HOW LABELING CHANGES CONSUMERS' TASTE PERCEPTIONS: A FIELD EXPERIMENT ON ORGANIC AND LOCAL APPLES

by

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ABSTRACT

The markets for organic and local foods have grown rapidly over the past decade. Among the reasons for this impressive growth, taste has been considered one of the more important. However, little is known regarding the role of labeling in consumers' taste perceptions for local and organic foods. Learning how taste and labeling may interact and alter consumer perceptions would also be of benefit to many in the food marketing system. The goals of this study were thus twofold. The first was to determine if labels play a role in consumers' perception of taste of organic and local apples. The second was to examine what contributes to the changes.

To accomplish these goals, three sessions of field experiments were conducted in Delaware in late October and early November 2012 with a total of 106 participants. These sessions represented the student sample, the general public and consumers who likely purchased organic and local foods more, respectively. In an experiment, each person was first served five freshly cut slices of Gala apples labeled A, B, C, organic, and local, presented together on one plate. Unknown to them, the slices labeled A and organic came from the same apple, as did those slices labeled B and local. The apple labeled C was a conventional version. While tasting, each person was asked on a survey to rate and rank the taste of apple slices. Surveys presented the apple names in different orders in case people followed the list when tasting. Demographic

information and opinion questions regarding local and organic foods were also asked for modeling purposes.

The one-tail Wilcoxon Signed-Rank test was performed to test the mean of the ratings and rankings. Results from pooled data indicated that subjects' taste perception of organic and local apples changed significantly by the labeling information: the mean rating and ranking of labeled organic apples and labeled local apples were significantly higher than the corresponding unlabeled ones. However, these three sessions did not act in agreement. Next, a two-limit Tobit model regression was performed to further investigate the differences in taste ratings from the unlabeled organic/local apples to the labeled apples. The biggest factor was found to be the session difference.

Results indicated that there existed groups of consumers that reacted differently to the influence of labeling. Some were affected while others were not. It could have something to do with their shopping habits but in this experiment, demographics was not a contributor.

Chapter 1

INTRODUCTION

1.1 Background and Motivation

Organic and local foods have been gaining more popularity for both researchers and consumers in recent years. With a growth rate of 9.4 percent during 2011, sales of organic food in the US outpaced the growth of total food sales, which was only 3.2 percent (see Table 1.1 and Figure 1.1). The organic Trade Association (2012) reported that the organic market has reached new heights, with retail sales totaling $29.2 billion, and continues to increase its overall share in the market, climbing to 4.2 percent of the $695.7 billion in food sales in 2011. However, this figure was only 1.2 percent in 2000. The organic food sector grew by $2.5 billion during 2011, with the fruit and vegetable category contributing almost 50 percent of those new dollars.

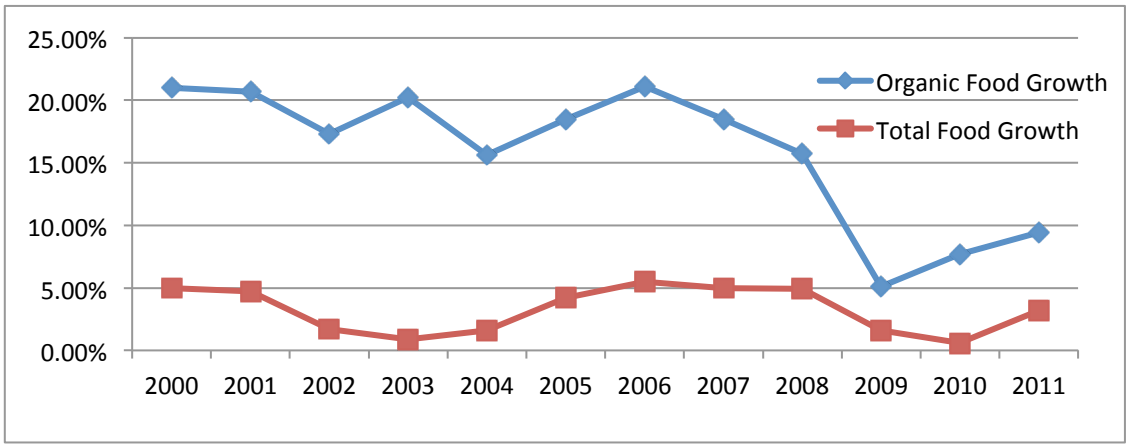
As to the case of local food, there have been no firm statistics about its sales due to the ambiguousness in the definition of "local": consumers' interpretation of "local" may involve various measures of geographical distance (mile radius, political and regional boundaries) or even include considerations on the length of the food supply chain (Hand and Martinez, 2010). A USDA research report states that,

Table 1.1 Organic Food VS Total Food Sales, Growth and Penetration, 2000-2011

Year	Organic Food	Growth	Total Food	Growth	Organic % Total
2000	6,100	21.00%	498,380	5.00%	1.20%
2001	7,360	20.70%	521,830	4.70%	1.40%
2002	8,635	17.30%	530,612	1.70%	1.60%
2003	10,381	20.20%	535,406	0.90%	1.90%
2004	12,002	15.60%	544,141	1.60%	2.20%
2005	14,223	18.50%	566,791	4.20%	2.50%
2006	17,221	21.10%	598,136	5.50%	2.90%
2007	20,410	18.50%	628,291	5.00%	3.20%
2008	23,607	15.70%	659,012	4.90%	3.60%
2009	24,803	5.10%	669,556	1.60%	3.70%
2010	26,708	7.70%	673,324	0.60%	4.00%
2011	29,220	9.40%	695,714	3.20%	4.20%

Source: Organic Trade Association's 2011 and 2012 Organic Industry Survey ($ mil consumer sales)

Figure 1.1 Organic Food vs Total Food Growth, 2000-2011



Source: Organic Trade Association

"According to the definition adopted by the U.S. Congress in the 2008 Food, Conservation, and Energy Act, the total distance that a product can be transported and still be considered a 'locally or regionally produced agricultural food product' is less than 400 miles from its origin, or within the State in which it is produced" (USDA, 2010). However, surveys have shown that people have different opinions on this, and, "local" might mean different things to different people. In spite of the vague definition, US Department of Agriculture (USDA) data and industry sources suggested double-digit annual growth (Martinez et al., 2010). Locally produced foods may have brought in $7 billion in 2011, compared to $4.8 billion in sales in 2008 (Los Angeles Times, 2011).

With the burgeoning of these markets, when it comes to the motivation for buying organic and/or local foods, studies have come up with different explanations. Some speculate that it is environmental concerns that are driving people to purchase these foods (Pirog and Larson, 2007), but others find that production and quality concerns can also lead to consumers' purchasing behavior (Bond et al., 2008). Still, most studies have shown that private values rank above public-good values for a large range of food products. For example, Lusk and Briggerman (2009) rank taste as the third most important among consumers (after safety and nutrition) and Constanigro et al. (2011) report a similar rank among these values. Taste is also reported to be one

of the most important reasons for consumers to purchase organic food repeatedly (see the next chapter for more details).

With regards to the sensory properties of organic food, the results of previous studies are inconsistent, both in panelists' analyses and consumers' expectation and descriptive data. Hughner et al. (2007) summarized the studies on organic food consumption. The authors found in the existing literature that many consumers associate "organic" with a higher quality and therefore, they perceive a better taste, but blind taste tests only favor some categories of organic food over their conventional counterpart. Thus, the premium for organic food is partly the result of consumers' ex ante perspective. Other studies have conflicting results considering the comparison of the taste of organic and local food. More studies are needed to investigate the taste of these foods and obtain consumers' preferences for them.

In addition, previous studies have been using definitions and/or other information to affect consumers and to extract their willingness to pay for organic foods. A uniqueness of this study was that no information about organic or local food was provided (e.g. definition). Thus this experiment was the closest to real purchasing behavior in a food store and the results reflect consumers' true preferences as much as possible.

The literature has few studies that investigate the direct interaction of tasting and labeling. Napolitano et al. (2013) had consumers taste and compare

cooked organic and conventional chicken breast and found that respondents were more affected by the labels. Lee et al. (2013) reported similar conclusions experimenting on cookies, yogurt and potato chips. Fresh fruits and vegetables have not been investigated much yet on this subject. Thus this experiment will give important insights on how consumers' taste perceptions change after being affected by labeling information.

1.2 Purpose

The purpose of this study was to examine the influence of label on consumers' taste preferences for organic, local and conventional apples. The first of the goals was to examine if labels play a role in consumers' perception of the taste of organic, local and conventional apples by serving participants slices of the same apples with different labels. Unaware of this fact, participants were asked to rate and rank the taste of these slices, and results showed that labels do matter in terms of taste. Another purpose was to determine consumers' changes in taste ratings under the influences of the labels by performing Tobit regression analysis using subject demographics and session information.

This study contributes to the literature in the following ways. First, as far as we know, this was the first study to examine the interactions of tastes and labels on fresh food (apples). Different labels on the same apples applied in this within-

subject experimental design directly measured the influences of organic and local labels. Second, through the experiment, no definition or other information about organic and local foods was provided to the participants. Most previous studies influenced participants with additional information in their experiments.

Results of this research will benefit producers and marketers by providing information on consumers' perception of taste of organic and local apples. More consumer-attractive labeling involving taste could be applied according to the results. For example, conventional apples could be labeled with the phrase 'Taste better than you think.' Also, results of consumers' actual preferences of these apples will help in different marketing strategies.

1.3 Organization of Thesis

Following this introduction is a detailed literature review. The first part is a general review of organic and local foods: why people buy them, the characteristics of the people who purchase them and other related items are discussed. Next, some sensory tests, which are done on organic and/or local foods, are reviewed on foods such as yogurt, cookies, fruits and vegetables. Results are compared with respect to consumers' preferences and whether there are statistically significant differences between these foods. Also, the influences of organic-related and local-related labeling are examined.

Chapter three discusses the experimental design. The process of the experiment is presented, followed by the explanation of the survey used in the experiment. Additionally, the reasons for both rating and ranking the tastes of the apples are justified.

In the following chapter, we start with the data analysis methods: Wilcoxon Singed-Rank Tests were used to interpret the ratings and rankings of the sensory results.

In chapter five, Tobit regression was performed to determine the differences of taste ratings. The concepts and application of this methods are detailed in the section. Following these, results of this experiment are presented and discussed.

The last chapter interprets and summarizes the results. Then the theoretical and practical implications of the thesis are discussed. Last, this chapter concludes with limitations of the study and suggestions of future research.

Chapter 2

LITERATURE REVIEW

This chapter reviews the literature on organic and local food, focused on the aspects of tasting and labeling. First, past literature that studies the characteristics of organic and local buyers and the factors that drove people to purchase these foods is introduced. Then, recent studies that investigated the taste of organic food or local food and compared it with conventional food are examined on several fresh and processed foods. Last, the effects of labeling on consumers' purchasing decisions and preferences are discussed.

2.1 Organic and Local Food

This study focused on two niche food products: organic and local. There have been a large amount of studies that explore consumers' preferences, perceptions and willingness to pay (WTP) toward organic and local foods as well as organic and local consumers' demographics.

What are the characteristics that relate to consumers' purchasing organic food? Though it is generally claimed that social and economic demographic characteristics are essential, previous studies were not entirely consistent with these

explanations. There is no complete profile of the people who buy organic food more than others.

Dimitri and Dettmann (2012) analyzed records of food purchasing data over a one-year period from 44,000 households using demographic information. The results confirmed the relation of higher education and the higher possibility of purchasing organic food. Also, the influence of marital status, household income and access to organic was positively consistent across different model specifications. Ngobo (2011) also found that higher income and college education could induce a greater chance of purchasing organic food by analyzing a dataset of 4,500 households in 25 stores over a period of five years. They concluded that older families and consumers with high-level occupations (e.g. executive, business people) would have a greater likelihood of buying organic food. Higher income and higher education were also related with higher frequency of purchasing organic food by some other studies (Spiller and Obermowe, 2009; Padel and Foster, 2005; Stobelaar et al, 2006).

When it came to gender, women were found to be willing to pay more for organic food and more concerned with healthy diets and food safety (Urena et al, 2008; Fagerli and Wandel, 1999; Yiridoe et al, 2005). Findings regarding other social demographic variables on the influence of buying organic have been mixed. Loureiro et al. (2001) found that having children under 18 would increase the purchase of organic food, while Zepeda and Li (2007) had the opposite conclusion and Durham

(2007) did not find any impact of having children under 18 on buying organic food. Ethnicity generated mixed results as well (Baxter, 2006; Dettmann and Dimitri, 2010).

Besides the search for characteristics, there have been numerous studies that try to explain why consumers purchase organic food as well. The relative importance of these factors was also found to be inconsistent. In general, the reasons could be categorized into private (health, food safety, etc.) and public (environment, social welfare, etc.) ones. Davies et al. (1995) summarized various groups of organic consumers as healthy eaters, humanists, hedonists, welfare enthusiasts and environmentalists.

When it came to private reasons, Bonti-Ankomah and Yiridoe (2006) identified health to be the most crucial reason that consumers demanded organic food. Padel and Foster (2005) reviewed the literature and also concluded that health was a very important motive (but not the only one) that drove people to buy organic food and that for different food products there could be different reasons. For example, for organic meat, McEachern and Willock (2004) reported four most important factors (meat safety, animal welfare, quality assurance and media topics) and emphasized that these could not be generalized to account for other food types. For different countries there were inconsistent conclusions as well. Wier and Calverly (2002) found that consumers concerned with food safety in Britain, France, Denmark and Germany

would purchase organic food. In Costa Rica, health and environmental concerns were reported to be the most important motives for organic consumers (Aguirre, 2001).

Public reasons were also important for the consumers. McCluskey et al. (2009) examined respondents' preferences for three socially responsible food products with in-person survey data and concluded that concern for the environment was the most important factor to explain consumers' WTP across all three products. Durham (2007) also stated that personal health and environmental protection drove people's consumption of organic food and especially reported that the concern for the environment increased organic food purchase more than health motives.

Other motivations such as freshness (Buzby and Skees, 1994; Groff et al., 1993), nutrition (Buzby and Skees, 1994; Cunningham, 2002; Demeritt, 2002), pesticide-free (Byrne et al., 1994, Huang, 1996) have also been found to be important when people made their organic food purchase decisions.

So how well do consumers understand organic food? Hu et al. (2011) studied consumers' WTP for different labeling versions of a processed food and found that consumers were confused about the meaning of the organic logo. Also, Bonti-Ankomah and Yiridoe (2006) reviewed consumers' knowledge of organic food products and came to the following conclusions. First, consumers were not consistent in the explanation of what was organic though they did have some understanding about organic products. Second, consumers did not quite understand the complexity

of organic production or the attributes of organic food. Demeritt (2002) reported that 59% of the respondents stated that they never purchased organic food only because they knew nothing about it. Thus, a potential organic food market existed and could be developed if the knowledge of organic food could be spread to more consumers.

Similar to organic food, there have been several reasons for consumers to purchase local food in the literature. Consumers were also driven by both public and private motives. Local food was assumed to be fresher and consumers had more faith in local food products because they knew the producers personally (Midmore et al., 2005; Tilmany et al., 2008). A survey conducted by the Food Marketing Institute in 2009 rated freshness, supporting the local economy and tasting good as the three most important reasons that respondents purchased local food. Keeling et al. (2009) also reported that nutrition was another driver for local food. The taste of local and organic food was also reported a significant consideration for consumers' purchasing behavior. The next part is a detailed review on this.

2.2 Taste

According to Darby and Karni (1973), there were three levels of food attributes. The first level included search attributes (e.g. price and appearance), of which consumers could easily obtain information about. Taste belonged to the second level, namely experience attributes: consumers would only know after they tried or

consumed the product. Credence attributes were the third level, of which consumers could not know even if they had experience with the product. Labeling is used to form a credence attribute into a search attribute.

Lusk and Briggeman (2009) studied consumers' food value systems by utilizing the method of best-worst scaling. People were asked to choose the most and the least important issues when purchasing food in each question. A list of eleven food value items were presented and distributed to the survey questions. Their results showed that on average, the value of taste was the third most important among consumers. Also, these values played an important role in consumers' preferences for organic food. According to Hamm et al. (2002), taste was also the third most important, following food safety and nature conservation, of sales arguments used to justify the price premium for organic foods. It has been pointed out that sensory properties were important factors and should be taken into account in organic food marketing strategies (Brennan and Kuri, 2002; Padel and Midmore, 2005). Cunningham (2002) reported that 93% of the Canadian consumers considered taste as a key consideration when they bought organic food. Similarly, it was reported that 87% of American consumers considered taste as the primary reason when they purchased fresh products (The Packer, 2002).

In spite of the essential role of taste reported in the literature, there are conflicting results regarding whether or not organic food has better taste than

conventional food on a wide range of products (Zhao et al., 2007; Shafie and Rennie, 2012; Moser et al., 2011). Fillion and Arazi (2002) examined orange juice and milk to determine whether the claim of 'organic food tastes better' could be substantiated via sensory analysis using trained panelists and general consumers. On one hand, panelists could distinguish between the taste of organic and conventional orange juice, and consumer testing further indicated that organic orange juice tasted better. However, organic milk and its conventional counterpart were not differentiated in terms of taste. Thus, they concluded that the global claim was not valid, and each type of product should be treated separately before making any judgment on its taste.

According to Padel and Foster (2005), fruits and vegetables were consumers' first and in many cases only experience with buying organic food, and consumers would associate organic first with fruits and vegetables. This makes sense as organic fruits and vegetables comprise the largest segment of the organic food market (Moser et al., 2011). Given the role of fruits and vegetables, studies focused on their taste have been done on a variety of products.

Gilsenan et al. (2006) carried out a study on Irish grown organic and conventional tomatoes to compare the taste, texture and appearance using semi-trained panelists. No statistically significant difference was found in these sensory attributes. Yet, Gilsenan et al. (2012) shared that conventional tomatoes were sweeter and less sour than organic ones when evaluated by a trained panel. Also, unaware that they

were comparing organic and conventional produce, a consumer panel in their study was able to detect a perceivable difference between organically farmed and conventionally produced tomatoes (in a triangle test), but favored the taste of the conventional ones (in a paired preference test). According to Lawless and Heymann (2010), a triangle test is a type of difference test to determine if there exists a sensory difference between two products. It could be in the form of AAB or ABB (A and B represent two products), where three coded samples are presented to the panelist to pick out one that is different from the other two. Additionally, Gilsenan et al. (2008, 2010) did studies on carrots, mushrooms and potatoes, yet they did not observe significant difference in the taste of organic and conventional versions of these vegetables.

Meanwhile, organic bananas were not distinguished from conventional bananas by a triangle test (Caussiol and Joyce, 2004). Also, Reganold (2001) did not detect overall acceptance differences in organic, conventional and integrated production apples by consumers, though organic apples were evaluated as less tart and sweeter.

Of the studies that investigated multiple varieties of organic fruits and vegetables, Basker (1992) investigated the taste of nine kinds of organic and conventional products (bananas, mangos, orange juice, grapefruit, white grapes, tomatoes, carrots, spinach, and sweet corn) and reported that organic bananas,

conventional mangos and conventional orange juice were preferred, but the difference between the organic and conventional types was not significant among the other products. Similarly, Tobin et al. (2013) compared the sensory properties of nine organic and conventional fruits and vegetables (apples, bananas, broccoli, carrots, cherry tomatoes, onions, oranges, potatoes, and vine tomatoes) using a trained panel of nine. Their analysis did not show statistical difference between organic and conventional versions for any individual product or for overall pooled data. Zhao et al. (2007) produced organic and conventional vegetables (arugula, cucumbers, mustard greens, onions, spinach, tomatoes and red loose leaf lettuce) to compare the overall liking by consumers and also found no difference. Covariance analysis showed that demographic information could affect sensory evaluations as well and the study suggested further studies investigate the detailed influence.

These studies show the inconsistent results regarding the comparison of taste in organic and conventional fresh foods, and that consumers' perception of taste could be affected by several factors, with labeling being one of them. Next is a review of previous studies that explored the effects of labeling on consumers' choice as well as the interaction of taste and labeling.

2.3 Labeling

Food labeling has been a key marketing strategy to discriminate and promote certain foods. Organic and local labels have also brought much attention to the literature. A vast amount of studies have been focused on how consumers react to these labels and what their preferences are.

First, eco-labeled apples were investigated by Louriero et al. (2001). They collected in-store survey data to assess consumers' choices among organic, eco-labeled and conventional apples and found that eco-labeled apples were in general less desired than organic apples. Especially for those who had children and were more concerned with health and the environment, organic apples were their choice if the prices of organic and eco-labeled apples were equal, possibly because organic apples were more established and preferred by consumers. On the other hand, people without children or with less concern about health and the environment selected conventional apples instead. Thus, eco-labeled apples were considered the intermediate product amongst consumers. Labels had strong effects on consumers' choices with different demographic characteristics.

When it came to the welfare-labeled food, according to Olesen et al. (2010), if a certain production method, which could benefit the environment or be better for the welfare of fish, could be marked and labeled on the fish product, then producers might gain a price premium from these labels. They investigated consumers'

WTP for organic and welfare-labeled salmon utilizing a non-hypothetical choice experiment and found that consumers preferred these labels and were willing to pay a price premium of approximately 15% for organic and welfare-labeled salmon of the same color as conventional salmon.

Researchers also compared the values of organic and local labeling and most found that local trumped organic. James et al. (2009) used a choice experiment to elicit consumers' preferences for applesauce among the attributes of locally grown, organically grown, low fat and no sugar added. Their analysis indicated that WTP for local was higher than the other three labels. They also found that WTP for organically and locally grown products would decrease with the increase of consumers' knowledge of agriculture. Another study by Constanigro et al. (2011) using apples also showed that local was valued higher than organic. This was explained by public and social reasons (e.g. supporting the local community). Loureiro and Hine (2002) reported higher price premium for locally grown (Colorado) potatoes than for organically grown ones. Bond et al. (2008) also found that three out of four consumers were willing to pay more for locally grown than for both organic and vitamin C enhanced melons.

The labels of organic and local were also studied together with other attributes. Hu et al. (2009) used an in-store conjoint experiment to examine consumers' WTP for the attributes of organic, local (Kentucky-grown) and sugar-free

on six types of processed blueberry products. Their results showed that across all types WTP for local and organic products generally were higher though there was heterogeneity in consumers' preferences and WTP estimates. Hu et al. (2012) found similar results from an experiment on blackberry jam conducted in Kentucky. They evaluated different levels of local labeling (sub-state, state-level and multi-state level) and concluded that consumers were no more likely to purchase a sub-state level product (from their own region of the state) than to buy a state-level product. In addition, the label of organic largely increased WTP among consumers.

Different levels of organic labels have been compared as well. Van Loo et al. (2011) reported that overall consumers were willing to pay a price premium of 103.5% for USDA certified organic chicken breast, much higher compared to 34.8% for the general organic label, especially for habitual organic buyers (244.3% and 146.6%, respectively). In Europe, there were also several types of organic labeling. Janssen and Hamm (2011) interviewed 2441 consumers of organic food from six countries and found that their choices of label were more subjective than objective. Thus it was suggested that organic food products use well-known certification to increase consumers' trust.

Labeling and taste could interact and change consumers' perception toward food. There are only a few studies that focus on this interaction. Napolitano et al. (2013) found that consumers were more affected by the organic label than the

sensory properties of cooked chicken breast. Train panelists were able to distinguish the differences in taste of organic and conventional chicken breast while general consumers could not in a blind tasting round. Further surveys showed that consumers perceived organic as tasting better, and a second round of tasting with the organic and conventional labels revealed that the participants preferred the taste of organic chicken breast. Thus, the effect of labeling overwhelmed actual tasting in this study.

Lee et al. (2013) concluded that organic labels biased taste perceptions. Three paired food samples (cookies, yogurt and potato chips) were tasted and evaluated by the participants. There were two identical organic items in each pair with one item labeled conventional. The 'organic' ones in the experiment received higher WTP and better nutritional evaluations, though consumers who bought organic food more often reported smaller differences in the evaluation for the 'organic' and 'conventional' food products.

In a similar experiment, Toschi et al. (2012) labeled two kinds of conventional nonflavored yogurts as organic and had participants taste them in both a blinding test and a labeled test. The results indicated that for one kind, consumers rated the labeled 'organic' one better and rated it good in the blind taste test. However, the other kind of conventional yogurt was rated bad in the blind test and was rated worse when labeled organic. Toschi et al. explained that consumers had higher

expectation of taste and quality for organic good and when it was not as good, consumers would be disappointed more.

This experiment also studied the interaction of tasting and labeling and their influence on consumers' preferences for organic, local and conventional apples. However, a different method of labeling was used and no deception of any kind was involved. In the next chapter the experiment will be introduced.

Chapter 3

METHODOLOGY

The main purpose of this thesis is to investigate if labeling plays a role in consumers' perception of taste of organic, local and conventional apples. In addition, we would like to examine what contributes to the differences of their taste perception. Thus, a within-subject design of field experiments was chosen to accomplish these goals, similar to the real world scenario where consumers are faced with real products and make purchasing decisions accordingly.

Three sessions were conducted in Delaware between October 26th and November 4th, 2012, with a total of 124 participants. The first two were carried out on campus at the University of Delaware and in a local park, respectively, while the last one took place at a natural food store during which time a farmers' market was held in front of the store. In our opinion, the local park can best represent the general population. The student session was picked because students were future consumers and their opinions of organic and local foods mattered. Additionally, people who went to the natural food store and a farmer' market would generally pay more attention to organic and local food and buy them. It would be necessary to understand their behavior. We thought that consumers in different sessions might show different

patterns in their behavior, thus, all the analyses would be done based on location among other things. In each session, subjects were approached and asked to participate in a study involved eating apples and taste evaluation. Subjects received five dollars in cash in exchange for their participation.

3.1 Experimental Design

After a subject agreed to participate, he or she was served with five slices of freshly cut Gala apples together on one plate. Gala apples were selected for two reasons. First, the taste of them is mild amongst the various kinds of apples. Second, it is easy to get similar-looking organic, local, and conventional Gala apples so that participants would not be biased towards the appearances. Additionally, the skin texture of the apples picked was similar so that the participants would not be able to tell the difference. The apples were washed before the experiment, but not pealed. These slices were labeled A, B, C, local and organic. No other information about these apples was provided except for their labels, while in fact, slice A and slice organic came from the same apple and so did slice B and slice local. The slices labeled C were actually the conventional ones, bought from a supermarket in the neighborhood. Organic apples were purchased from a Whole Foods store and the local ones came from a nearby orchard. The letters and real labels were not matching so that participants would not think of them as matching and try to pair them.

Before tasting, consumers were given a survey (included in Appendix A) to fill out during the experiment and asked to drink some water and eat some crackers in between trying different slices to cleanse their palate. The object of a palate cleanser is to assist in the removal of residual materials. According to Lucak and Delwiche (2009), among various kinds of palate cleansers (chocolate, pectin solution, table water crackers, warm water, water and whole milk), table water crackers were the only effective one after they tested them on foods representing different tastes and mouthful effects (table water crackers are essentially the same as crackers). Ross et al. (2007) also reported that crackers were the most effective palate cleansers. At the conclusion of the experiment, participants were paid and thanked.

3.2 Survey Design

The survey was designed to determine participants' evaluation of the taste of different apples and record their demographic information as well as their knowledge and opinion of organic and local foods.

3.2.1 Rating and ranking

The survey starts with participants' sensory evaluation of the apples. According to Lawless and Heymann (2010), scaling is the application of judgments, which are transformed to numerical values in order to describe the degree of liking or

disliking for the apples in the experiment. The psychophysical basis of scaling states that as the physical strength of the stimulus increases, the sensation will increase in some orderly way. Also, several different scaling methods have been used to apply numbers to sensory experience. Among them, category scaling and ranking are used in the survey.

According to Cook and Beckman (2009), a nine-point scale would generate more accurate results than other scales. Thus, the first part of the survey was a nine-point scale to rate the taste of the apples (nine points are appropriate also given they provide enough alternatives, but not too many for general, untrained consumers), one being the most disliked and nine being the most liked, followed by a rank of the taste from the most favored kind to the least favored one (no ties allowed). The names of the labels were presented in different orders on the survey in case people followed the given sequence, although participants were told to start with any slice they would like.

The reasons that these two methods of scaling were chosen are as follows (Lawless and Heymann, 2010). They are both easy to understand and well suited to consumer work. By ratings, participants would focus on the sensory properties of each variety of apple. Then they could compare the tastes through ranking them. Ranking has the advantage of simplicity in data handling and minimal assumptions about level of measurement since the data is treated as ordinal. In spite

of this, in this experiment there were five apples to compare, so ratings were also used. Results from the ratings could help participants remember and thus reduce the possibility of errors.

3.2.2 Demographic and other information

For modeling purposes, gender, race, income, age and education were gathered. Also, on a five-point scale (1 as negative, 3 as neutral and 5 as positive), people's general opinion of organic food and local food were collected. There were also some statements on the survey regarding people's specific ideas and knowledge of these foods (see next chapter for more details). For these statements, participants were asked to rate their agreement with them on a seven-point scale, where 1 represented strongly disagree, 4 meant neutral and 7 indicated strongly agree.

Above is all the information collected in the experiment. The next chapter will reveal the results of this experiment and a detailed discussion of them.

Chapter 4

STATISTICAL ANALYSIS

4.1 Respondent Demographics and Opinions of Organic and Local

Table 4.1 shows the demographic summary of the sample in comparison to the 2010 Delaware Census Data. The gender of the respondents was distributed fairly evenly, with more females (62.96%) than males (37.04%). It was in line with the literature that more females were dominant shoppers since the last session (with 71% females) was conducted near a natural food store and a farmers' market. There were also more females (61%) in the park session. The age of the participants spanned widely with the majority belonging to the group of 18 to 30 (35.19%). This was probably due to the fact that the first experiment was carried out at the University of Delaware and most of the participants were students in that session. Besides, the age group of 31 to 40 had a slight higher frequency (25.00%) than the census data (12.20%), possibly for the same reason.

Compared to the general population of Delaware, consumers in this experiment were more educated: almost 78% of them had at least college education (42.59% for college and 35.19% for post graduate). It could be explained by the fact that, being a college city, Newark has a more educated population. The remaining

Table 4.1 Summary of Demographic Variables (Sample Size N=108)

		Survey		Census
	Characteristic	Number	Frequency	Frequency
Gender				
	Male	40	37.04	48.50
	Female	68	62.96	51.50
Age				
	18-30	38	35.19	16.50
	31-40	27	25.00	12.20
	41-50	11	10.19	14.30
	51-60	20	18.52	13.70
	61-75	11	10.19	14.00
	Over 75	1	0.93	6.40
Education				
	Less than High School	2	1.85	12.30
	High School	22	20.37	32.70
	College	46	42.59	43.70
	Post Graduate	38	35.19	11.30
Household Income				
	Less than $25,000	26	24.30	20.10
	$25,000 to $49,999	17	15.89	23.50
	$50,000 to $74,999	22	20.56	20.10
	$75,000 to $99,999	15	14.02	13.40
	$100,000 to $149,000	18	16.82	14.20
	$150,000 to $199,999	8	7.48	4.90
	$200,000 or more	1	0.93	3.80
Race				
	White	84	77.78	65.10
	Black or African American	11	10.19	21.90
	Hispanic or Latino	3	2.78	8.40
	American Indian or Alaskan Native	0	0.00	0.70
	Asian	6	5.56	3.40
	Other	4	3.70	0.50

Source: Delaware Census 2010 Data http://www.uscensus2010data.com

22% of the sample had high school education or less. As for the household income, 24.30% of participants reported a total of less than $25,000, while the state level was 20.10%. Additionally, the state level (23.50%) of people with household income between $25,000 and $50,000 was almost 7% higher than that of this experiment (15.89%). Also, people with the highest household income (over $200,000) made up of 0.93% of the sample (e.g. one participant), almost 3% lower than the census. The rest of the sub groups of the household income were comparable to the census data with the largest difference being 2.58%.

In terms of race, the majority of the sample were white (77.78%), slightly higher than the state level of 65.10%. Fewer Black or African Americans (10.19%) and Hispanic or Latino people (2.78%) were reported than the census (21.90% and 8.40% respectively). In this experiment, the race of Asian took up 5.56% of the sample, almost the same as the state level of 3.40%.

In conclusion, from the analysis of the demographic information, the subjects in this study were younger and more educated than the population of Delaware. There were also more people whose race was White and fewer whose race were Black, African American or Hispanic.

Apart from the demographic data, people's opinions of organic and local foods were also collected. To start, participants were asked to rate their general opinions of organic and local on a scale of five, one being negative and five being

positive. As shown in table 4.2, the means were 4.26 and 4.35 respectively, indicating that people thought slightly higher of local food than organic food. This result was in agreement with some previous studies, which stated that local food was rated higher than organic food by the respondents (Yue and Tong, 2009; Constanigro, 2011). A Wilcoxon Signed-Rank Test was conducted to compare the means of these opinions (Wilcoxon, 1945). The null hypothesis that the means were equal was not rejected (the p-value was 0.57) indicating that the difference was not statistically significant. Thus, it was concluded that though local food was rated higher, it was not significant.

Table 4.2 Opinions of Organic and Local Foods

Session	Organic		Local	
	Mean	St Dev	Mean	St Dev
University (19 obs)	3.42	1.12	4.11	0.99
Park (31 obs)	4.00	1.06	4.32	0.79
Natural store/ farmers' mkt (56 obs)	4.70	0.66	4.45	0.83
total (106 obs)	4.26	1.01	4.35	0.85

More importantly, the results were further investigated by location. As discussed earlier, session was the one thing that could group the consumers besides their demographics in this experiment. Opinion of local food was higher than that of organic food in both the university and the natural food store and farmers' market session while it was lower in the park session. Of the three sessions, consumers from the natural food store and farmers' market rated both organic and local foods with the

highest means.

Next, table 4.3 shows the results of some detailed statements regarding these two niche foods by location. The statements were displayed on the questionnaire along with a seven-point scale, with one being strongly disagreed, 4 being neutral and 7 being strongly agreed.

When it came to the relation with health, organic food scored higher with the mean of 5.47 than local food (4.42). The results could be explained as that people somewhat agreed that eating organic foods benefited health but were neutral of the idea that eating local foods did the same. The Wilcoxon test returned with a p-value of <0.0001, indicating a highly statistically significant difference between organic and local food. Thus, people associated organic food with health significantly more than local food.

In terms of the environment, again people thought more of organic food (with a mean of 5.77). Still, the mean of 5.25 for local food also indicated that people did agree with this statement. A p-value of 0.0015 from the Wilcoxon test suggested that this difference was significant. Thus, respondents had higher public value (e.g. the environment) for organic food as well.

As for the case of taste, the means of 4.79 of organic and 4.76 of local suggested that consumers just slightly agreed with the statements that they tasted better. The Wilcoxon Test did not show any significant difference between the two.

People also seemed to try harder to buy local food (5.37) than to purchase organic food (4.91). Interestingly, participants were only neutral (4.10) that they should pay more for organic food, while they disagreed slightly that they should pay more for local food (with a mean of 3.55). The Wilcoxon Test indicated significant difference for both statements. Combined with the fact that these two statements had the lowest mean of all, it could be concluded that the consumers were the least happy with the prices of organic and local food.

Next, let's take a look at organic and local separately. For consumers in this experiment, the environment was rated higher than health for both organic and local food; the p-value was 0.0025 for organic food and <0.0001 for local food. They had more confidence that organic and local food were better for the environment than for health. This meant that people agreed more with the public values of these niche foods than their private values.

In summary, the consumers in this study answered most of the questions with "neutral" or "slightly agree". Organic food was valued higher in respect of being good for the environment and health, tasting better and paid more for. On the other hand, people indicated more efforts to purchase local food. Recall that in terms of their opinions of organic and local food, people thought more of local food. It might be because local food was considered to be better for the local economy (Food Marketing Institute, 2009), support the local farmers (Stephenson and Lev,

2004), or be fresher (Brown, 2003) as suggested in the literature.

Table 4.3 Statements Regarding Organic and Local Foods

Item	Session	Mean	St Dev
Organic food is better for the environment	University (19 obs)	4.74	1.48
	Park (31 obs)	5.55	1.31
	Natural store/ farmers' mkt (56 obs)	6.25	1.00
	total (106 obs)	5.77	1.31
Eating organic food benefits your health	University	3.95	1.51
	Park	5.26	1.26
	Natural store/ farmers' mkt	6.11	1.20
	total	5.47	1.50
I try to buy locally grown food	University	4.53	1.78
	Park	5.10	1.45
	Natural store/ farmers' mkt	5.80	1.29
	total	5.37	1.50
Local food is better for the environment	University	4.42	1.50
	Park	4.90	1.45
	Natural store/ farmers' mkt	5.73	1.43
	total	5.25	1.53
I try to buy organic food products	University	2.84	1.64
	Park	3.97	1.74
	Natural store/ farmers' mkt	6.13	1.08
	total	4.91	1.94
Organic food tastes better	University	3.74	1.63
	Park	3.97	1.74
	Natural store/ farmers' mkt	5.43	1.51
	total	4.79	1.61

Table 4.3 Statements Regarding Organic and Local Foods (continued)

Locally grown food tastes better	University	4.21	1.62
	Park	4.81	1.28
	Natural store/ farmers' mkt	4.93	1.54
	total	4.76	1.49
Eating local food benefits your health	University	3.53	1.58
	Park	4.23	1.56
	Natural store/ farmers' mkt	4.82	1.66
	total	4.42	1.68
I think I should pay more for organic food	University	3.37	1.57
	Park	4.06	1.75
	Natural store/ farmers' mkt	4.38	1.85
	total	4.10	1.80
I think I should pay more for local food	University	3.37	1.26
	Park	3.81	1.80
	Natural store/ farmers' mkt	3.46	1.91
	total	3.55	1.77

Then, let's look at the statistics of the statements based on location. There is a clear trend in the numbers. In nine out of the ten statements, the means were in the ascending order from the University session to the park and to the natural food store and farmers' market. The only exception was the last one, "I think I should pay more for local food", where the general population rated it with a higher mean. So it was concluded that consumers from the natural food store and farmers' market did in many aspects value organic and local food more. This could be explained by

their possible purchasing behavior in these places. In contrast, the students thought less of organic and local food than the general public. The reason might be that they were younger and did not pay as much attention to food and health.

4.2 Rankings and Ratings of the Taste

At the beginning of this experiment, participants were provided with five slices of apples on one plate. They were asked to taste and evaluate the slices. As noted earlier, apple A and apple Organic came from the same organic apple and so did apple B and apple Local. It was hypothesized that, first, the organic apples tasted better than the A apples and second, the local ones tasted better than the B ones even though they were from the same apples. Thus, the hypotheses suggest statistically significant higher ratings and rankings for organic and local apples compared to their counterparts. The reason was that, according to the literature, people valued organic and local foods more and associated them with a better taste. Yet it remained to be discovered whether organic or local apples tasted better. First, let's take a look at the means of the rankings and ratings. Table 4.4 shows the descriptive analysis of the results by location.

Table 4.4 Ratings and Rankings of the Taste

Session	Apple	Rating		Raking	
		Mean	St Dev	Mean	St Dev
University					
(19 obs)	A	6.58	1.30	2.37	1.07
	Organic	6.42	1.95	2.37	1.26
	B	5.00	1.73	3.84	1.30
	Local	5.68	1.73	3.05	1.27
	C	5.58	2.27	2.37	1.26
Park					
(31 obs)	A	6.19	1.68	3.07	1.44
	Organic	6.13	1.67	2.93	1.28
	B	5.55	1.89	3.21	1.35
	Local	5.81	1.85	2.97	1.40
	C	6.13	1.93	2.83	1.67
Natural store/					
Farmers' mkt	A	5.95	1.82	3.07	1.18
(56 obs)	Organic	6.86	1.96	2.27	1.13
	B	4.61	1.86	3.98	1.08
	Local	5.25	2.18	3.25	1.39
	C	6.29	2.08	2.42	1.57
Total					
(106 obs)	A	6.13	1.70	2.94	1.26
	Organic	6.57	1.89	2.48	1.22
	B	4.95	1.87	3.74	1.24
	Local	5.49	2.01	3.14	1.37
	C	6.11	2.07	2.71	1.64

In terms of rating for the full sample, the organic apple tasted the best, followed by apple A and apple C (conventional apples). The local apple and apple B were less favored by the participants. In addition, rankings of the taste yielded consistent results. The organic apple ranked first, followed by apple C and apple A. Again, the local apple and apple B were not as preferred as the other ones.

The organic apple was rated with a mean of 6.57, significantly higher than the local apple with a p-value of <0.0001 tested with the Wilcoxon test, and it also ranked significant higher than the local apple (p-value was 0.0006). Thus, it was concluded that in this experiment, the labeled organic apple tasted better than the labeled local apple. From earlier discussion, the respondents' ideas of taste showed that they were indifferent in terms of the statements 'organic food tastes better' and 'local food tastes better'. In spite of the fact that the survey was completed after the tasting part, their opinions of taste were different from the results generated from this experiment. Or at least the taste of organic and local apples were different from the respondents' general idea of the taste of organic and local food.

Next, Wilcoxon Signed-Rank Tests were conducted to test the hypotheses. Since the data were not normally distributed, standard t tests could not be used. Thus, this non-parametric statistical test was adopted instead to compare whether the population mean ranks differed in the paired data. In this experiment, it was hypothesized that the rating and ranking of the taste of labeled organic apples were statistically significantly higher than the unlabeled ones and so were the labeled and unlabeled local apples. Table 4.5 shows the one-tailed outcome.

Table 4.5 P-value of the Wilcoxon Signed-rank Test

		Rating		Ranking	
Session	N of Obs	Organic	Local	Organic	Local
University	19	0.3109	0.0558	0.5000	0.0171
Park	31	0.4684	0.2103	0.3985	0.2198
Natural Store/farmers' mkt	56	0.0001	0.0116	0.0002	0.0032
Total	106	0.0049	0.0017	0.0037	0.0006

Overall, the pooled data showed significance for both organic and local apples in both rating and ranking. So it was concluded that, the labeling information significantly changed people's perceptions of taste. After knowing that the apple was organic (or local), the participants considered it tasting better. The result was consistent with some recent studies (Napolitano et al., 2013; Lee et al., 2013), demonstrating that consumers were more affected by the labeling information than by the actual sensory properties.

However, the three sessions had quite different results. In the student session, organic apples were not rated or ranked statistically significantly different from their counterpart apple A, while local apples were rated and ranked significantly higher than apple B in terms of taste. Thus, in this session, the effect of labeling was significant for local food but not found significant for organic food.

However, no significant difference was found for the park session in taste from either organic apples or local apples. Given this session was conducted in a

local park and represented the general public, it seemed that the general population were not found to be influenced by the labels when assessing taste. The actual taste was dominant in their opinion.

The session near the natural food store and farmer's market was the only one that completely agreed with the hypotheses. Participants gave the taste of both organic and local apples higher rating and ranking. Expect for the rating of the local apple (at 0.05 level of significance), all other three were highly significant at the 0.01 level. The consumers who would come to these two places may be expected to show more concern for both organic and local food. It was not surprising that people who likely buy organic and local food more often would give these more credit and think of them as tasting better.

Thus, this experiment showed that people generally valued organic and local food more in taste so that they thought the organic and local apples tasted better than their counterpart. The general population were not found to be influenced by the labels and their taste perceptions stayed the same, while consumers from the natural food store and farmers' market were significantly affected by the labeling information. However, the students were only changed by the label of local. That the three sessions had different results suggested consumers of different life styles and shopping habits might have different opinions. It would be interesting to see what contributed to the differences in people's taste ratings and rankings. The next chapter further

investigates these factors with regression analysis. Future research could also focus on exploring the difference behind this conclusion and better investigated the preferences and expectations of people who belong to different groups.

Chapter 5

RESULTS AND DISCUSSION

This chapter first discusses and presents the results of Tobit regression analysis for both organic and local apples. Then they are discussed and interpreted combined with the statistical analyses in chapter 4.

5.1 Regression Analysis

To further investigate the difference in subjects' taste ratings of the organic and local apples, regression analysis was conducted using their demographic and session information, as well as their opinions of organic and local foods. Given the test results from the Wilcoxon Signed-Rank Test, the session difference was important for the taste differences. So they were added to the models. As far as the demographic variables were concerned, because there was no theoretical reason as how they could influence consumers' taste perceptions, we included them in the regression analysis to see if they were the reasons behind the rating difference. These variables were generally considered important when it came to organic and local food following the literature. The dependent variable of the model was the difference in ratings from the unlabeled apples to the labeled ones. Due to the possibility that the

ratings of one and nine might exist, censored regression techniques were needed. In this case, a two-limit Tobit model was constructed because the ratings of one and nine could appear on either labeled or unlabeled apples, or in both, making differences of ratings potentially upper and lower censored (Long, 1997). In the model, it is assumed that there is a latent variable $rdiff^{*}_{i,jk}$ representing subject i's actual difference in taste rating for the unlabeled apple j to the corresponding labeled apple k. When these two ratings are within one and nine, the true value of the latent variable $rdiff^{*}_{i,jk}$ can be observed. However, the true value cannot be observed when either or both ratings are at the extreme. To be specific,

$$rdiff^{*}_{i,jk} = \begin{cases} rdiff_{i,jk} = x\beta + \varepsilon_i & \text{if } 1 < r_{i,k} < 9 \text{ and } 1 < r_{i,j} < 9 \\ [r_{i,k} - 1, \infty) & \text{if } r_{i,j} = 1 \\ (-\infty, 1 - r_{i,j}] & \text{if } r_{i,k} = 1 \\ (-\infty, r_{i,k} - 9] & \text{if } r_{i,j} = 9 \\ [9 - r_{i,j}, \infty) & \text{if } r_{i,k} = 9 \\ (-\infty, \infty) & \text{if } r_{i,j} = 1 \text{ and } r_{i,k} = 9 \\ & \text{or } r_{i,j} = 9 \text{ and } r_{i,j} = 1 \\ & \text{or } r_{i,j} = 1 \text{ and } r_{i,k} = 1 \\ & \text{or } r_{i,j} = 9 \text{ and } r_{i,k} = 9 \end{cases}$$

where $r_{i,j}$ and $r_{i,k}$ represent subject i's ratings of the unlabeled apple j and the corresponding labeled apple k, respectively, β is a vector of coefficients, x represents a vector of independent variables and ε_i represents the error term. As

indicated above, the model is estimated based on the latent variable, censored when the rating is one or nine.

Following Hustvedt and Bernard (2008), the model was fitted with the variance being the function of demographic variables and subjects' opinions of local and organic foods, given the possibility of heteroskedasticity, which could produce insufficient estimates. To check and correct this potential problem, it was proposed that the error term ε_i was independently and normally distributed with mean zero and variance σ^2 [$\exp z_i\gamma$], where γ is a second vector of parameters, z_i represents a second vector of variables and σ^2 is the variance when $z_i\gamma$ is zero.

Based on the literature and previous analysis of the differences of taste ratings, the following equations were proposed to explain the relationship between the independent variables and the taste-rating differences of organic and local apples. The mean portion was as follows:

$$rdiff^* = \beta_0 + \beta_1 University + \beta_2 Natural\_Store + \beta_3 Male + \beta_4 College + \beta_5 Post\_graduate + \beta_6 White + \beta_7 Income + \beta_8 Age + \beta_9 Organic\_opinion + \beta_{10} Local\_opinion + \varepsilon$$

where the definitions of the variables are in table 5.1.

In the model investigating the difference of organic taste ratings, it was hypothesized that the variables Natural_store and Organic_opinion had positive effects on the dependent variable. In addition, the variables University, Natural_store and Local_opinion were proposed to have positive influences on the differences of local

ratings. However, the influence of demographic information was not clear on either model due to the lack of similar studies for comparison.

Table 5.1 Definitions and descriptive statistics for variables in Tobit regressioin

Name	Definition	Percent
University	1 if subject is from the University session, 0 otherwise	17.92
Natural_store	1 if subject is from the natural store and farmers' market, 0 otherwise	52.83
Male	1 if Male, 0 if Female	37.04
College	Highest level of education completed was college	22.22
Post_graduate	Highest level of education completed was post graduate	35.19
White	1 if subject is white, 0 otherwise	77.78
		Mean
Age	Mid-point of the subject's age range in years	39.63
Income	Mid-point of the subject's income range in thousand dollars	70.56
Organic_opinion	Likert scale to express the opinion of organic food: 1=negative, 5=positive	4.26
Local_opinion	Likert scale to express the opinion of local food: 1=negative, 5=positive	4.35

In generating the variance portion of the model, both the demographic and session information and opinions of organic and local were considered. It was hypothesized that any of these variables could influence the error variance, but the signs were not clear. Tests conducted for heteroscedasticity showed different significant sources for the two models. In the model for organic apples, Natural_store was found to be significant while in the model for local apples, the opinion of organic food was the source. Thus, the form of the variance portion for the first model is

$z_i\gamma = \gamma_1 Natural\_store$

for the second model it is

$z\gamma = \gamma_1 Organic\_opinion$

The models were estimated using the maximum likelihood method with the QLIM procedure SAS.[1] In the next part, results are presented.

5.1 Results for Organic apples

Coefficient estimates for the changes of taste ratings from the unlabeled organic apples to the labeled ones from the Tobit regression analysis are shown in table 5.2.

[1] Tobit model applies where there might be censored data. Rankings were not modeled because they could not be censored in any way. Logistic regression was performed on both ratings and rankings, but the estimates were not significant.

Table 5.2 Effect of demographics and opinions on differences of organic ratings

Model selection	Parameter	Estimate	Standard error	P-value
Regression				
	Intercept	-1.7563	3.4656	0.6123
	University	0.6611	1.1035	0.5491
	Natural_store	**1.8846**	1.0098	0.0620
	Male	0.7085	0.8515	0.4054
	College	-1.3403	1.1631	0.2492
	Post_graduate	-1.4068	1.1611	0.2257
	White	1.0283	1.0740	0.3383
	Income	-0.0008	0.0090	0.9223
	Age	-0.0291	0.0317	0.3585
	Organic_opinion	**0.9107**	0.4615	0.0485
	Local_opinion	-0.0904	0.5349	0.8657
Variance				
	Sigma	2.2203	0.2570	<.0001
	Natural_store	**1.3714**	0.4437	0.0020

Note: Bold coefficients are significant at the 10% or lower

In the mean portion, the variables University and Organic_opinion were statistically significant. Specifically, subjects' opinion of organic food was significant at the 5% level. Higher opinion would indicate larger difference in taste ratings from the unlabeled organic apples to the labeled ones. This was consistent with some other studies discussed in the literature. The other variable Natural_store suggested that subjects from the third session rated the taste of organic apples significantly higher than subjects from the park session when the same apples were provided with labeling. Given the locations of these two sessions, it seems that

consumers who shopped at the natural food store associated organic food with better taste, which was indeed consistent with the results from the Wilcoxon test presented in the last chapter. Demographic information did not reveal any influence on the dependent variable in this model. The possible reasons are: first, the lack of variability in gender and race; second, subjects with higher and lower income, education and income had similar choices, thus canceling out the effects. There might be other significant variables that were not collected or captured, like the frequency of buying organic food, which might warrant further investigation.

Next, in the variance portion, Natural_store was found to be the source of heteroscedasticity, and the positive sign implied that subjects had a higher variance in their ratings. One possibility is that this session had the largest number of subjects thus had the most diversity. However, it might also be that subjects from the natural food store and farmer's market had different preferences for the unlabeled organic apples: some of them liked the apples while others not. Once they tasted the labeled organic apples, they raised the ratings simply because of the labeling. This group was the most affected by the labeling and they had the most diversity in their ratings at the same time.

5.2 Results for Local apples

Table 5.3 presents the results from Tobit regression analysis on

differences of local ratings.

Table 5.3 Effect of demographics and opinions on differences of local ratings

Model selection	Parameter	Estimate	Standard error	P-value
Regression				
	Intercept	0.1906	2.8669	0.9470
	University	**1.7869**	0.9476	0.0593
	Natural_store	**1.6743**	0.8470	0.0481
	Male	0.3112	0.7714	0.6866
	College	-0.9251	0.9988	0.3544
	Post_graduate	-0.8473	1.0230	0.4078
	White	-0.2598	0.8641	0.7637
	Income	-0.0078	0.0070	0.2680
	Age	0.0189	0.0281	0.5006
	Organic_opinion	-0.4641	0.3640	0.2023
	Local_opinion	0.4303	0.4499	0.3389
Variance				
	Sigma	1.0615	0.3416	0.0019
	Organic_opinion	**0.5169**	0.1650	0.0017

Note: Bold coefficients are significant at the 10% or lower

Both the variables University and Natural_store are significant in the above model. Therefore, session difference contributed the most to the difference between unlabeled and label local ratings. Again this agrees with the results of the Wilcoxon tests. Similar to the first model, demographic information was not found significant, though it is odd that the subjects' opinion of local food was not either. It was assumed that higher opinion of local food would indicate more influence by the labeling. Maybe their opinion of local food contributed more to their caring about the

local economy and paying attention to the freshness of food, but when it came to taste, opinions did not matter. When they were asked about their opinion of local food, they gave general judgment in the survey. They did not relate it to the taste of the apples.

Orgnic_opinion was determined as the source of heteroscedasticity in this model, and the positive sign indicated that subjects with higher opinion of organic food would have higher variance in their local-apple ratings. Consumers can sometimes confuse the concepts and standards of niche foods. Thus, their opinion of one kind might have some influence on another. In the case, it could be implied that consumers with higher opinion of organic food had a variety of ratings for the local apples. It is possible that some subjects treated organic and local food equally, and they thought they were similar in some way. However, there were also those who defended organic food and did not like local food. It would need further investigation on this subject given the lack of relevant studies.

Based on the estimates of the two models, it is concluded that session is the most important factor in determining the differences from the unlabeled apples to the labeled ones. Student sample, general population who went to the park and consumers who shopped at the natural food store had different taste perceptions of organic and local apples.

Chapter 6

CONCLUSION

Now that the results have been presented, the final chapter concludes the thesis, discusses limitations of the study and comes up with suggestions for future research.

6.1 Conclusion

There is no doubt that the markets for organic and local foods have been growing fast. The organic food section has a larger growth rate than the total food section in the past decade. Even though the growth of organic food was reduced by the 2008 economic crisis, it has already picked up its pace hand in hand with the economic recovery and once again organic food gained a two-digit growth rate in 2012. On the other hand, local food sales have also shown a strong momentum. There have been numerous studies that investigate all aspects of organic and local foods: who are the buyers, why consumers purchase these, what people know and think of them, how much people are willing to pay for them, etc. Among these, questions like ‘does organic/local food taste better than conventional food’ or ‘is taste a reason consumers buy organic/local food’ have not been studied a lot. There are no

certain answers to these questions, but it is already suggested that taste does play a key role in food choices (Lusk and Briggerman, 2009; Constanigro et al., 2011).

This thesis was dedicated to discovering how consumers react to labeling information when it came to taste. The question asked was: 'does the same apple taste different when it was labeled as an organic or local apple?' To achieve this goal, subjects from three different sessions were provided with five slices of apples on the same plate to rank and rate their taste. These slices, respectively, came from labeled organic apple, unlabeled organic apple, labeled local apple, unlabeled local apple and unlabeled conventional apple, of which the labeled and unlabeled organic/local apples were the same one. Consumers' demographics and opinions of organic and local foods were also collected in a survey.

Because the data was not normally distributed, the one-tail Wilcoxon Signed-Rank test was performed to test the mean of the ratings and rankings. Results from pooled data indicated that subjects' taste perception of organic and local apples changed significantly by the labeling information: the mean rating and ranking of labeled organic apples and labeled local apples were significantly higher than the corresponding unlabeled ones. This supported our hypothesis, however, these three sessions did not act in agreement. Subjects from the University session were not found to change their taste evaluation for labeled organic apples while subjects from the park session were not found to change taste evaluation for either labeled organic or

labeled local apples. Only consumers from the natural food store and farmers' market thought both labeled organic and labeled local apples tasted significantly better than the unlabeled ones. Given the locations of the sessions, it could be concluded that the consumers who went shopping at the natural food store were the most influenced by the labels of organic and local, while the consumers who went to the park were the least influenced. Additionally, subjects' opinion of local food (with the mean of 4.35 on a scale of 5) was slightly higher than their opinion of organic food (the mean was 4.26), although the difference was not statistically significant.

Next, Tobit model regression was performed to further investigate the differences in taste ratings from the unlabeled organic/local apples to the labeled apples. Because the ratings of one and nine might be censored, a two-limit Tobit model was applied. Also, to correct the potential problem of heteroscedasticity, the sources were located and reported using SAS. In the organic model, opinion of organic food and session three were found to have positive influence on the differences and in the variance portion, the positive sign of Natural_store indicated that subjects in that session had a higher variance in their ratings. In the local model, the variables of University and Natural_store were statistically significant, which suggested that subjects from these two sessions were largely affected by the labeling information. Then opinion of organic was identified as the source of heteroscedasticity with a positive sign. Though these results were consistent with the

results of the Wilcoxon Signed-rank tests, regrettably, demographic information was not significant in either model. Based on the estimates of these two models, it is concluded that session is the most important factor in determining the differences from the unlabeled apples to the labeled ones. Student sample, general population and possible organic and local food shoppers had different taste perceptions of organic and local apples.

In conclusion, this thesis found that consumers' taste perception of organic and local apples was significantly influenced by the labeling information and more interestingly, subjects of different sessions reacted quite differently.

6.2 Implications

One contribution of this study is that definitions and other related information were not provided in the experiment. The subjects were simply asked to participate in an apple tasting experiment. Thus the results revealed their true opinions and taste perceptions. No deception was involved in the process, as the labels were either letters or the real type of apple. Thus, the subjects could not be misled by the information provided. This was also the first study to explore the interaction of taste and labeling on a fresh product.

As discussed in the literature, some consumers relate organic and local food with good taste. Is this because they really taste good or because of their names?

This study indicated that, when provided with the actural labels, organic and local apples were found to taste statistically significantly better. Though the consumers were eating the same apples, change of labels played a major part in their taste perception. This finding is of importance to researchers and marketers. If one wants to know whether or not some type of organic or local food tastes better than the conventional counterpart, blind tasting might be considered since labels could affect the results. Marketers could take advantage of consumers' high expectation and promote products accordingly.

Another major finding of the experiment was that there existed different groups of consumers that did not react to the labeling the same way. Because the general public was not founded to be affected by the labels, marketers might think of other ways to promote products, like mentioning health and the environment. Students were considered with higher education but they did not change taste perception toward the label of organic. They might know better about organic food thus understood organic was not about better taste or they were young and did not start to care about their food. The niche food did not matter to them. It was expected to see that the consumers near the natural food store and farmers' market thought of organic and local food as tasting better. This could be one reason of their likely purchase behavior.

The discovery of these sessions is important because it was the first

time to group people with physical locations other than demographic information. The location indicated consumers with similar living styles and shopping habits. Compared to the general population, consumers of some sessions had different perception and behavior. It would be benefit a lot to find more on this direction.

6.3 Limitations and Suggestions

There are a number of limitations in this study. First, only one type of apple was investigated in the experiment. Apples could represent fresh food, but to better understand the influence of labeling on consumers' taste perception and to avoid possible bias toward certain food products, future research could consider expanding the food list to a more comprehensive one, including other fruits, vegetables, eggs, meat, seafood and processed organic food.

Next, due to the choice of the locations, subjects in this study were mainly from the state of Delaware and its nearby states (though students from session one could come from other places as well). This might affect the subjects' taste perception of local food, so the results might not apply nationwide. More experiments conducted in other places are needed for a more general conclusion. Also, the first session consisted of college and graduate students, which might contribute to the whole sample's being more educated and younger than Delaware population. Future experiments could look for a more general sample to investigate the topic.

Last, though it was discovered that consumers were influenced by the labeling information, Tobit model regression did not find enough independent variables to explain the differences other than the session variables. The characteristics of the subjects in each session could be further explored as well. Questions like the frequency of purchasing organic and local food as well as the confidence in organic and local might be added to the survey. Also, there might exist other sub groups of consumers that can be defined by how their taste perception of organic and local can be influenced by the labeling information. Future studies could consider adding more locations to investigate.

The results of this study and other studies focusing on how consumers' taste perception can be changed by the labels of organic and local can improve the understanding of consumer behavior and benefit the markets. Since no extra information was provided in this experiment, the difference in taste evaluation came directly from the subjects' ideas of organic and local food. The study also contributes to the literature by exploring the interaction of taste and labeling. Marketers and producers could take advantage of the results and target on certain consumers in terms of taste.

REFERENCES

Alfnes, F., A. G. Guttormsen, G. Steine, and K. Kolstad. 2006. "Consumers' Willingness to Pay for the Color of Salmon: A Choice Experiment with Real Economic Incentives." *American Journal of Agricultural Economics* 88:1050-61.

Anne, D. 1996. "Who buys organic food?: A Profile of the Purchasers of Organic Food in Northern Ireland." *British Food Journal* 97:17-23.

Basker, D. 1992. "Comparison of Taste Quality Between Organically and Conventionally Grown Fruits and Vegetables." *American Journal of Alternative Agriculture* 7:129.

Bateman, I.J. 2009. "Reducing Gain–loss Asymmetry: A Virtual Reality Choice Experiment Valuing Land Use Change." *Journal of Environmental Economics and Management* 58:106-18.

Bond, C.A. 2008. "Understanding Consumer Interest in Product and Process-based Attributes for Fresh Produce." *Agribusiness* 24:231-52.

Brennan, C. S., and V. Kuri. 2002. "Relationship between Sensory Attributes, Hidden Attributes and Price in Influencing Consumer Perception of Organic Foods." Paper presented at UK Organic Research 2002 Conference, Aberystwyth, Wales.

Buzby, J.C. 1994. "Consumers Want Reduced Exposure to Pesticides on Food (Charting the Costs of Food Safety)." *FoodReview* 17:19-4.

Byrne, P.J. 1992. "Pesticide Residue Concerns and Shopping Location Likelihood." *Agribusiness* 10:491-501.

Caussiol, L.P. 2004. "Characteristics of Banana Fruit from nearby Organic versus Conventional Plantations: A Case Study." *The Journal of Horticultural Science and Biotechnology* 79:678.

Combris, P., P. Bazoche, E. Giraud-Heraud, and S. Issanchou. 2009. "Food Choices: What do We Learn from Combining Sensory and Economic Experiments?" *Food Quality and Preference* 20:550-7.

Cook A.D., and T.J. Beckman. 2009. "Does Scale Length Matter? A Comparison of Nine- versus five-point Rating Scales for the Mini-CEX." *Advances in Health Sciences Education: Theory and Practice* 14:655-64.

Costanigro, M., D.T. McFadden, S. Kroll, and G. Nurse. 2011. "An In-store Valuation of Local and Organic Apples: the Role of Social Desirability." *Agribusiness* 27(4): 465-77.

Darby, M.R. 1973. "Free Competition and the Optimal Amount of Fraud." *The Journal of Law and Economics* 16:67.

Dettmann, R.L. 2009. "Who's Buying Organic Vegetables? Demographic Characteristics of U.S. Consumers." *Journal of Food Products Marketing* 16:79-91.

Didier, T., and L. Sirieix. 2008. "Measuring Consumer's Willingness to Pay for Organic and Fair Trade Products." *International Journal of Consumer Studies* 32:479-90.

Dimitri C., and R.L. Dettmann. 2012. "Organic Food Consumers: What do We Really Know about Them?" *British Food Journal* 114:1157-83.

Durham, C.A. 2007. "The Impact of Environmental and Health Motivations on the Organic Share of Produce Purchases." *Agricultural and Resource Economics Review* 36:304-20.

Fagerli, R. 1999. "Gender Differences in Opinions and Practices with regard to a 'Healthy Diet'." *Appetite* 32:171-90.

Fillion, L., and S. Arazi. 2002. "Does Organic Food Taste Better? A Claim Substantiation Approach." *Nutrition and Food Science* 32:153-7.

Gilsenan C., R.M. Burke, and C. Barry-Ryan. 2010. "A Study of the Physicochemical and Sensory Properties of Organic and Conventional Potatoes (Solanum Tuberosum) before and after Baking." *International Journal of Food Science and Technology* 45:475-81.

——. 2012. "Do Organic Cherry Vine Tomatoes Taste Better than Conventional Cherry Vine Tomatoes? A Sensory and Instrumental Comparative Study from Ireland." *Journal of Culinary Science and Technology* 10:154-67.

Gracia, A., B. Lopez-Galan, and J. Barreior-Hurle. 2014. "Are Local and Organic Claims Complements or Substitutes? A Consumer Preferences Study for Eggs." *Journal of Agricultural Economics* 65:49-67.

Groff, A.J., C.R. Kreidor, and U.C. Toensmeyer. 1993. "Analysis of the Delaware Market for Organically Grown Products." *Journal of Food Distribution Research* 24:118-25.

Holmes T.J., R. Yan, and R. Skaggs. 2012. "Predicting Consumers' Preferences for and Likely Buying of Local and Organic Produce: Results of a Choice Experiment." *Journal of Food Products Marketing* 18:369-84.

Hu, W., T. Woods, and S. Bastin. 2009. "Consumer Acceptance and Willingness to Pay for Blueberry Products with Nonconventional Attributes." *Journal of Agricultural and Applied Economics* 41:47-60.

Hu, W., M.T. Batte, T. Woods, and S. Ernst. 2012. "Consumer Preferences for Local Production and Other Value-added Label Claims for a Processed Food Product." *European Review of Agricultural Economics* 39:489-510.

Huang, C.L. 1996. "Consumer Preferences and Attitudes towards Organically Grown Produce." *European Review of Agricultural Economics* 23:331-42.

Hughner, R.S., P. McDonagh, A. Prothero, C.J. Shultz, and J. Stanton. 2007. "Who are Organic Food Consumers? A Compilation and Review of Why People Purchase Organic Food." *Journal of Consumer Behavior* 6:94-110.

Hustvedt, G., and J.C. Bernard. 2008. "Consumer Willingness to Pay for Sustainable Apparel: The Influence of Labelling for Fibre Origin and Production Methods. " *International Journal of Consumer Studies* 32:491-98.

James, J.S., B.J. Rickard, and W.J. Rossman. 2009. "Product Differentiation and Market Segmentation in Applesauce: Using a Choice Experiment to Assess the Value of Organic, Local, and Nutrition Attributes." *Agricultural and Resource Economics Review* 38:357-70.

Janssen, M., and U. Hamm. 2012. "Product Labelling in the Market for Organic Food: Consumer Preferences and Willingness-to-pay for Different Organic Certification Logos." *Food Quality and Preference* 25:9-22.

Lawless, H.T., and Heymann H. 2010. *Sensory Evaluation of Food: Principles and Practices*, 2nd ed. New York: Springer.

Lee, W.C.J., M. Shimizu, K.M. Kniffin, and B. Wansink. 2013. "You Taste What You See: Do Organic Labels Bias Taste Perceptions?" *Food Quality and Preference* 29:33-9.

Long, J.S. 1997. *Regression models for categorical and limited dependent variables*. Thousand Oaks: Sage Publications.

Loureiro, M.L. 2002. "Discovering Niche Markets: A Comparison of Consumer Willingness to Pay for Local (Colorado Grown), Organic, and GMO-Free Products." *Journal of Agricultural and Applied Economics* 34:477-88.

Loureiro, M.L., J.J. McCluskey, and Ron C. Mittelhammer. 2001. "Assessing Consumer Preferences for Organic, Eco-labeled, and Regular Apples." *Journal of Agricultural and Resource Economics* 26:404-16.

——. 2002. "Will Consumers Pay a Premium for Eco-labeled Apples?" *Journal of Consumer Affairs* 36:203-19.

Lucak, C.L., and J.F. Delwiche. 2009. "Efficacy of Various Palate Cleansers with Representative Foods." *Chemosensory Perception* 2:32-9.

Lusk, J.L. 2009. "Food Values." *American Journal of Agricultural Economics* 91:184-96.

Martinez, S., M.S. Hand, M. Da Pra, S. Pollack, K. Ralston, T. Smith, S. Vogel, S. Clark, L. Tauer, L. Lohr, S.A. Low, and C. Newman. 2010. *Local Food Systems: Concepts, Impacts, and Issues* Economic Research Report No. (ERR-97).

McCluskey, J.J., C.A. Durham, and B.P. Horn. 2009. "Consumer Preferences for Socially Responsible Production Attributes Across Food Products." *Agricultural and Resource Economics Review* 38 (2009):345-56.

Morven, G. 2004. "Producers and Consumers of Organic Meat: A Focus on Attitudes and Motivations." *British Food Journal* 106:534-52.

Moser R., R. Raffaelli, and D. Thilmany-McFadden. 2011. "Consumer Preferences for Fruit and Vegetables with Credence-based Attributes: a Review." *International Food and Agribusiness Management Review* 14:121-42.

Napolitano F, C. Castellini, S. Naspetti, E. Piasentier, A. Girolami and A. Braghieri. 2013. "Consumer Preference for Chicken Breast may be more Affected by Information on Organic Production than by Product Sensory Properties." *Poultry science* 92:820-6.

Ngobo, P.V. 2011. "What Drives Household Choice of Organic Products in Grocery Stores?" *Journal of Retailing* 87:90-100.

Padel, S. 2005. "The Development of the European Market for Organic Products: Insights from a Delphi Study." *British Food Journal* 107:626-46.

Padel, S., and C. Foster. 2005. "Exploring the Gap between Attitudes and Behaviour: Understanding why Consumers Buy or do not Buy Organic Food." *British Food Journal* 107:606-25.

Reganold, J.P. 2001. "Sustainability of three Apple Production Systems." *Nature* 410:926-30.

Ross, C.F., C. Hinken, and K. Weller. 2007. "Efficacy of Palate Cleansers for Reduction of Astringency Carryover during Repeated Ingestions of Red Wine." *Journal of Sensory Studies* 22:293-312.

Schmit, T.M., B. Rickard, and J.,Taber. 2013. "Consumer Valuation of Environmentally Friendly Production Practices in Wines, Considering Asymmetric Information and Sensory Effects." *Journal of Agricultural Economics* 64:483-504.

Shafie, F.A. and D. Rennie. 2012. "Consumer Perceptions towards Organic Food." *Procedia - Social and Behavioral Sciences* 49:360-7.

Slattery, E. 2011. *Characteristics of Conventional and Organic Apple Production in the United States*. Washington DC: U.S. Department of Agriculture, Economic Research Service.

Stobbelaar, D.J. 2007. "Adolescents Attitudes towards Organic Food: a Survey of 15- to 16-year old School Children." *International Journal of Consumer Studies* 31:349-56.

The Packer. 2002. *Fresh Trends 2002: Key Findings of Packer's Fresh Trends Report*, http://www.bountyfresh.com/fresh_report4.htm.

Tobin R., S. Moane, and T. Larkin. 2013. "Sensory Evaluation of Organic and Conventional Fruits and Vegetables available to Irish Consumers." *International Journal of Food Science and Technology* 48:157-62.

Toschi, T.G., A. Bendini, S. Barbieri, E. Valli, M.L. Cezanne, K. Buchecker, and M. Canavari. 2012. "Organic and Conventional Nonflavored Yogurts from the Italian Market: Study on Sensory Profiles and Consumer Acceptability." Journal of the Science of Food and Agriculture 92:2788-95.

Ureña, F. 2008. "Women, Men and Organic Food: Differences in Their Attitudes and Willingness to Pay. A Spanish Case Study." *International Journal of Consumer Studies* 32:18-26.

Van Loo, E.J., C. Vincenzina, R.M. Nayga, M. Jean-Francois, and S.C. Ricke. 2011. "Consumers' Willingness to Pay for Organic Chicken Breast: Evidence from Choice Experiment." *Food Quality and Preference* 22:603-13.

Wier, M. 2002. "Market Potential for Organic Foods in Europe." *British Food Journal* 104:45-62.

Wilcoxon, F. 1945. "Individual Comparisons by Ranking Methods." *Biometrics Bulletin* 1:80-3.

Yiridoe, E.K. 2005. "Comparison of Consumer Perceptions and Preference toward Organic versus Conventionally Produced Foods: A Review and Update of the Literature." *Renewable Agriculture and Food Systems* 20:193-205.

Yue, C., H.H. Jensen, D.S. Mueller, G.R. Nonnecke, D. Bonnet, and M.L. Gleason. 2007. "Estimating Consumers' Valuation of Organic and Cosmetically Damaged Apples." *HortScience* 42:1366-71.

Zepeda, L. 2007. "Characteristics of Organic Food Shoppers." *Journal of Agricultural and Applied Economics* 39:17-28.

Zhao, X., E. Chambers, Z. Matta, T.M. Loughin, and E.E. Carey. 2007. "Consumer Sensory Analysis of Organically and Conventionally Grown Vegetables." *Journal of Food Science* 72:87-91.

APPENDIX A - SURVEY

Taste and Willingness to Pay for Apples

1. Taste Rating
Try each of the five apple slices and rate the taste of each on the scale below (circle answer). To be able to accurately examine the taste of each, have a cracker and a drink of water between each sample. Please do not discuss your opinions with anyone else taking the study.

Apple	Dislike Extremely				Neither Like Nor Dislike				Like Extremely
A	1	2	3	4	5	6	7	8	9
B	1	2	3	4	5	6	7	8	9
C	1	2	3	4	5	6	7	8	9
Local	1	2	3	4	5	6	7	8	9
Organic	1	2	3	4	5	6	7	8	9

2. Taste Ranking
Rank the taste of each apple from 1 (the most preferred apple) to 5 (the least preferred apple). Note that ties are not allowed in the ranking.

A _____

B _____

C _____

Local _____

Organic _____

3. What is your gender? (circle one) Male Female

4. What is your ethnicity? (check one)

__ White __ Black or African American

__ Hispanic or Latino __ American Indian or Alaskan Native

__ Asian __ Other

Over →

5. *What is your opinion of:*

	Negative		Neutral		Positive
Organic Food	1	2	3	4	5
Local Food	1	2	3	4	5

6. *Please rate your agreement with the following using the scale below:*

1 Strongly Disagree	2 Disagree	3 Slightly Disagree	4 Neutral	5 Slightly Agree	6 Agree	7 Strongly Agree

Eating organic food benefits your health	1	2	3	4	5	6	7
Organic food tastes better	1	2	3	4	5	6	7
I try to buy organic food products	1	2	3	4	5	6	7
Organic food is better for the environment	1	2	3	4	5	6	7
I think I should pay more for organic food	1	2	3	4	5	6	7
Eating local food benefits your health	1	2	3	4	5	6	7
Locally grown food tastes better	1	2	3	4	5	6	7
I think I should pay more for local food	1	2	3	4	5	6	7
Local food is better for the environment	1	2	3	4	5	6	7
I try to buy locally grown food	1	2	3	4	5	6	7

7. *What is the highest level of education you have completed?*

_____	Less than High School	_____	High School
_____	College	_____	Post Graduate

8. *What is your total household income?*

_____	Less than $25,000	_____	$25,000 to $49,999
_____	$50,000 to $74,999	_____	$75,000 to $99,999
_____	$100,000 to $149,999	_____	$150,000 to $199,999
_____	$200,000 or more		

9. *In which age group do you belong?*

_____	18 to 30	_____	31 to 40
_____	41 to 50	_____	51 to 60
_____	61 to 75	_____	Over 75

APPENDIX B – PERMISSION LETTER

Certification of Training
Human Subjects in Research

The University of Delaware certifies that Yinan Liu
attended an institutional training session on the use of human subjects in research on

August 23, 2012.
(Date)

The session included the following topics:

- The Belmont Report
- Federal regulations for using humans in research (45 CFR 46)
- The University's Federalwide Assurance
- Informed consent
- Institutional procedures
- Sources for additional information.

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