Modeling the Joint Decisions on Consumer Store Selection and Product Choice

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Abstract

Grocery Stores often face two marketing strategies. One is from the product level by expanding food categories and diversified food choices. Another one focuses on enhancing store features, either taking advantage of new technologies to improve shopping experience or promoting corporate social responsibility. The two strategies indicate two different assumptions on the consumer decision-making process before they start the grocery shopping trip. We utilize the choice experiments by presenting different choice scenarios to model consumers' joint decisions between store selection and food choice to better understand the decision-making process. A Bayesian approach model is constructed to explain the joint decision of consumer store selection and food choice, which helps identify the importance of store features and food selections on consumer grocery shopping behavior. The results show that grocery stores ought to have two marketing strategies. Only emphasizing on one perspective will not have any impact on consumers' decision on their grocery shopping trips.

Keywords: Joint Decision, Choice Experiments, Bayesian Approach, Unconditional and Conditional Utility.

Introduction

The grocery store share of food at home expenditures is about 58.4 percent in 2017 and the products and services offered by the food marketing system contributed more than 80% of the total consumer food expenditures (Martinez, 2011; Okrent et al., 2018). To stay competitive in business, both traditional and non-traditional grocery retailers come up with different marketing strategies to attract consumers (Martinez, 2011). Besides, the food marketing system is experiencing significant and fundamental changes because of the development and adoption of new technologies and consumers' increasing awareness of the social and environmental impact of food production. The current technological advancements in the market introduced the evolution direction for food retailers. The introduction of self-checkouts using mobile apps and delivery options improve the consumer shopping experience. Moreover, automation offers a handful of benefits to help grocery stores operating. On the other side, consumer preference is also changing. For example, there is a shift in consumer preference to more socially responsible products, which motivates food retailers to make changes to attract socially responsible consumers (Bénabou & Tirole, 2010; Lockie, 2009; Moon & Vogel, 2009). Thus, the direction of developing grocery stores falls into two strategies. One strategy is from the product level, by expanding food categories and diversified food choices such as organic and local food or meal kits (Martinez, 2011). Through this approach, grocery stores intend to increase competitiveness by providing healthier or more environmentally friendly choices to satisfy people's growing demand for such food (Minaker et al., 2016; Volpe et al., 2017). The other strategy focuses on enhancing store features, either taking advantage of technology development to improve shopping experience or promoting corporate social responsibility such as building an ethical image in the market (Lusk & Norwood, 2011; Michaud et al., 2013).

Maslow's hierarchy of needs indicates there is order inside human needs, from lower-order needs such as physiological and safety needs to higher-order such as self-actualization (Maslow, 1943). Consumers' needs for food are fulfilled by their grocery store selection and food choice that meet their hierarchy needs at the same level. The two strategies that grocery stores can implement indicate different assumptions on the consumer decision-making process before they start the shopping trip for groceries. The first strategy assumes that the assortment and varieties of food have a stronger influence on consumer food shopping behavior. That is, consumers would decide which stores to visit based on their needs for certain types of food. In contrast, the second strategy assumes that store features have a more influential impact on consumers' shopping behavior. They will first decide where to shop and then make product purchase decisions in that store. Despite a large body of studies on consumer store selection behavior or food purchase behavior, few have investigated the interrelationship between consumer store selection and product choice, which is essential for developing the grocery store industry.

To stay competitive in the market, grocer retailers need to consider which strategies could be their option. The development paths of grocer retailers are largely based on consumer preference for food products and grocery stores. For example, due to the increased demand for promoting a healthy diet, more and more grocery stores expanded their current product lines to provide more healthy options. Meanwhile, store choice also impacts the probability of purchasing organic produce (Thompson & Kidwell, 1998). Padel & Foster (2005) found that organic food purchase decision often associates with a healthy diet. This also explains why both traditional and non-traditional grocery stores have introduced organic food into their shelves. It is unclear which path is a better approach to increasing the competitiveness of grocery stores. Understanding the roles of food choice or grocery store selection on consumer food shopping behaviors could help better develop the food marketing system. Therefore, it is important to understand whether consumers decide on the stores for shopping because of their need for certain products, or they decide where to go grocery first and then make shopping decisions of products in stores. The objective of this study is to examine the joint decision between preference on grocery store selection and food choice using the choice experiment. Particularly, using the Bayesian approach, we estimate the effect of store features on product choice and the impact of product attributes on store selection.

Literature Review

Factors Affecting Food Choice

There is a great number of studies investigating consumer willingness-to-pay on different food attributes. Organic and local attributes are the most popular attributes among those works. The rapid growth of organic and local food markets has attracted a lot of attention from consumers, food retailers, and researchers (Adams & Salois, 2010; Brune et al., 2020; Dangi et al., 2020; Danner & Menapace, 2020; Russell & Zepeda, 2008; Tandon et al., 2020; Voon et al., 2011; Zanoli et al., 2013). Organic food is produced using sustainable agriculture practices that help promote ecological health, and local food supports local farmers and the local economy (Chang & Lusk, 2009; Chen et al., 2019; Chen et al., 2018; Curl et al., 2013). Recent studies have investigated consumers' preferences and WTP for organic food and local food and factors that drive local and organic food consumption (Bazzani et al., 2017; Darby et al., 2006). These studies show that consumers are, in general, willing to pay more for organic and local food. Food quality and security, health consciousness, environmental concern, animal rights, the trust of food labels are the key factors affecting consumer choice of organic and local food. In addition, some demographic characteristics such as age, gender and education level also have significant effects on consumer preference for these foods (Aryal et al., 2009; Honkanen et al., 2006; Hughner et al., 2007; Michaelidou & Hassan, 2008; Roitner-Schobesberger et al., 2008; Thøgersen, 2006).

Another influential factor in consumer food purchase behaviors is consumers' ethical concern (Carrigan & Attalla, 2001; Creyer & Ross Jr, 1997; Honkanen et al., 2006). Research shows that people with strong environmental concerns would be more likely to pay a premium for eco-labeled and organic food products (Honkanen et al., 2006; Loureiro et al., 2002; Michaud et al., 2013). On the other side, ethical concern also impacts consumer preference in grocery store selection. One motivation that drives grocers and food retailers to operate ethically is that their ethical behaviors are expected to affect store image, which, in return, can influence consumers' purchase decisions (Mascarenhas, 1995). Consumers consider companies' ethical conduct during the purchase decision process and are willing to pay a price premium for rewarding ethical behavior (Creyer & Ross Jr, 1997; Jin, Lin, & McLeay, 2020; López-Fernández, 2020). Hence, companies need to set up strategies to respond to consumer demand for ethical business conduct (Kuokkanen & Sun, 2020). Even though consumers express their willingness to reward ethical companies and punish unethical ones, their ethical criteria in purchase behavior is often outweighed by the price, quality, value, and convenience in reality (Carrigan & Attalla, 2001). Thus, it is still unclear whether companies' ethical behavior will have a significant impact on consumer choice (Carrigan & Attalla, 2001; Kuokkanen & Sun, 2020).

Factors Affecting Grocery Store Selection

Most studies on grocery store selection focus on specifics store types and examined what store characteristics affect consumer patronage on different store types. There are seven common store types: traditional grocery stores (supermarkets), drug stores, mass merchandisers, supercenters, warehouse club stores, convenience stores, and other stores (Dong & Stewart, 2012). The influential factors in the literatures are mostly traditional store characteristics including price, product assortment and quality, distance and location, marketing strategy and service quality (Baltas & Papastathopoulou, 2003; Dong & Stewart, 2012; Huddleston et al., 2009; Kyureghian & Nayga Jr., 2013; Morschett et al., 2005; Pan & Zinkhan, 2006; Solgaard & Hansen, 2003). Those studies show that price and promotional deals are significant drivers for consumer choices on store formats: price is negatively associated with choice on supercenters and mass merchandisers while price promotion positively impact on grocery, drug, and mass merchandiser stores (Dong & Stewart, 2012; Kyureghian & Nayga Jr., 2013). Product assortment and quality are the most important determinants on store patronage, however, assortment will impact the choice on store formats while the effect of quality doesn't vary between formats (Baltas & Papastathopoulou, 2003; Solgaard & Hansen, 2003). Store location also plays a role in consumer grocery store selection and consumers consider it as a signal to convenience and transportation cost (Baltas & Papastathopoulou, 2003; Solgaard & Hansen, 2003). Grocery stores established suitable retail marketing strategies to attract consumers and their store image and service appear to be significant factor in driving consumer choice (Morschett et al., 2005; Pan & Zinkhan, 2006).

Relationship between Food Choice and Grocery Store Selection

Besides those factors in food choice and grocery store selection, product purchase behavior correlates with the store selection and grocery store types will impact people's motivation to buy different food (Ngobo, 2011). The decision to visit different types of grocery stores is highly associated with what types of food consumers want to purchase from that store. Healthier food choices are usually linked to higher food expenditure shares at supermarkets and supercenters (Volpe et al., 2017). When purchasing fruits and vegetables, shopping at different types of grocery stores depends on store marketing characteristics, such as price promotion and weekly specials, and household demographic characteristics, and physical availability of different types of retail stores(Kyureghian & Nayga Jr., 2013). On the other hand, the consumer preference for food also depends on the types of grocery stores. Ellison et al. (2016) explored that organic labels were not viewed equally by consumers across different retail outlets: people have higher willingness-to-pay (WTP) for organic food at fresh format stores than supercenters. Target seems to be a better retailing place for promoting organic snacks than Walmart (Ellison et al., 2016; Ngobo, 2011). Ellison et al. (2016) found that Target promotes organic snacks better than Walmart.

Those studies indicate that the consumer decision-making process is dynamic. Therefore, the decision on both food choice and grocery store selection is dynamic and those two selections often correlate with each other (Arrow & Fisher, 1974; Dixit, 1992). Choice-making often depends on the information people obtain during the decision-making process (Bazzani et al., 2017). Past literatures examine what factors affect food choice and grocery store selection in separate cases, and even though studies reveal there is relationship between food choice and grocery store selection, they seldom examine the bi-directional relationship by putting food choice and grocery store selection contexts together. Thus, in this research, we will use choice experiment to present both choice scenarios to consumers and capture this dynamic decision between food choice and grocery store selection. The contribution of this study is to integrate food choice and grocery store selection together to understand consumers' joint decision on the stores for shopping because of their need for certain products, or they decide where to go grocery first and then make shopping decisions of products in stores.

Experimental Design

We designed choice experiments (CE) to elicit consumer preference in grocery store selection and food choice contexts. There will be six attributes to describe a generic grocery store in grocery store CE and four attributes in food CE. Each participant will be asked to finish six grocery store choice sets and eight food choice tasks. In each choice set, there will be two alternatives and one opt-out option. Respondents are asked to choose one, either from two alternatives or opt-out.

For grocery store CE, there are two main categories of store attributes: direct store features and indirect store features. The direct store features are store type and traveling time. The store type indicates the high technology adoption, and the levels are regular, partly automated, and fully automated. The traveling time will be the payment vehicle in this CE. The levels are 5 minutes, 10 minutes, and 15 minutes, which is referred from Sands et al. (2009). The indirect store features are related to food products in the store because food product assortment serves as one of the most important factors for store success. Those attributes are the extensiveness of the selection of organic food, local food, and food with ethical labels. Each of them has three levels: low, average, high. Organic foods are produced according to federal guidelines indicating with USDA certified organic label and organic farmers use natural substances and physical, mechanical or biologically based farming methods to the fullest extent possible (McEvoy, 2019). The definition of local foods is that food produced and transported less than 400 miles from its origin or within the State which they are produced (Martinez et al., 2010). The ethical label is based on a third-party organization certificate: ethicalconsumer.org. The function of this label is to promote to consumers the ethical values of the company in the market. To obtain the label, the organization will assess the company and products from 5 main categories: animals, environment, people, politics, and sustainability. The last attribute is the average price level of the products sold in the stores since price perception is an essential factor that leads to different grocery store selection. Table 1 shows the attributes and levels in grocery store CE.

Table 1: Attributes and Levels in Grocery Store CE

Store Attributes	**Levels**
Store Type	Regular Store, Partly Automated Store, Fully Automated Store
Traveling Time	5 Minutes, 10 Minutes, 15 Minutes
Local Food Availability	Low, Average, High
Organic Food Availability	Low, Average, High
Ethical Labeled Food Availability	Low, Average, High
Price Level	Low, Average, High

For food choice, the focal product is the strawberry, as the representative food on fresh produce. We selected the strawberry because it is relatively homogeneous, so they could be used to identify different effects (Costanigro et al., 2016). Moreover, the U.S. is one of the largest strawberry producers globally (Choi et al., 2017). Thus, studying consumer preference for the strawberry can obtain important marketing information for U.S. fresh produce market. The food attributes include price and non-price attributes. There are four price levels for strawberry. These price levels are adapted from the USDA Agricultural Marketing Service (AMS) price datasets. The non-price attributes include organic, local, and ethical labels. Those labels are consistent with indirect store attributes related to food in grocery store CE. The consistency will help us to explore the association between grocery store selection food choice. The levels of those food labels are either with labels presented on the product or not. Table 2 shows the attributes and levels in food choice CE.

Table 2: Attributes and Levels in Food Choice CE

Food Attributes	Levels
Price	Strawberries: $1.99/lb, $2.69/lb, $3.39/lb, $4.09/lb.
USDA Organic Label	Yes, No
Local Label	Yes, No
Ethical Label	Yes, No

SAS macro was used to generate a D-optimal design of the CE with no-prior information. The design finds the best combination of attribute levels to minimize the D-error of the parameters in the consumer utility function. The D-error is one of the most common criteria to find the optimal designs, and the design with a minimum D-error value would be a D-efficient design (Yeh et al., 2020). The final grocery store CE has 18 choice sets, and the final food CE has eight choice sets. The choice sets in the grocery store CE are evenly divided into three blocks to bring down the potential burden on respondents when participating in the survey. In the survey, respondents will answer six grocery store choice sets and eight food choice sets.

To examine the joint decision between grocery store selection and food choice, we presented two main situations. The first situation asks respondents first to answer a grocery store CE, which we will obtain the unconditional utility for store (Figure 1a). Then, out of the eight food choice sets, two will be displayed randomly for respondents to choose, which will be used as unconditional utility for food. After that, one of the store alternatives profiles (as the combination of store attributes) in the grocery store CE will be randomly shown to the respondents when they answer food CE, and this will be used for conditional utility for food. Before asking respondents to answer food CE, we first give them an example showing that they will shop at the displayed store, which strawberries they will buy (Figure 2). Respondents will start to answer the food CE questions (Figure 1b).

In the second situation, participants first need to finish the food choice CE questions, counting as unconditional utility for the food (Figure 3a). Then, two of the 18 store choice sets will be randomly presented to participants and let them to choose, which will be used as unconditional utility for the store. After that, one of the food alternatives profiles (as the combination of food attributes) in food choice CE is randomly selected and it will be shown at each choice set in grocery store CE, and this will be treated as conditional store utility. With that, we also state that “you are assumed to buy the strawberry shown on the top right of the page, which grocery store would you go for shopping this strawberry supposing it is available in both stores?” (Figure 4). All CE questions include the opt-out option, indicating that people can choose to go to neither of the stores or purchase neither of the food.

Figure 1a: Example in Grocery Store CE followed by Strawberries CE

Figure 1b: Example in Grocery Store CE followed by Strawberries CE

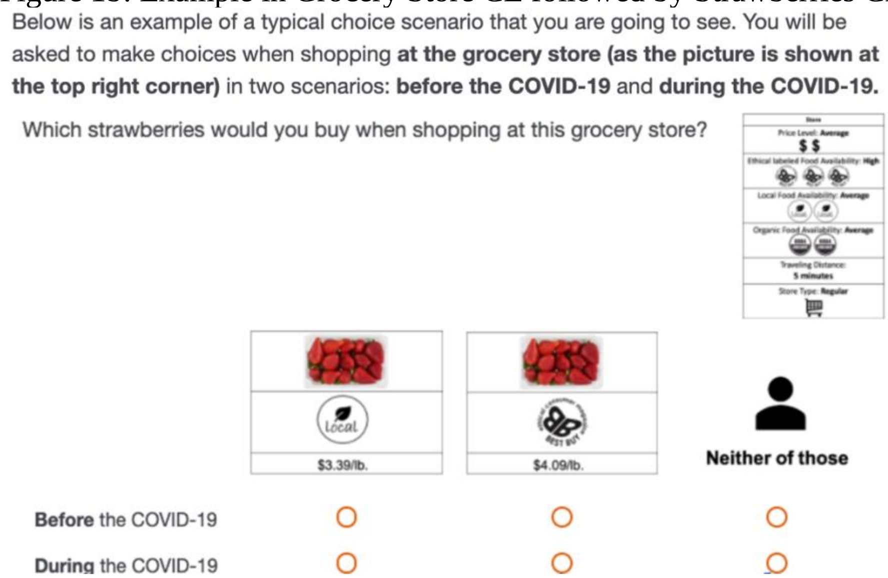

Figure 2: Statements Before Food Choice CE

Figure 3a: Example in Strawberries CE followed by Grocery Store CE

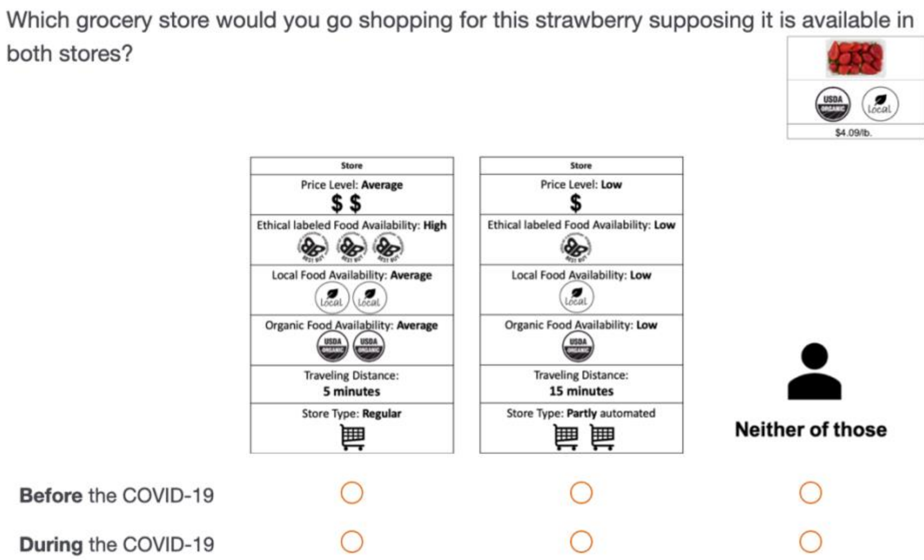

Figure 3b: Example in Strawberries CE followed by Grocery Store CE

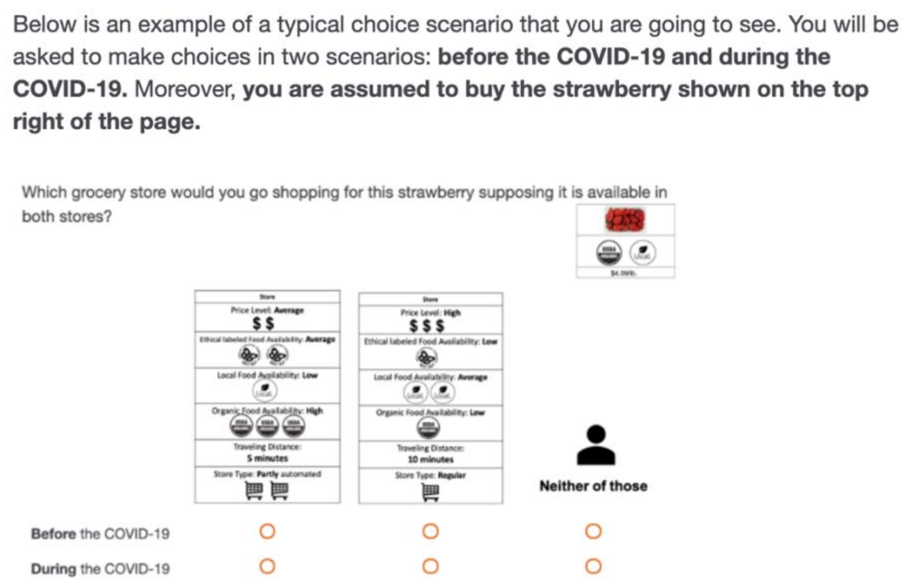

Figure 4: Statements Before Grocery Store CE

Data Collection

The survey is hosted on Qualtrics, and Qualtrics distributes it in March 2021 to its national representative consumer panels in the United States. We anticipate collecting 1,200 valid responses. We first conducted the soft launch and collected around 103 valid responses. Notice that we are still in the process of data collection. Qualified participants are over 18 years old and the primary shoppers for household groceries. There are three main sections: general questions, choice experiment questions, and demographic information questions. The general questions collect information on consumer food shopping behavior, motivation for visiting a grocery store, and their perception of selected grocery store attributes. The choice experiment questions encompass both food choice and grocery store selection. There are four groups: two groups will first be presented 6 choice sets of grocery store CE and then followed by 8 choices sets of one product (either strawberries or milk); the other two groups will be shown 8 choice sets of one product (either strawberries or milk), then followed by 6 choice sets of grocery store CE. Respondents will be randomly distributed into one of the four groups and then answer the choice experiment question. The last section collects participant demographic characteristics such as gender, education level, marriage status, households' size, living area (zip code, urban or rural), income, etc.

Methodology

Considering an individual's shopping trip, his/her utility of visiting a store s and purchase a product j can be defined as

$$U_{isj} = \alpha * U_{is} + \gamma * U_{ij} + w * U_{is} * \ U_{ij} \quad (1)$$

where U_{is} is the utility of vising store s and U_{ij} is the utility of purchasing product j. α, γ and w are the relative importance of U_{is}, U_{ij}, and the interaction term, respectively. This utility function indicates that U_{isj} not only depends on the preference for stores and products, but also depend on the relative weight of the utilities of store and product. For instance, if product A1 and A2 are available at store S1 and S2, respectively. And A1 $>$ A2 (A1 is preferred to A2), and S1 $<$ S2 (S2 is preferred to S1), then the preference for product dominates, or the utility of the product has a relatively larger weight (γ), then $U_{\text{i A1 S1}} > U_{\text{i A2 S2}}$. The individual would purchase product A1 at store S1 even though she prefers S2. In contrast, if the utility of the store has a relatively larger weight (α), The individual would purchase A2 at store S2 even though she prefers product A1. This utility extends the theoretical framework in previous studies that either focuses on preference for stores (U_{is}) or preference for products (U_{ij}).

Based on Lancaster (1966) utility theory, both U_{is} and U_{ij} can be defined as the function of the attributes, where U_{is} is a function of store features or characteristics, and U_{ij} is a function of product attributes or characteristics. The probability that an individual *i* visits store *s* and purchases product *j* can be calculated as

$$P_i(S = s \text{ } and \text{ } J = j) = P_i(U_{isj} > U_{itk} \ \forall \text{ t} \neq \text{s or k} \neq \text{j}) = P_i(\alpha * U_{is} + \gamma * U_{ij} + w * U_{is} * U_{ij} > \alpha * U_{it} + \gamma * U_{ik} + w * U_{it} * U_{ik} \ \forall \text{ t} \neq \text{s or k} \neq \text{j}) \quad (2)$$

Notice that it is hard to observe an individual's joint decision on the store to visit and product to purchase because what usually available are the stores that she/he visits or the products that she /he buys in the stores. Therefore, we can rewrite the above equation as

$$P_i(S = s \text{ } and \text{ } J = j) = P_i(S = s) * P_i(J = j \mid S = s) = P_i(U_{is} > U_{it} \ \forall \text{ t} \neq \text{s}) * P_i\big(U_{ij} > U_{ik} \ \forall \text{ k} \neq \text{j} \mid \text{S} = \text{s}\big) \quad (3)$$

where $P_i(S = s)$ is the probability of vising the store *s*, and $P_i(J = j \mid S = s)$ is the probability of purchasing *j* conditional on that the individual visits the store.

Correspondingly, the joint probability can also be written as

$$P_i(S = s \text{ } and \text{ } J = j) = P_i(J = j) * P_i(S = s \mid J = j) = P_i\big(U_{ij} > U_{ik} \ \forall \text{ k} \neq \text{j}\big) * P_i(U_{is} > U_{it} \ \forall \text{ t} \neq \text{s} \mid \text{J} = \text{j}) \quad (4)$$

where $P_i(J = j)$ is the probability of purchasing the product *j*, and $P_i(S = s | J = j)$ is the probability of visting the store *s* conditional on purchasing product *j*.

The unconditional probability ($P_i(S = s)$ and $P_i(J = j)$) and conditional probability ($P_i(\mathrm{J} = \mathrm{j} \mid \mathrm{S} = \mathrm{s})$, $P_i(S = s | J = j)$) can be estimated based on the random utility theory. The random utility theory suggests that an individual's utility is composted of a deterministic component that can be observed by researchers and an unobservable stochastic error. This suggests that $U_{is} = V_{is} + \varepsilon_{is}$ and $U_{ij} = V_{ij} + \varepsilon_{ij}$, where V_{is} and V_{ij} are the deterministic components, and ε_{is} and ε_{ij} are unobservable stochastic errors. The conditional utility $U_{ij}|s$ and $U_{is}|j$ can also be specified in the same way accordingly. Assuming that the utility is a linear function of store/product attributes, and the stochastic components follow Gumbel distributions, then the unconditional probabilities that an individual choose a store *s* or purchase a product *j* can be estimated as

$$P_i(S = s) = P_i(U_{is} > U_{it}\ \forall\ \mathrm{t} \neq \mathrm{s}) = \int \frac{\exp(\beta` * X_{is})}{\sum_{s=1}^{S} \exp(\beta` * X_{is})} f(\beta) d\beta \quad (5)$$

and

$$P_i(J = j) = P_i\left(U_{ij} > U_{ik}\ \forall\ \mathrm{k} \neq \mathrm{j}\right) = \int \frac{\exp(\alpha` * X_{ij})}{\sum_{j=1}^{J} \exp(\alpha` * X_{ij})} f(\alpha) d\alpha \quad (6)$$

The conditional probabilities are

$$P_i(S = s | J = j) = P(U_{is} > U_{it}\ \forall\ \mathrm{t} \neq \mathrm{s} | J = j) = \int \frac{\exp(\beta` * X_{is} | J=j)}{\sum_{s=1}^{S} \exp(\beta` * X_{is} | J=j)} f(\beta) d\beta \quad (7)$$

and

$$P_i(J = j \mid S = s) = P_i\left(U_{ij} > U_{ik}\ \forall\ \mathrm{k} \neq \mathrm{j} \mid S = s\right) = \int \frac{\exp(\alpha` * X_{ij} | S=s)}{\sum_{j=1}^{J} \exp(\alpha` * X_{ij} | S=s)} f(\alpha) d\alpha \quad (8)$$

$f(\beta)$ and $f(\alpha)$ are density function of the preference parameters for store attributes and product attributes, respectively.

The utility functions in equation (5) – (8) can be estimated using mixed logit models. After obtaining preference parameters, the unconditional and conditional probabilities of choosing a store and purchasing a product can be estimated. Using the Bayesian approach, individual-level parameters can also be estimated for each person (β_i, α_i), which allows to predict the probability of each individual's choice of a specific store or product (e.g., $P_i(S = s)$, $P_i(J = j)$). The predicted probabilities from (5) and (8) can then be used to calculate the jointed probability $P_i(S = s \text{ } and \text{ } J = j)$ based on equation (3) or (4).

Our purpose is to estimate α and γ in equation (2), therefore to determine the relative importance of store and product in an individual's decision to shop. As equation (2) shows, $P_i(S = s \text{ } and \text{ } J = j) = P_i(U_{isj} > U_{itk} \ \forall \text{ t} \neq \text{s or k} \neq \text{j}) = P_i(\alpha * U_{is} + \gamma * U_{ij} + w * U_{is} * U_{ij} > \alpha * U_{it} + \gamma * U_{ik} + w * U_{it} * U_{ik} \forall \text{ t} \neq \text{s or k} \neq \text{j})$ and at this point, we have $P_i(S = s \text{ } and \text{ } J = j)$, U_{is} and U_{ij}. It is hard to analytically derive the formula to estimate α and γ because we don't have information on other stores and products (t and k, $\forall$ t $\neq$ s or k $\neq$ j) when the individual makes a joint decision. However, we use the probability $P_i(S = s \text{ } and \text{ } J = j)$ as a linear approximation of U_{isj} because $P_i(S = s \text{ } and \text{ } J = j)$ is a monitonic fuciton of U_{isj}. As a result, we can estimate α and γ using the following model

$$P_i(S = s \text{ } and \text{ } J = j) = \alpha * U_{is} + \gamma * U_{ij} + w * U_{is} * U_{ij} + e_i \quad (9)$$

Results

As mentioned in survey design, there will two scenarios and each has three steps. Scenario 1 is the store CE will be displayed following with the strawberry CE. Therefore, step 1 is to choose a preferred store (or opt-out option) in the store CE. Step 2 is to choose the preferred strawberries (or opt-out option) in the strawberry CE. Step 3 is similar as Step 2 but with a specific store choice set presented (store profile). Scenario 2 is the strawberry CE will be presented followed by the store CE. Step 1 is to choose the preferred strawberries (or opt-out option) in the strawberry CE. Step 2 is to choose a preferred store (or opt-out option) in the store CE. Step 3 is similar as Step 2 but with a specific strawberry choice set presented (strawberry profile). Table 3 reports summary statistics of the respondents' demographics in those two scenarios. Generally, those two groups are similar, except for some income level and education level groups.

For both scenarios, the unconditional and conditional utility probabilities of choosing a certain alternative need to be derived. For unconditional utility probabilities, all the displayed attributes are included in the mixed logit model. To model the conditional utility probabilities, we interact the store attributes with the strawberry attributes to capture all the possible effects. However, practically, we figure out that if including all the possible interaction terms into the model, the Hessian matrix of the model turns out to be singular. Thus, we delete some interaction terms to derive plausible results.

Table 3. Means and Percentage of Respondent Demographics by Scenarios

	Scenario 1	Scenario 2
Variable	Mean	Mean
Age	59.122	56.642
	Percentage	Percentage
Annual Income		
Under $14,999	8.20%	9.30%
$15,000-$24,999	14.30%	7.40%
$25,000-$34,999	8.20%	16.70%
$35,000-$49,999	10.20%	14.80%
$50,000-$74,999	22.40%	14.80%
$75,000-$99,999	12.20%	14.80%
$100,000-$149,999	10.20%	11.10%
$150,000-$199,999	2.00%	3.70%
$200,000 or more	8.20%	3.70%
Gender		
Female	46.90%	46.30%
Male	49.00%	50.00%
Education		
Less than high school graduate	4.10%	0.00%
High school graduate	30.60%	18.50%
Some college or associate degree	28.60%	40.70%
Bachelor's degree	12.20%	18.50%
Graduate or professional degree	20.40%	18.50%
Employment		
Employed full time	26.50%	25.90%
Employed part time	2.00%	9.30%
Self-employed	2.00%	7.40%
Unemployed	12.20%	11.10%
Student	6.10%	3.70%
Retired	44.90%	50.00%
Other	2.00%	3.70%
no. of observation	49	54

There are 49 valid responses in the Scenario 1. We first obtain unconditional utility for stores and strawberries, as well as conditional strawberry utility given the specific store profile. Table 4-6 displayed the mixed logit results for three models in each step in Scenario 1. As Table 4 shows, traveling time and high price level of a store are the only two significant variables impacting consumers' willingness to shop at a store. This shows that longer time traveling to the store and higher overall price level will negatively influence the willingness to shop at a store. In the unconditional strawberry CE case (Step 2), only price of the strawberry affects people' preference with significant negative impact, while other food labels don't play a role. When we interacted the store profile with the strawberry attributes, similar as the unconditional strawberry CE case, only the price attribute negatively impacts the utility. Moreover, none of the store attributes affect the utility but some interaction term has significant impact. PRICE*P3 (high over price level) together negatively affect the preference on strawberries.

Table 4. Mixed Logit Model Results for the Unconditional Store Utility from Step 1 in Scenario 1

Variable	Coeff.	Std. Err.	p-value	
Traveling Time	-0.230	0.071	0.001	**
Intercept	-4.361	1.132	0.000	***
Average Overall Price Level	0.201	0.653	0.759	
High Overall Price Level	-4.006	1.651	0.015	*
Average Ethical Labeled Food Availability	-0.392	0.726	0.589	
High Ethical Labeled Food Availability	-0.892	0.522	0.088	.
Average Local Food Availability	-0.800	0.855	0.350	
High Local Food Availability	0.413	0.504	0.413	
Average Organic Food Availability	0.861	0.597	0.149	
High Organic Food Availability	0.216	0.518	0.677	
Partly Automated Store	0.138	0.440	0.753	
Fully Automated Store	-0.599	0.549	0.276	
sd. Average Overall Price Level	2.965	1.224	0.015	*
sd. High Overall Price Level	6.704	2.247	0.003	**
sd. Average Ethical Labeled Food Availability	2.753	0.825	0.001	***
sd. High Ethical Labeled Food Availability	2.181	0.576	0.000	***
sd. Average Local Food Availability	2.636	0.942	0.005	**
sd. High Local Food Availability	2.751	1.062	0.010	**
sd. Average Organic Food Availability	0.859	0.504	0.088	.
sd. High Organic Food Availability	0.852	0.440	0.053	.
sd. Partly Automated Store	1.606	0.637	0.012	*
sd. Fully Automated Store	2.292	0.613	0.000	***

no. of observations	294			
Log Likelihood	-243.85			

Note: ***, **, * indicates the significant level at 1%, 5%, and 10%, respectively.

Table 5. Mixed Logit Model Results for the Unconditional Strawberry Utility from Step 2 in Scenario 1

Variable	Coeff.	Std. Err.	p-value	
Price	-2.085	0.631	0.001	***
Intercept	-7.085	2.053	0.001	***
Ethical Label	-0.532	0.467	0.255	
Local Label	0.636	0.453	0.161	
USDA Organic Label	0.775	0.659	0.240	
sd. Ethical Label	0.943	0.929	0.310	
sd. Local Label	0.999	1.096	0.362	
sd. USDA Organic Label	2.607	1.231	0.034	*
no. of observations	98			
Log Likelihood	-79.984			

Note: ***, **, * indicates the significant level at 1%, 5%, and 10%, respectively.

Table 6. Mixed Logit Model Results for the Conditional Strawberry Utility from Step 3 in Scenario 1

Variable	Coeff.	Std. Err.	p-value	
Price	-1.257	0.224	0.000	***
Intercept	-5.510	0.720	0.000	***
Price*Average Overall Price Level	-0.265	0.185	0.152	
Price*High Overall Price Level	-0.462	0.207	0.026	*
Ethical label*Partly Automated Store	-0.707	0.625	0.258	
Ethical label*Fully Automated Store	-0.999	0.683	0.143	
Ethical label	0.637	0.495	0.198	
Local Label	0.152	0.228	0.503	
USDA Organic Label	-0.135	0.338	0.689	
sd.Ethical Label	0.590	0.400	0.140	
sd.Local Label	0.365	0.486	0.452	
sd.USDA Organic Label	0.929	0.434	0.032	*
no. of observations	192			
Log Likelihood	-150.64			

Note: ***, **, * indicates the significant level at 1%, 5%, and 10%, respectively.

After running the mixed logit model, both unconditional utility probabilities and conditional utility probabilities are obtained. In the Table 7, *U.is* is individual i's predicted probabilities of choosing the store *s* from the Step 1 matching with the store profile in Step 3. *U.ij* is individual i's predicted probabilities of choosing the strawberry *j* from the Step 2. The dependent variable (*U.ijs*) is the product of *U.is* and the predicted conditional probabilities of choosing the strawberry *j* from the Step 3 with the store *s* matching with the presented store profile. Since each respondent will have two *U.ij*, the data to estimate the joint decision is panel data. Those predicted probabilities are continuous. To estimate equation (1), linear regression for panel data is used to estimate the α, γ and w. From the results in Table 7, only the interaction term is significant, indicating that unconditional utility of either the store or the strawberries is not important in determining the joint decision to a grocery shopping trip. The coefficient of the interaction term is about 0.02, accounting for the small positive interactive impact between choosing a store *s* and buying the strawberries *j* on the final joint decision. Comparing to the main effect of *U.is* and *U.ij*, the interaction term is relatively more important in affecting the joint probability of going to the store *s* and buying the strawberries *j*. This indicates that neither store selection nor food choice dominate the grocery shopping trip individually, instead, both together lead to the final joint decision.

Table 7. Linear Regression Model Estimates of the Joint Decision in Scenario 1

Description	Variable	Coeff.	Std. Err.	p-value	
	intercept	0.000	0.000	0.319	
Unconditional store utility	U.is	0.003	0.002	0.074	
Unconditional strawberry utility	U.ij	0.000	0.000	0.414	
	U.is*U.ij	0.020	0.008	0.019	*
R-Squared	0.295				
Adj. R-Squared	0.238				
no. of observation	41				

Note: ***, **, * indicates the significant level at 1%, 5%, and 10%, respectively.

There are 54 valid responses in the scenario 2. To model the joint decision, like the Scenario 1, we first use mixed logit model to obtain the predicted probabilities of unconditional utility for store and strawberries, as well as conditional store utility given the specific strawberry profile. The mixed logit model is used to calculate those utilities. Table 8-10 displayed the mixed logit results for three models from each step in Scenario 2. Price and local label are significant in the unconditional strawberry utility, indicating that lower price and local labelled strawberries are most preferred by consumers. In the unconditional store utility case, only partial automated store negatively impacts the willingness to shop at a store, while all other attributes didn't have any effect. The trends seem to be very different in conditional store utility case from Step 3. Even though there is no estimation for very few variables in the model, however, multiple store attributes and interaction terms displayed the significant impact. For store attributes, consumers are more likely to shop at a store with low traveling time, average price level, less ethical labeled food availability and regular store without any automation technology adopted in-store. Besides, the interaction between the price of strawberries and overall price level of the store (both average and high) negatively affects the preference to shop at a store when there is a specific type of strawberries the respondent needs to buy. The interaction between food labels and the availability of that labeled food in the store also plays a role in determining respondents' willingness to shop. For example, the positive coefficient of the ethical label of the strawberries and the high ethical labeled food availability of the store indicates that when the consumer requires to buy ethical-labeled strawberries, her/his likelihood to shop at a store with high ethical labeled food availability will be greater than other stores.

Table 8. Mixed Logit Model Results for the Unconditional Strawberry Utility from Step 1 in Scenario 2

Variable	Coeff.	Std. Err.	p-value	
Price	-1.335	0.138	0.000	***
Intercept	-5.387	0.476	0.000	***
Ethical Label	-0.134	0.166	0.418	
Local Label	0.495	0.182	0.007	**
USDA Organic Label	-0.074	0.220	0.737	
sd. Ethical Label	0.174	0.460	0.706	
sd. Local Label	0.908	0.212	0.000	***
sd. USDA Organic Label	0.869	0.274	0.002	**
no. of observations	432			
Log Likelihood	-332.17			

Note: ***, **, * indicates the significant level at 1%, 5%, and 10%, respectively.

Table 9. Mixed Logit Model Results for the Unconditional Store Utility from Step 2 in Scenario 1

Variable	Coeff.	Std. Err	p-value	
Traveling Time	-4.506	2.465	0.068	
Intercept	-149.244	104.472	0.153	
Average Overall Price Level	-22.114	20.164	0.273	
High Overall Price Level	-154.918	110.579	0.161	
Average Ethical Labeled Food Availability	6.416	5.040	0.203	
High Ethical Labeled Food Availability	79.389	50.801	0.118	
Average Local Food Availability	54.252	31.300	0.083	
High Local Food Availability	-25.312	21.252	0.234	
Average Organic Food Availability	39.155	22.000	0.075	
High Organic Food Availability	-51.845	37.888	0.171	
Partly Automated Store	-33.297	16.229	0.040	*
Fully Automated Store	-127.689	82.136	0.120	
sd.Average Overall Price Level	140.106	98.375	0.154	
sd.High Overall Price Level	9.775	6.917	0.158	
sd.Average Ethical Labeled Food Availability	3.610	4.941	0.465	
sd.High Ethical Labeled Food Availability	133.936	91.088	0.141	
sd. Average Local Food Availability	12.072	10.413	0.246	
sd. High Local Food Availability	33.550	22.735	0.140	
sd.Average Organic Food Availability	196.174	143.640	0.172	
sd. High Organic Food Availability	42.814	29.774	0.150	
sd. Partly Automated Store	67.928	51.722	0.189	
sd. Fully Automated Store	208.987	145.123	0.150	
no. of observations	108			
Log Likelihood	-82.05			

Note: ***, **, * indicates the significant level at 1%, 5%, and 10%, respectively.

Table 10. Mixed Logit Model Results for the Conditional Store Utility from Step 3 in Scenario 1

Variable	Coeff.	Std. Err	p-value	
Traveling Time	-0.235	0.078	0.003	**
Intercept	-7.387	1.685	0.000	***
Price	0.058	.	.	
Ethical label	-0.002	23990	1.000	
Local Label	-0.003	.	.	
USDA Organic Label	-0.002	46573	1.000	
Price*High Overall Price Level	-1.666	0.686	0.015	*
Price*Average Overall Price Level	-1.296	0.650	0.046	*
Average Ethical Labeled Food Availability*Ethical Label	3.870	1.264	0.002	**
High Ethical Labeled Food Availability*Ethical Label	4.893	1.465	0.001	***
Average Local Food Availability *Local Label	1.446	0.915	0.114	
High Local Food Availability *Local Label	0.035	0.958	0.971	
Average Organic Food Availability*Organic Label	-0.475	0.904	0.600	
High Organic Food Availability*Organic Label	2.064	1.157	0.075	.
Partly Automated Store*Ethical Label	3.762	1.336	0.005	**
Fully Automated Store*Ethical Label	-2.791	1.212	0.021	*
Average Overall Price Level	3.814	1.937	0.049	*
High Overall Price Level	-1.850	2.129	0.385	
Average Ethical Labeled Food Availability	-3.119	0.885	0.000	***
High Ethical Labeled Food Availability	-2.402	0.759	0.002	**
Average Local Food Availability	0.111	0.613	0.857	
High Local Food Availability	0.414	0.780	0.595	
Average Organic Food Availability	-0.185	0.743	0.803	
High Organic Food Availability	-1.418	0.971	0.144	
Partly Automated Store	-1.742	0.666	0.009	**
Fully Automated Store	-2.763	0.796	0.001	***
sd. Average Overall Price Level	7.174	1.906	0.000	***
sd. High Overall Price Level	7.108	1.874	0.000	***
sd. Average Ethical Labeled Food Availability	2.360	0.913	0.010	**
sd. High Ethical Labeled Food Availability	2.567	0.657	0.000	***
sd. Average Local Food Availability	2.302	0.625	0.000	***
sd. High Local Food Availability	2.722	0.899	0.002	**
sd. Average Organic Food Availability	0.578	0.407	0.155	
sd. High Organic Food Availability	2.786	0.780	0.000	***
sd. Partly Automated Store	3.281	0.839	0.000	***
sd. Fully Automated Store	4.306	1.021	0.000	***
no. of observations	324			
Log Likelihood	-234.44			

Note: ***, **, * indicates the significant level at 1%, 5%, and 10%, respectively.

Following the same procedure in Scenario 1, both unconditional utility probabilities and conditional utility probabilities are obtained from those mixed logit models. In the Table 11, *U.ij* is individual i's predicted probabilities of purchasing the strawberry *j* from the Step 1 matching with the strawberry profile in Step 3. *U.is* is individual i's predicted probabilities of choosing the store *s* the Step 2. The dependent variable (*U.ijs*) is the product of U.is times the predicted probabilities of choosing the store *s* from the Step 3 with the strawberry *j* matching with the presented strawberry profile. Even though each respondent will have two *U.is*, however, those store choice sets from Step 3 is randomly selected from the total 18 store choice sets, thus, the unconditional store CE may not be matched with the store CE in the Step 2. Ultimately, the data becomes cross-sectional with continuous values after matching the strawberry profile and there are 27 observations left. Table 11 shows the results of linear regression to estimate equation (1) in Scenario 2. Consistent with Scenario 1, only the interaction term is significant. This indicates that the interaction effect of food choice and store selection positively affect the joint probability of going to the store *s* and buying the strawberries *j*. This again confirms that the joint probability of a grocery shopping trip is only determined by integrating food choice and store selection together.

Table 11. Linear Regression Model Estimates of the Joint Decision in Scenario 2

Description	Variable	Coeff.	Std. Err.	p-value	
	intercept	0.000	0.000	0.994	
Unconditional store utility	U.is	0.000	0.000	0.987	
Unconditional strawberry utility	U.ij	0.002	0.006	0.773	
	U.is:U.ij	0.240	0.045	0.000	***
R-Squared	0.793				
Adj. R-Squared	0.766				
no. of observation	27				

Note: ***, **, * indicates the significant level at 1%, 5%, and 10%, respectively.

Conclusions

This study aims to examine the bi-directional relationship by putting food choice and grocery store selection contexts together. By utilizing choice experiments, we create two different scenarios for consumers to state their preference under different choice scenarios to calculate their utility and capture the dynamic decision-making process between food choice and grocery store selection.

In the scenario where consumers need to decide the store choice first, surprisingly, only two store attributes affect their store selection. Without showing any store profile, we find that consumers only care about the price of strawberries when making a food choice. When presenting a specific store profile, besides price, PRICE*P3 (high over price level) together negatively impact the WTP of the strawberries. In this scenario, there is no bi-directional relationship by putting food choice and grocery store selection contexts together. From the results in estimating equation (1), we can conclude that either store selection or food choice dominate the grocery shopping trip individually, instead, both together lead to the final joint probability.

On the other hand, different attributes impact both consumers store selection and food choice when first seeing strawberry CE followed by store CE. In the food CE, Price and local label are both significant affecting consumers' preference. At the unconditional store CE, only partial automated store negative impacts consumers' preference towards a store. However, with specific strawberry profile displayed along with store CE, there are multiple store attributes and interaction terms showing significant impact. This indicates that there exists bi-directional relationship when putting food choice first and food choice may dominate the joint probabilities of one grocery shopping trip and impact consumers' store selection. However, in the estimate of the joint probabilities, only the interaction term between unconditional food utility and unconditional store utility significantly affects the final joint probability, which is consistent with the first scenario.

Even though there are differences in each scenario when estimating the utility for each choice set, however, the estimation in equation (1) indicates that the interaction effect outweighs the main effect of store selection and food choice on the final joint decision of a grocery shopping trip. This indicates that both store features and food attributes are important to the development of a grocery store. When considering about which marketing strategies to develop the store, grocers should always integrate two marketing strategies together. Only emphasizing on one perspective will not have an impact on consumers' decision on their grocery shopping trips.

For the next step, as more valid responses available, we expect to see different results. And we will also check the effect of the demographic and other consumption-related variables on the final joint decision.

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