round.

Please note that any of the three bids could be binding in the end.

Broccoli A: please rate its **taste**: (from 1-9, with 9 being most favorable, 5 being indifferent, 1 being unfavorable)

	1	2	3	4	5	6	7	8	9
Broccoli A									

Broccoli A: please indicate the **maximum** you would be willing to pay for **1 pound** of each broccoli type between $0.00 and $5.00 (with a maximum of two decimals) by entering the amount in the boxes below:

Broccoli A:	$

Please use the water in the cup and the cracker in the bowl to clear the remaining taste before proceeding to the next product.

Broccoli B: please rate its **taste**: (from 1-9, with 9 being most favorable, 5 being indifferent, 1 being unfavorable)

	1	2	3	4	5	6	7	8	9
Broccoli B									

Broccoli B: please indicate the **maximum** you would be willing to pay for **1 pound** of each broccoli type between $0.00 and $5.00 (with a maximum of two decimals) by entering the amount in the boxes below:

Broccoli B:	$

Please use the water in the cup and the cracker in the bowl to clear the remaining taste before proceeding to the next product.

Broccoli C: please rate its **taste**: (from 1-9, with 9 being most favorable, 5 being indifferent, 1 being unfavorable)

	1	2	3	4	5	6	7	8	9
Broccoli C									

Broccoli C: please indicate the **maximum** you would be willing to pay for **1 pound** of each broccoli type between $0.00 and $5.00 (with a maximum of two decimals) by entering the amount in the boxes below:

Broccoli C:	$

Bidding result

Now you have bid for six rounds. We will now reveal the number for the binding round.

Next, we'll announce the market price for 1 pound of broccoli for the round selected.

Please record the market price that is drawn below:

Market price	$

Your compensation will be calculated at the end of the experiment based on the market price and your bid for the selected round.

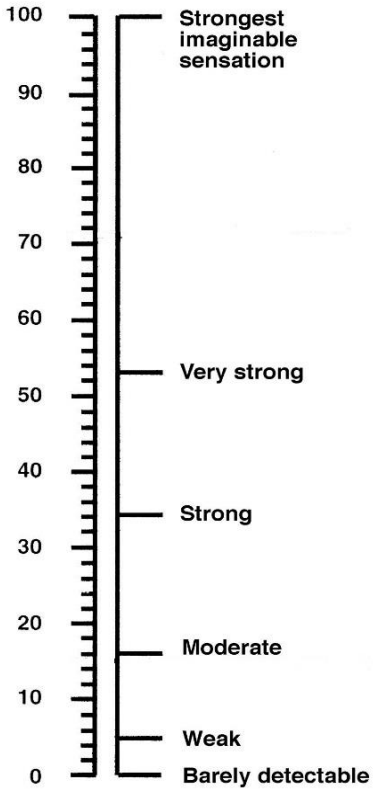
Part D: tasting test

In front of you, there is a cup of water and a paper strip. Please read the instructions first:

Step1: Take a sip of water and swish it around your mouth to clean it

Step2: Take the paper strip out and place it on your tongue for 30 seconds or until it's fully wet

Step3: Please rate the intensity of the taste of the paper strip report your feeling from 0 point to 100 points.



Note: the 0 point means the paper strip is no sensation, and the 100 points is the strongest sensation of any kind, including pain, that you can imagine experiencing

Intensity of sensation (0 – 100 points)	

Now we would like to ask you some questions regarding your eating and drinking behavior or preference, please answer openly and truthfully.

1. Your preference for salted snacks such as nuts, pretzels, and potato chips:
   I find most snacks too salty.
   ☐ I like salty snacks.
   ☐ I am addicted to salty snacks.

2. Your salt preferences
   (try to answer by your taste preference, not from a health standpoint)
   ☐ I find many foods too salty.
   ☐ Food usually tastes fine as it is and/or I add a modest amount of salt when I cook.
   ☐ I usually add a little extra salt to my food, or would like to but don't for health reasons.
   ☐ People give me a hard time for adding too much salt.

3. Describe the perfect cup of coffee/tea:
   ☐ I like it very strong (espresso or black tea: English Breakfast tea).
   ☐ I like it strong (Starbucks, Peet's or Earl Grey tea).
   ☐ I like it medium (the weak coffee served at work, green or herbal tea).
   ☐ Coffee/tea tastes terrible; I can't stand it.

4. Sugar in your coffee/tea
   (if you don't drink either of them, please answer by your taste preference):
   ☐ I drink coffee/tea with no sugar.
   ☐ A touch.
   ☐ One teaspoon or the equivalent.
   ☐ Two or more teaspoons.

5. How do artificial sweeteners taste such as in diet sodas?
   (try to answer by your taste preference, not from a health standpoint)
   ☐ No taste problem or I can not tell the difference.
   ☐ Do not know-I've never tried an artificial sweetener in my life.
   ☐ Taste funny, but not too bad.
   ☐ I can tell a big difference but have adapted OR some are much better than others.
   ☐ They taste horrible.

6. Cream/milk in your coffee/tea:
   ☐ I drink coffee/tea black.
   ☐ A touch of cream/milk.
   ☐ Moderate cream/milk.
   ☐ Lots of cream/milk.

7. Do you enjoy coffee with steamed milk or flavoring such as almond, vanilla, Irish Cream? (if you don't drink coffee, please answer by your taste preference):
   ☐ No.
   ☐ Cappuccino, latte, or cafe au lait - but not flavorings.
   ☐ Sometimes.
   ☐ Yes.

8. Do you occasionally drink very strong liquors such as straight Scotch, Cognac or Armagnac?
   ☐ Yes.
   ☐ Sometimes.
   ☐ Never.

Before the experiment ends, you will be asked to complete a short survey. You will also be asked to complete a receipt to receive your payment and/or broccoli. Finally, you will proceed to the administrator to get your product and remaining balance.

Please use the table below to help you calculate compensation:

Broccoli Type for Exchange:	☐ A ☐ B ☐ C
Market Price:	$
Winning bid:	☐ Yes ☐ No
Compensation: (please round up decimals to the nearest whole number)	$

Exit Survey

1. What is your gender?
   ☐ Male ☐ Female

2. What is your age?
   _____

3. What is the highest level of education you have completed?
   ☐ Less than High School ☐ High School/GED
   ☐ Some College ☐ 2-year College Degree
   ☐ 4-year College Degree ☐ Masters Degree
   ☐ Doctoral Degree ☐ Professional Degree (JD, MD)

4. How would you identify yourself?
   ☐ White/Caucasian
   ☐ African American
   ☐ Asian
   ☐ Other

5. How many people are there in your household?
   ☐ 1 ☐ 2 ☐ 3
   ☐ 4 ☐ 5 ☐ 6
   ☐ More than 6

6. Are you the primary grocery shopper in your household?
   ☐ Yes ☐ No

7. Based on your grocery shopping experience, what do you think is the retail price for 1 pound of broccoli?
   _____ $/lb

8. Please indicate approximately what percentage of vegetables that you purchase is organic.
   _____%

9. Have you had farm experience before, e.g. lived or worked on a farm?
   ☐ Yes ☐ No

10. How often do you cook your meals?
   ☐ Never ☐ Less than once a week
   ☐ 1-3 times a week ☐ 4-5 times a week
   ☐ More than 5 times a week

11. How often do you include broccoli in your meal per month (dining out included)?

☐ Less than 1 times a month ☐ 1-4 times a month

☐ 5-10 times a month ☐ 11-15 times a month

☐ More than 15 times a month

12. What is your preferred way of cooking broccoli (you can choose multiple)?

☐ Steamed ☐ Boiled

☐ Baked ☐ Raw in salad

☐ Other (please indicate)

13. Are you vegetarian or vegan?

☐ Yes ☐ No

14. Do you have broccoli inventory at home? If so approximate how many pounds?
(Please input zero if you don't have any broccoli inventory at home)

_____ lb

15. How hungry are you?
(Please rate on a scale of 1-9, with 9 being very hungry, 1 being not at all hungry)

	1	2	3	4	5	6	7	8	9
Hunger level									

This is the end of the experiment.

Please write down your compensation on the receipt and proceed to the administrator.

Thank you for participating in this study!

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