

THESIS

HOW COLORADOAN'S ATTRIBUTES, BEHAVIORS, AND ATTITUDES AFFECT  
DEMAND FOR LOCAL FOOD

Submitted by

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## ABSTRACT

### HOW COLORADOAN'S ATTRIBUTES, BEHAVIORS, AND ATTITUDES AFFECT DEMAND FOR LOCAL FOOD

Demand for local food has grown within the last several decades, leading to changes in the ways consumers shop for their food for at-home consumption. Many previous studies have investigated demand for local food in order to understand if and how private and public attributes, behaviors, and attitudes affect consumers' decisions to purchase local food. However, few studies have explored how these factors are related to a consumer's use of search, experience, and credence dimensions used when shopping and how these vary between different types of local food consumers. This study attempts to understand how consumers who are purchasing state branded products, interested in purchasing locally grown vegetables and fruits, and shopping at direct markets use product attributes, behaviors, and attitudes in different ways and how these factors relate to search, experience, and credence dimensions. We find that individuals interested in state branded products and locally grown vegetables are more likely to use experience dimensions, individuals interested in state grown fruits are more likely to use search dimensions, and individuals shopping at direct markets are more likely to use credence dimensions. These results provide insight into why these dimensions are most likely to be utilized by certain consumer groups and why the consumer groups differ.

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## INTRODUCTION

U.S. consumers are highly differentiated when it comes to their shopping behaviors and product preferences. As one example, at an aggregate level, we can see that increasingly, people shop at different locations. According to the United States Department of Agriculture's (USDA) Economic Research Service (ERS), in 2014, Americans spent \$1.46 trillion on food, and 49.9% of this total were expenditures on food for at-home consumption. The ERS also found that consumer's choices for retail location of at-home food expenditures have changed in the last several decades. In 1990, 80% of food for at-home consumption was purchased at supermarkets and other grocery stores and more recently, in 2014, that number had dropped to 65% ("After falling in the late 1990s and early 2000s, supermarkets' share of at-home food spending has stabilized," 2016). The USDA also conducted the National Household Food Acquisition and Purchase Survey (FoodAPS) to understand where Americans are purchasing their food for at-home consumption in a one-week period. Results indicate that households across the nation and across income levels use a variety of markets in a one-week period to obtain their food for at home consumption (Todd and Scharadin, 2016). It was also found that regardless of income, consumers do not choose their shopping location purely based on price, but on a number of additional attributes including location, quality, and the choices of products available (Ver Ploeg et al., 2015).

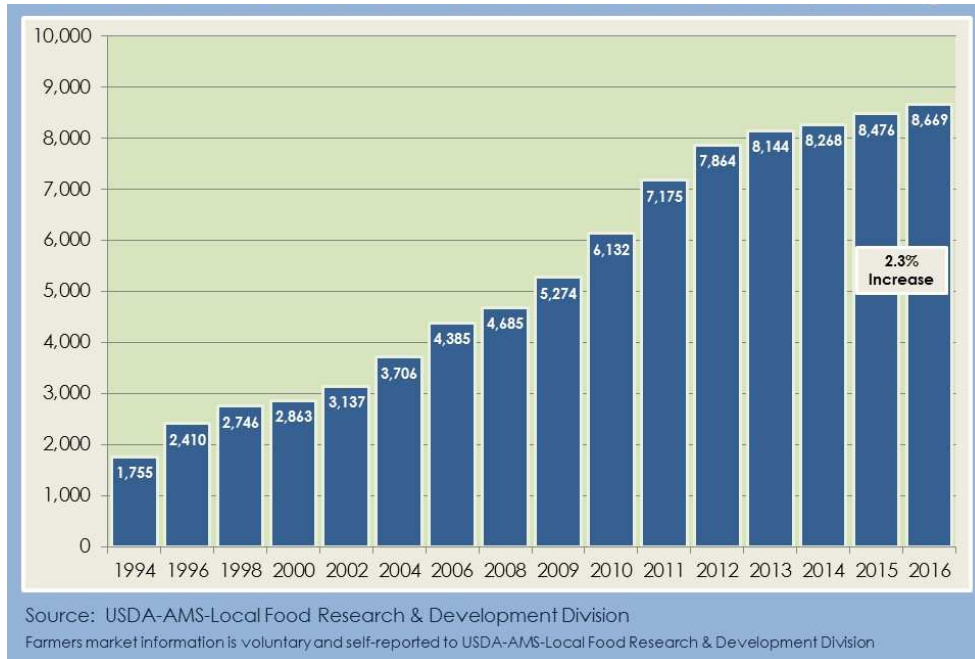
One highly visible example of differentiated food markets is the growth of local foods and subsequently, the growth in state branding and promotion policies targeted toward local food. In 2015, \$8.7 billion in locally grown agricultural products were sold throughout the United States (U.S. Department of Agriculture, National Agricultural Statistics Service, 2016).

Although local food is a burgeoning market within the agricultural industry, the definition of what local is remains unclear as the term is not defined or regulated by the federal government. One program designed to indicate local food products to consumers and influence them are state branding programs, which provide information to the consumer about products produced in a given state (Onken & Bernard, 2010). This research addresses what we can learn from consumers who are influenced by state branding programs as well as gain a deeper understanding of more nuanced local food purchases through consumers who are interested in purchasing vegetables and fruits identified as Colorado grown and individuals shopping at direct-to-consumer markets. We believe that consumers purchasing Colorado Proud products will use different factors than consumers who are interested in purchasing Colorado grown fruits and vegetables and who are shopping at direct markets due to the differentiation in the types of consumers and their needs. The three specific research questions addressed are:

1. *What factors affect Colorado consumers' choice to buy Colorado Proud products?*
2. *What factors affect Colorado consumers' interest in purchasing vegetables or fruits that are available and identified as Colorado grown?*
3. *What factors affect Colorado consumers' propensity to spend a greater percentage of food at home expenditures at direct markets?*

One piece of evidence that demonstrates growing interest in the local food sector is growth in the number and diversity of local food markets. According to the USDA's National Agricultural Statistics Service (NASS), direct-to-consumer markets allow the producer and the consumer to directly interact and can include farmers' markets, on-farm stores, roadside stands, and CSA (community supported agriculture) activities, for example (U.S. Department of

Agriculture, National Agricultural Statistics Service, 2016). Direct-to-consumer markets enable farms to be directly connected to the consumer (Low et al., 2015). Figure 1 highlights the growth of farmers’ markets across the United States from 1994 to 2016. Across this 12-year period, the number of farmers’ markets increased every year (“Farmers Markets and Direct-to-Consumer Marketing,” 2016).

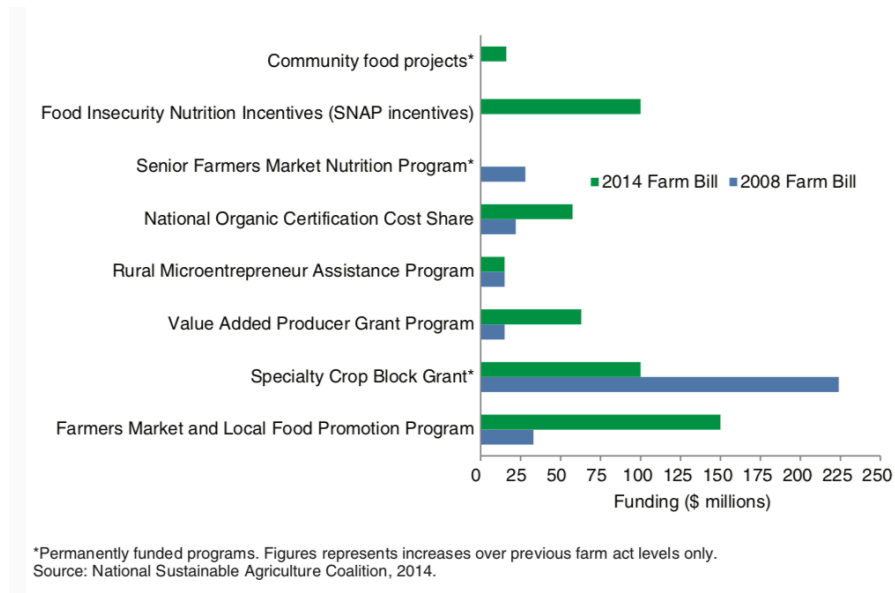


Source: “Farmers Markets and Direct-to-Consumer Marketing,” 2016

Figure 1: Number of farmers’ markets across the United States from 1994 - 2016

Another example of interest in local food is growth in federal and state policies aimed at growing these markets. Nationally, the Agricultural Act of 2014 (known as the Farm Bill) is a federal bill that establishes programs related to food policy and agriculture. Funding for programs such as the Farmers’ Market and Local Food Promotion Program, Value-Added Producer Grant, and Specialty Crop Block Grants have grown in more recent Farm Bills (Low et al., 2015). Figure 2 compares program support between the 2008 and 2014 Farm Bill. The Farmers Market and Local Food Promotion Program, for example, supports local food systems

through the expansion and creation of new markets and support organizations focused on increasing local food access (Low et al., 2015).



Source: Low et al., 2015

Figure 2: Spending levels for local food programs supported by the 2008 and 2014 Farm Bills

State governments are also involved in funding projects and programs surrounding the local food system. Figure 3 highlights state-level laws enacted from 2007 to 2013 (Low et al., 2015). Programs that expand farmers’ markets are most common across states and have grown the most. However, programs to support community gardens, urban agriculture, and nutrition programs have also grown over the six-year period.

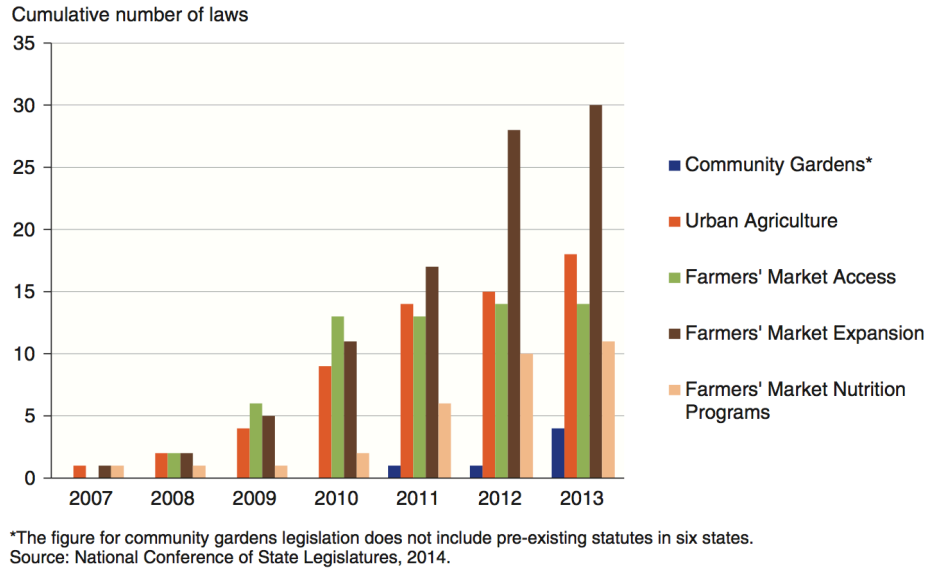


Figure 3: State-level food policy laws by topic and year

One challenge with policies and programs supporting local food is that there is no universal definition. According to Hand and Martinez (2010), when local food is demarcated, it is often tied to geographic or political boundaries. However, the most important claim of local food is that these particular goods satisfy certain characteristics that consumers look for, such as quality, freshness, or social, environmental, or economic benefits (Hand & Martinez, 2010). As local food does not have a clear definition, it often means different things to different people, and accordingly, consumers rely on various types of information to help them make purchasing decisions. One primary additional source of information is relayed directly from consumers via direct-to-consumer markets (Thilmany McFadden, 2015). Instead of defining local food by a geographic or political boundary, it can instead be defined by how it changes the overall food system and how those changes align with what consumers are wanting to see (Thilmany McFadden, 2015). Nurse, Onozaka, and Thilmany McFadden (2012) find that local may be more about how producers meet the consumer’s desired changes of the food system.

Previous studies have found that consumers tend to associate local products as having distinct qualities. In a national survey analyzed by Onozaka, Nurse, and Thilmany McFadden (2010), 70% of respondents rated local food as having superior freshness, 60% rated local food as higher quality, 50% rated local food as having high food safety, and 50% rated local food as having higher nutritional value as compared to non-local produce. Respondents also believed locally produced food to be superior at supporting the local economy and providing fair returns to farmers as compared to non-locally produced food (Onozaka, Nurse, and Thilmany McFadden, 2010).

One way in which information about local food is given to consumers is through state agricultural branding programs, which have been developed by every state and are created to provide information to the consumer about products produced in a given state (Onken & Bernard, 2010). Although each state operates their program independently, most have some sort of qualification to be considered local, as well as an official logo designating the food as local on the product. Branding programs in general are developed to gain attention to a particular product, as shown in the case of Oregon's state tourism campaign 'Oregon. Things Look Different Here.' According to Curtis (2000), Oregon developed this campaign in response to a poor performing state economy with the goal to brand Oregon as a desirable place to move to and do business in, garnering more attention to the state as whole. Agricultural state branding programs exist to highlight what products are produced within the state and capture a share of the increased interest in local products we are seeing throughout the U.S. Producers and individuals along the supply chain also receive benefits from state branding as the differentiation allows these individuals to benefit from premium pricing (Nganje, Hughner, and Lee, 2011). However, state branding programs are publicly-funded programs that aim to increase statewide awareness of

local food to as many consumers as possible as well as benefit as many producers as possible. Because of the this, state branding programs are often designed to be the widest definition of local because the program must be catered toward benefiting a wide range of agricultural and food businesses throughout a given state.

The Colorado Department of Agriculture manages Colorado's state branding program, Colorado Proud. The program started in 1999 and allows producers who grow, process, or raise their produce within Colorado to use the Colorado Proud logo as well as other marketing materials. Colorado Proud products can be found in grocery stores, farmers' markets, garden centers, and restaurants (Colorado Department of Agriculture, 2017). Colorado is an interesting state to look at in terms of understanding demand for local food due to the large interest in product differentiation within the state. The state branding program has been around for almost 20 years and when asked about their awareness of Colorado Proud, 86.6% of surveyed Coloradoans answered that they were aware of the program. According to the USDA National Agriculture Statistics Survey (NASS), Colorado had a total of \$26 million in direct market sales in 2015 (United States Department of Agriculture, Census of Agriculture, 2015) and \$181 million in organic sales in 2016, making it one of the top ten states for organic production and a growing state in local food production (U.S. Department of Agriculture, National Agricultural Statistics Service, 2017).

This thesis contributes to the body of literature about local food and market choices in three main ways. First, this paper bridges studies done about trust in information and how that affects consumer's interest in purchasing a particular good. Studies within applied communications focus on how individuals use trust and information to make decisions. However, these studies are often qualitatively focused. Studies within applied economics tend to

focus on quantifying a consumer's choices, but often do not include variables on how information and trust influence a consumer's decision to purchase a good. This paper attempts to combine these two areas by explaining how information and trust are relevant to the economic decision to purchase a good.

A second contribution is to understand if the factors that consumers are using to inform their purchases of state branded products are the same or different from the factors being used by consumers interested in purchasing state grown produce and by consumers purchasing from direct markets. As mentioned, state branding programs allow for all producers throughout the state to benefit from differentiating their products as local. However, consumers purchasing specific locally-grown or raised products or in more nuanced ways such as at direct markets may not be using the state branding program to inform their decisions. This analysis attempts to understand the factors being used by different types of local food consumers as well as understand why these differences may exist.

Lastly, many studies in literature about local food and market choices use national datasets. This study focuses on Colorado, which has a high awareness of the state branding program and a large interest in differentiated products. Colorado is also a state where nutrition gained from fruits and vegetables is lacking. A survey conducted by the Colorado Department of Public Health and Environment found that 86% of Colorado adults were not eating the daily consumption recommendations of fruits and vegetables (Colorado Department of Public Health and Environment, 2014). Increasing fruit and vegetable availability and consumption are growing topics of interest to public health organizations across the state.

This paper will first take a look at previous literature related to these research questions. This includes an overview of how characteristics of food help determine how consumers make



decisions, how trust is an important factor in that information decision and how consumers use information to advise their decisions, a breakdown of state branding programs including Colorado's program, and how characteristics of markets help consumers make decisions. Next, the theoretical model is addressed, outlining utility theory as well as characteristic demand theory. The next section highlights the econometric application and data used to parameterize the econometric models. Lastly, results are presented and discussed, allowing for an understanding of which factors are influencing consumer's decisions on local food and market choice. The discussion includes factors that are particularly interesting and how these results might influence higher participation in local food purchasing and markets.

## LITERATURE REVIEW

In order to understand the factors that influence consumers to purchase local food and to shop at direct-to-consumer markets, it is first important to explore literature relating to these areas. In this literature review, we will first address what previous research finds about how consumers are choosing the type of food they purchase. Next, we will review how trust and information affect what consumers ultimately choose to do, as well as how state branding programs are designed to give producers information. We will then review the literature on why consumers are choosing to spend their money at direct-to-consumer markets. Lastly, we will explain how this thesis contributes to the literature overall.

### *Food Choice*

When looking at the body of literature that focuses on how consumers are choosing to purchase local products, the main factors influencing consumer's choice are product attributes. A product attribute is a characteristic of the product itself, such as the way it looks, the way it tastes, or where it comes from. Individual products can have many different attributes. Overall, these studies find that individuals who value certain attributes are more likely to purchase local products. Table 1 highlights the different attributes referred to throughout this literature review, the definition of what that attribute means, and specific articles in which these attributes are discussed. This table breaks down five different types of attributes: private attributes, public attributes, search dimensions, experience dimensions, and credence dimensions. Private attributes meet the consumer's needs and wants, such as taste, convenience, and price. Public attributes meet society's needs and wants, such as the environmental or economic impact of a particular product. Search dimensions are attributes an individual is able to see when they

purchase the product, such as information displayed on a label or the outward appearance of the product. Experience dimensions are the attributes an individual experiences when they actually consume the product, such as the taste and texture of the product. Lastly, credence dimensions are the attributes of a product an individual would not be able to understand themselves, but for which they must rely on outside information to understand. A common example of this is products labeled as organic or local. Private and public attributes are unique and do not overlap with each other, however, consumers are using both private and public attributes as search, experience, and credence dimensions in combination when they are thinking about the types of products to purchase or the retail location to shop at (Grunert, 2002).

Table 1: Definition and use of product attributes and dimensions

<b>Attribute</b>	<b>Definition</b>	<b>Occurrence in the literature</b>
Private attributes	Product attributes that benefit the individual and meet the individual's needs and wants, such as taste, convenience, and price	Thilmany, Bond, and Bond (2008); Onozaka, Nurse, and Thilmany McFadden (2010); Cranfield, Henson, and Blandon (2012); Costanigro et al. (2011), Bond, Thilmany, and Keeling Bond (2008); Zepeda and Nie (2012); Zepeda and Li (2006), Keeling Bond, Thilmany, and Bond (2009), Nganje, Hughner, and Lee (2011), Peterson, Taylor, and Baudouin (2015), Vassalos, Gao, and Zhang (2017), Zepeda (2009)
Public attributes	Product attributes that benefit a group of people and meet society's needs and wants, such as local, environmental impact, and economic impact	Thilmany, Bond, and Bond (2008); Onozaka, Nurse, and Thilmany McFadden (2010); Cranfield, Henson, and Blandon (2012); Costanigro et al. (2011), Bond, Thilmany, and Keeling Bond (2008); Zepeda and Nie (2012); Zepeda and Li (2006), Keeling Bond, Thilmany, and Bond (2009), Nganje, Hughner, and Lee (2011), Peterson, Taylor, and Baudouin (2015), Vassalos, Gao, and Zhang (2017), Zepeda (2009)

Search dimensions	Qualities or attributes of the product an individual can see when they purchase the product, such as color or information found on a label	Grunert (2002); Peterson, Taylor, and Baudouin (2015)
Experience dimensions	Qualities or attributes of a product that the purchaser only knows after they've eaten the product, such as taste	Grunert (2002)
Credence dimensions	Product qualities an individual consumer would not be able to understand themselves, but instead must rely on others for trustworthy information, such as whether the product is local or not	Grunert (2002); Peterson, Taylor, and Baudouin (2015)

As a consumer is shopping for products, he or she creates a quality expectation, which measures the quality they expect to get out of the product (Grunert, 2002). After the consumer makes a purchase decision and consumes the product, the quality experience is measured. The difference between the consumer's quality expectation and quality experience measures the consumer's satisfaction. If there is a small difference between the two quality measures, the consumer is satisfied. The higher the consumer satisfaction, the more likely the consumer will purchase the product again (Grunert, 2002). This is an important aspect for a product like food, which has a high frequency of purchase. We can also think of satisfaction in terms of utility. Consumers receive utility through the purchase and use of a good. The product's attributes inform which product the consumer will choose. The individuals choose the product with the attributes that bring them the highest expected utility (Nganje, Hughner, & Lee, 2011), and past experiences will play into those expectations.

Thilmany, Bond, and Bond (2008) assume consumers are choosing the shopping location and the product that maximizes their utility whenever they are purchasing food for at home consumption. They indicate that the utility gained from food purchases and from the source can

vary depending on what shopping location and what types of food are chosen. The authors, using a national dataset, also contend both shopping location and food choices are dictated by private and public attributes. If we want to know why consumers are purchasing local products, it is best to start by understanding what product attributes are associated with local food.

In Costanigro et al.'s (2011) study, which included a survey of 300 Colorado grocery shoppers, they asked respondents to rank specific attributes of produce from most important to least important. These included both private attributes (such as taste/visual appeal, healthfulness/nutrition, good value, and convenience) and public attributes (such as environmental impact, preserving farmland, and social fairness), that would also likely be tied to credence dimensions. Their results indicated survey respondents who value public good attributes are more likely to demand local products than those who do not value public good attributes. They also found individuals have a higher willingness to pay for local products when compared to organic products, which they believe indicates that a local label differentiates a product more effectively than an organic label.

Zepeda and Li (2006) also investigated which attributes affect a consumer's propensity to purchase local food using a national dataset including 956 observations. In their analysis, the authors consider many factors related to a consumer's willingness to shop locally. Behaviors such as home cooking, frequency of cooking, and gardening can dictate a consumer's choice to purchase local food. Attitudes such as enjoying cooking and supporting local farms are also believed to be important in consumer's local food decision. A consumer's environmental concerns could relate to their food purchasing decisions, as well as store choice and store availability (Zepeda and Li, 2006). Cranfield, Henson, and Bandon (2012) examined what factors affect a consumer's choice to buy local products using a dataset of 1,139 Canadian

consumers. The authors find individuals who are often handling food products through gardening or frequent cooking are more likely to purchase local food. Consumers who highly value food quality and food safety also are more likely to buy food produced locally.

Table 2 summarizes the findings from the above studies, including the primary contribution. Similar themes across these studies exist, especially when looking at the behaviors and attitudes of the consumer and the attributes and characteristics of the products. Individuals who highly value private attributes such as quality and taste as well as public attributes such as environmental or economic benefits are more likely to purchase local foods. Most often a mix of both private and public attributes are valued by local food shoppers.

Table 2: Primary contribution from studies exploring consumers’ local food choices

<b>Authors</b>	<b>Article</b>	<b>Primary Contribution</b>
Costanigro et al. (2011)	“An In-Store Valuation of Local and Organic Apples: The Role of Social Desirability”	Individuals who rank public attributes highly (environmental impact, preserving farmland, and social fairness) place more importance on the local brand. Individuals who rank convenience and value highly ignore the brand.
Cranfield, Henson, and Blandon (2012)	“The Effect of Attitudinal and Sociodemographic Factors on the Likelihood of Buying Locally Produced Food”	Consumer’s attitudes and behaviors (such as their value of safety and taste and their interest in growing and cooking their own food) as well as their opinions toward local food (such as how it benefits farms and the quality of it) increase the likelihood an individual buys local food.
Onozaka, Nurse, and Thilmany McFadden (2010)	“Local Food Consumers: How Motivations and Perceptions Translate to Buying Power”	Of the individuals asked to compare local and non-local products, 70% believe local food has superior freshness, 60% said it has higher quality, 50% said it has more food safety, and 50% said it has higher nutritional values.
Zepeda and Li (2006)	“Who Buys Local Food?”	The most important factors that influence a consumer’s local food shopping choices are other food-related behaviors (such as home cooking and gardening) and attitudes (such as supporting local farms).

A few studies also focused on cluster analysis to segment consumers into groups based on the attributes they tend to favor. This is another way of addressing how consumers with similar interest in particular attributes are purchasing the same products. Bond, Thilmany, and Keeling Bond (2008) used cluster analysis to better understand how private and public attributes differentially affect local food purchases based on what the survey respondent actually buys. The clusters were broken into four segments based on individual's tastes and preferences. The dataset included 1,549 respondents from across the United States.

Both the first and second clusters were driven by characteristics associated with private attributes. The first cluster contained older individuals with higher incomes whose purchasing decisions were driven by private attributes such as firmness, texture, and look of the products, and less driven by public attributes, such as organic or farmer relationships. The second cluster was also driven by firmness and texture of the product, but also by the value and safety of the product. The third cluster contained a higher selection of young, educated, urban individuals. This group valued organic and origin labels and was found to be more influenced by public attributes. The last cluster did not have strong preferences on either side of the scale measures, but focused instead on the price of the product. The authors find these consumer segments to be differentiated, and because of this differentiation, producers can potentially target different consumers using more refined promotion and retailing strategies. For example, the authors believe the third cluster is more likely to be influenced by producers at farmers' market due to their need for assurance about certain qualities, whereas the fourth cluster is unlikely to be motivated by what the producer says because of their focus on the product's price. Although all clusters find certain public and private attributes important, each cluster places importance on different attributes (Bond, Thilmany, & Keeling Bond, 2008).

Zepeda and Nie (2012) used a national dataset including 956 respondents to break consumers into clusters based on local food attributes. The first cluster was focused on individuals who enjoy shopping for and cooking their own food. The most important attributes to these consumers were health, safety, and freshness. The second cluster was more moderately focused on buying and cooking food for themselves. This group favored the attributes of safety, health, cost, and taste. Their last two clusters are not interested in cooking or buying their own food. The third cluster was focused on safety, low cost, convenience, and freshness, while the fourth cluster was focused solely on convenience and taste (Zepeda and Nie, 2012). The authors also used the clusters to segment consumers based on their product interests, and individuals interested in local and organic products are likely to land in clusters 1 and 2 due to the higher amounts of private attributes associated with local food being characterized in these clusters. Another interesting result is that individuals who were frequent local and organic food buyers were not correlated with the highest income groups, indicating interest in and willingness to pay for local and organic food is not simply predicated on income (Zepeda & Nie, 2012).

Table 3 shows the four different clusters found in both Bond, Thilmany and Keeling Bond's (2008) study as well as Zepeda and Nie's (2012) study. Similarities are found in the two studies. The third and fourth clusters in Zepeda and Nie (2012) are related to Bond et al.'s (2008) first and second clusters in terms of private attributes. These clusters are more concerned with the actual product itself and their private attributes rather than public attributes often associated with local food. Bond et al.'s (2008) third cluster contains individuals more likely to purchase based on product attributes such as local and organic, which is similar to Zepeda and Nie's (2012) finding in their first and second cluster. These individuals are more likely to be influenced by the farmer themselves and more likely to purchase local food.



Table 3: Cluster analysis comparison

	<b>Bond, Thilmany, and Keeling Bond (2008)</b>	<b>Zepeda and Nie (2012)</b>
<b>Cluster 1</b>	Segmented by demographics such as older in age and higher incomes. Value private attributes such as firmness, texture, and look of the products.	Segmented by activities such as cooking and buying their own food. Value private attributes of health, safety, and freshness. More likely to purchase local or organic food.
<b>Cluster 2</b>	Segmented by private attributes such as firmness, texture, value, and safety of the product.	Segmented by attributes of safety, health, cost, and taste. More likely to purchase local or organic food.
<b>Cluster 3</b>	Segmented by demographics such as young, educated, and urban. Value public attributes such as organic and origin labels.	Segmented by attributes of safety, low cost, convenience, and freshness. Not likely to purchase organic or local products.
<b>Cluster 4</b>	Segmented the private attribute of price.	Segmented by attributes of convenience and taste. Not likely to purchase organic or local products.

Overall, the reviewed studies demonstrate that consumers who value certain attributes are more likely to purchase local food. However, attributes are often not understood simply by looking at the product. Local food relies heavily on consumer trust due to credence dimensions because consumers cannot look at a product and ascertain whether or not it was locally produced. They instead must rely on credible information and trust in the information given to them that the product is locally produced. This can be information provided by the producer themselves (as is the case with direct markets), through an expert, such as a produce manager, or information presented on a product label (Grunert, 2002). As the food system becomes more complex, consumers are demanding more information on the food attributes so as to make more informed decisions (Zepeda & Li, 2006).

### *Trust and Information*

The advent of the modern age has led to a large amount of information and more diverse information sources (Huffman et al., 2004). Information is oftentimes conflicting or

contradictory, making consumers rely on what they deem as trustworthy sources of information to make a purchasing decision (Martin et al., 2016). Though the literature provides strong evidence that consumers want additional information in order to make more informed purchasing decisions, there is also evidence that consumers do not trust all information sources equally. Because there is differentiation among information sources, consumers are choosing which source most resonates with them. Labels are a common source of information, but can often be used to influence consumers rather than inform them (Huffman et al., 2004). If a consumer finds a particular label trustworthy, that factor may play the ultimate role in their purchasing decision (Hobbs & Goddard, 2015).

Consumers increasingly have a variety of sources at their disposal, and trust is a key factor in influencing a consumer's decision-making (Huffman et al., 2004). As Martin et al. (2016) show, consumers draw on information from multiple different sources, but some sources are perceived as more trustworthy to consumers than other sources. In their analysis of Colorado consumers, the information sources most likely to be trusted for agricultural information are university and research organizations, farmers and ranchers themselves, the Colorado Department of Agriculture, farm and ranch organizations, and the U.S. Department of Agriculture. In their research, they found that respondents ranked social media as the least likely source to be trusted for information about agriculture.

Focusing on general information about agriculture, Martin et al. (2016) found that individuals providing this information (such as extension agents, agriculture teachers, and industry advocates) are able to perform their job better when they understand how consumers use agricultural information to inform their purchasing decisions (Martin et al., 2016). They explored two different kinds of information in their analysis: information related to general agriculture,

such as how the product is grown and delivered to the consumer and information related to food quality, nutrition, and safety, which is more often represented through labeling and goes through a certification process. The authors find that information relating to food quality, nutrition, and safety is viewed as more trustworthy because consumers are familiar with nutritional labeling and gain confidence in the product because of it. Nutritional labeling is highly regulated by the government, while other labeling relating to quality, such as environmental or local labeling, follow guidelines and are loosely regulated by an outside organization. When products do not have a set guideline, labeling differences can lead to consumers inferring different information (Costanigro, Deselnicu, & Kroll, 2014). Tonkin et al. (2016) also see food labels as beneficial, as truthful labeling helps instill overall confidence in the food system (Tonkin et al., 2016).

Like Grunert (2002), Costanigro, Deselnicu, and Kroll (2014) find that labels are helpful for products being marketed based on credence dimensions. However, it is important to associate the attribute and the quality together. This means the programs sponsoring the label need to have some sort of certification or quality assurance to guarantee their product, as well as a way to inform the consumer about this certification.

Despite the importance of packaging labels, they can have different meanings. Food labels can come from both the government and private companies, and each has different goals associated with food labeling. Food labeling policy is designed in a way that allows companies to disclose positive information about their products, but also meets the government's regulation to disclose negative information about the product (Caswell 1998). Advertising and packaging on products are both an important way that producers communicate with consumers, as well as a way to entice consumers to buy a particular good (Goldberg & Sliwa, 2011). However, Costanigro, Deselnicu, and Kroll (2014) disagree, as they believe most food labels developed

through marketing campaigns are designed to persuade consumers rather than inform them. In order to address the concerns with food labels, a solution may be to have an outside certification program designated to labeling products and maintaining consistency across the local food system.

### *State Branding Programs*

One particular source of information about food attributes in the form of food labels is state branding programs. These programs are designed to indicate to consumers that the product was produced within the state. Although state branding programs have been developed in all 50 states, major discrepancies exist between the programs, meaning the effectiveness of state branding programs can vary from state-to-state. Another major difference is how consumers choose to use the information provided by state branding programs. Studies have found differing results: some consumers believe the state branding program and local food are the same, whereas others do not.

As of 2010, all states across the United States have a branding program focused on labeling foods produced within the state (Onken & Bernard, 2010). State branding programs first began in the 1930s as a way to differentiate commodities (Patterson, 2006). Well-known products from across the U.S. such as Washington apples and Florida citrus fruit were designated with a label, helping to create a stronger market for farmers sell their products during the Great Depression era. It was not until the 1980s when states began to organize programs to promote all agricultural products in the state, not just one particular commodity. New Jersey and Wisconsin were the first states to develop state branding programs. Other states saw the success of *Jersey Fresh* and *Something Special from Wisconsin* and decided to invest in their own programs. This led to eight states surrounding New Jersey and Wisconsin to develop programs in the 1980s.

States continued to adopt programs throughout the 1990s and 2000s, in large part due to federal government investment through the Emergency Agricultural Assistance Act of 2001, which provided \$160 million to the states to develop or enhance state branding programs. After many programs' inceptions, funding fluctuated, with some branding programs receiving consistent funding and others going years without any additional funding (Patterson, 2006).

According to Onken and Bernard (2010), 90% of the state branding programs across the states continue to be maintained by the state's own agriculture department. However, a few states opt to have private organizations finance and run their programs, such as Alabama and Indiana whose programs are operated by trade association groups whereas Rhode Island and Nevada's programs are operated by non-profit partnerships. Regardless of the administrative structure, awareness is a key component of a program's success; the more consumers who are aware of the state branding program helps measure the effectiveness and reach of the program (Onken & Bernard, 2010).

In Colorado, the Colorado Department of Agriculture organizes the state branding program to indicate to consumers which products are grown, processed, or produced within the state of Colorado. The Colorado Proud program started in 1999 (Colorado Department of Agriculture, 2017). Participating producers get to use the Colorado Proud logo (Figure 4) on their packaging and are given access to other marketing opportunities and materials. The Colorado Department of Agriculture regulates which products qualify as Colorado Proud products. According to the department, "'grown' applies only to fresh produce, herbs, grains, and horticultural products, 'raised' applies only to livestock, and 'processed' applies only to value-added/manufactured food products. Fresh produce, herbs, grains and horticulture products must be grown in Colorado. Livestock must be raised in Colorado. Value-added consumer foods must

be manufactured in a commercial kitchen in Colorado...” (Colorado Department of Agriculture, 2017). When 1,000 Colorado consumers were asked of their awareness of the Colorado Proud brand, 54.9% responded that they had heard of and purchased products related to the program, 27.2% had heard of the program, and 13.4% had never heard of the program. Overall, 82.1% of the sample was aware of the program.



Figure 4: Colorado Proud logo

The overall effectiveness of state branding programs has been assessed by various researches on a state-by-state basis. Perhaps due to the differences across state branding programs, no national assessment of state branding program exists to the authors' knowledge. Nganje, Hughner, and Lee's (2011) surveyed 315 shoppers in Arizona and found state branding initiatives are important to all groups along the supply chain within the state. The consumers benefit because state branding programs provide some certification that guarantee which products are locally produced, and therefore associated with attributes consumers link with local food. Producers also benefit through the differentiation of products that are normally considered the same because they are able to receive a higher value for a product if it is better aligned with local food qualities. Respondents in their survey ranked how they perceived the Arizona Grown label, and which statements most closely aligned with the goals of the programs. The top three

responses most chosen by respondents were “(1) more supportive of local farmers, (2) more desirable, and (3) healthier than conventionally grown produce” (Nganje, Hughner, & Lee, 2011).

Ruth and Rumble (2016) focused on Florida’s state branding program and how it has encouraged consumers to purchase Florida strawberries. Their study included 500 participants. Survey respondents rated taste, freshness, knowledge of the strawberry season, and knowledge of strawberry nutrition as extremely important attributes. Ruth and Rumble (2016) found that consumers want to see the “Fresh from Florida” state branding label. Consumers were presented with identical strawberries, one with a Florida state branding label and one without the label. Of the respondents, 76% said they would choose the product with the label on it. The authors believe this is because consumers value the state branding program. The logo made it easy for consumers to understand where the product was from, meaning they did not have to read the fine print on the package to learn where the product was produced. The label also allowed them to associate it with past experiences with Florida strawberries.

One challenge with state branding programs is that not all consumers define local as products from throughout the entire state. Carroll, Bernard, and Pesek’s (2013) study looked at the differences between consumer’s disposition for products labeled as locally grown, products labeled under a state branding program, and products labeled as organic at both farmers’ markets and grocery stores. This study surveyed 1,845 consumers in Delaware, Maryland, New Jersey, Pennsylvania, and Virginia. In the geographically large states in the study (Virginia, Pennsylvania, and Maryland), survey respondents preferred products designated as local over products designated under a state branding program. The authors believe this is due to the entirety of the state not being a small enough geographic location. In contrast, the survey

respondents from the smaller states in their sample (Delaware and New Jersey) valued the state branding program over local products. Zepeda and Li (2006) also found state labels to not be an appropriate substitute for local foods due to differences between products grown within the entire state and products grown more locally.

In contrast, Darby et al. (2008) surveyed 530 Midwestern consumers and concluded that the difference between “grown nearby” and grown within the state of Ohio was not distinguishable, meaning consumers view products produced nearby and products produced within the state as one in the same. The authors believe this has to do with size of Ohio, and question whether their results would be the same if they did this same survey in a larger state, such as California.

#### *Direct-to-Consumer Markets*

In addition to determining the attributes and information consumers use to make purchasing decisions, it is also important to understand what drives consumers decision making about where to buy their food. Different types of retail markets offer different types of attributes. Individuals who value certain attributes are more likely to gravitate toward markets that exhibit those attributes. Direct-to-consumer markets tend to have a strong combination of both private and public attributes because of their goals to bring fresh, local produce to the community and support small farms and businesses. Although individuals tend to shop at a variety of places to purchase their food for at-home consumption, they are choosing to shop at direct-to-consumer markets because these markets meet their demands in terms of attributes.

When consumers are choosing where to buy their food, they may also use credence and search dimensions. Although local products are increasingly available at traditional grocery stores, consumers are able to get information directly from the producer at direct-to-consumer



markets. This direct information exchange allows the consumer to understand more about the product and gives them confidence in the product they are purchasing, especially as it relates to credence dimensions. Peterson, Taylor, and Baudouin (2015) find that CSAs provide the most trustworthy credence dimensions because of the relationship that is created with the producer and consumer in this model. The authors argue that grocery store purchases will have the lowest trust in credence dimensions because third-party labels and certifications are not as easily confirmed as being true. Farmers' markets are the midpoint between these two outlets. They often have more information about the products on hand due to the farmer being available for information, but the authors find a consumer gets more interaction with the producer with a CSA-type of market.

A study of 1,549 nationwide grocery shoppers was conducted by Keeling Bond, Thilmany, and Bond (2009) to examine how particular attributes, such as economic benefits to agriculture, environmental benefits, food safety, large variety, and convenience, affected an individual's likelihood to shop at direct markets. They found white individuals were more likely to occasionally purchase produce through direct markets than other races. Consumers who are older and live in large cities are less likely to purchase through direct markets occasionally. Income was not a significant variable influencing consumer's purchase frequency, which Keeling Bond, Thilmany, and Bond conclude debunks the idea that only high-income consumers shop at direct markets. The authors also found that consumers who believe in supporting local producers and businesses tend to be inclined to always or occasionally shop at direct markets. They also find that consumers concerned with high quality products are also more likely to always shop at direct markets (Keeling Bond, Thilmany, & Bond, 2009). Consumers interested in buying fresh, unprocessed food are more likely to shop at direct channels, but are uninterested

in where the market is at or how the market looks. Consumers who do not buy from direct channels are more concerned with the aesthetic appearance and location of the markets. They also found organic production methods to be insignificantly related to direct purchase frequency. This is accredited to a wider availability of organic products in a variety of stores, meaning consumers do not need to buy these products solely at direct markets.

Gumirakiza, Curtis, and Bosworth's (2014) study surveyed 1,488 Nevada and Utah consumers in 2009 and 2011, respectively. They analyze four main motivators for attending farmers' markets. These motivators include buying produce, socializing, buying ready-to-eat food, and buying packaged foods, arts, or crafts (Gumirakiza, Curtis, & Bosworth, 2014). The authors first looked at consumers motivated to come to the farmers' market to purchase produce. Married, female consumers were more likely to come to the farmers' market to purchase produce. Home gardeners and agricultural enthusiasts also utilize farmers' markets for buying fresh produce. Individuals who frequently attend the farmers' market are doing so to purchase produce and not for other motivations such as socialization. Consumers interested in CSA memberships and consumers with food safety concerns are also motivated to attend farmers' markets to purchase produce. However, individuals lacking time to home cook meals are less likely to attend farmers' markets to buy produce, as well as consumers from large families. Overall, 78% of consumers are motivated to purchase produce at the farmers' market. Consumers more interested in socializing at farmers' markets are motivated to attend farmers' markets because of the characteristics and conveniences of the market itself, similar to what was found by Keeling Bond, Thilmany, and Bond (2009). When consumers become busier, they are more likely to attend farmers' markets to socialize rather than purchase food (Gumirakiza, Curtis, & Bosworth, 2014).

Nganje, Hughner, and Lee's (2011) study conducted interviews in basic grocery stores, premium grocery stores, farmers' markets, and restaurants, asking respondents to rank product attributes for fresh produce. Respondents in basic grocery stores ranked the most important attributes of produce as taste, freshness, appearance, price, and safety. Respondents interviewed at farmers' markets ranked taste, freshness, environmental friendliness, production method, and product origin as the most important attributes (Nganje, Hughner, and Lee, 2011). Attributes favored by basic grocery store respondents are all private attributes, meaning the individual benefits by observing these factors, however, farmers' market respondents answered with a mix of private and public attributes.

In Bond, Thilmany, and Keeling Bond's (2008) consumer cluster study, they also analyzed consumer's choice of primary and secondary shopping location. Of their sample, 96% cited their primary source of groceries as supermarkets and supercenters. Although a vast majority preferred supermarkets or supercenters for general grocery shopping, only 66% of that group utilized supermarkets or supercenters as their primary source of fresh produce. When looking closer at fresh produce shoppers, 30% listed their primary source of fresh produce as direct-to-consumer markets. These direct-to-consumer buyers are purchasing at direct-to-consumer markets because the products have higher rankings for taste, flavor, safety, and variety, which the authors associate with consumers finding higher quality produce at direct markets (Bond, Thilmany, & Keeling Bond, 2008).

Zepeda (2009) also focused on the factors that influence an individual's likelihood of shopping at a farmers' market. Individuals who favor nutrition over cost were more likely to shop at farmers' markets. Individuals purchasing products at farmers' markets were also more likely to buy organic, garden, cook, and exercise. Zepeda (2009) classifies these consumers as

health-conscious and value-conscious. Another interesting finding in this study is how consumers perceive price. Individuals who believe price is the most important factor of food are 17% less likely to shop at a farmers' market according to this study. Zepeda (2009) believes this has more to do with the transaction cost associated with shopping at a farmers' market. Consumers are not able to purchase all their food for at home consumption at the farmers' market, meaning they would have to shop at several different places to purchase all their groceries, requiring more time.

Another popular direct-to-consumer market is community supported agriculture (CSA). A CSA model allows for the producer to receive payments from the consumer upfront to help cover seasonal costs. The consumer then gets repaid in "shares" of the farm, meaning they are given a basket of produce on a consistent basis (usually designed to be once a week). Often, CSAs are picked up directly on the farm, meaning the consumer can actually see where their product is being grown and how it is being handled, giving them a large amount of information about the product they are consuming (Peterson, Taylor, and Baudouin, 2015).

Peterson, Taylor, and Baudouin (2015) use an order logit model to see how different characteristics affect 304 U.S. consumers' likelihood of joining a CSA, purchasing food at the grocery store, and purchasing food at a farmers' market in the United States. Individuals who are focused on knowing the origin of their food are more likely to participate in a CSA. This factor was the only differentiation between grocery stores, farmers' markets, and CSAs participants. A CSA allows participants to have the greatest amount of knowledge about the origin of their food, so it is logical that this variable would be the largest determinant of an individuals' willingness to participate in a CSA. The authors find consumers driven by knowing more information about their food purchases to be the most likely targets for CSA participation. Overall, American

shoppers are more interested in participating in CSAs if they desire to know more about the origin of their food (Peterson, Taylor, & Baudouin, 2015).

Vassalos, Gao, and Zhang (2017) also explore the factors that affect an individual’s participation in a CSA. These authors find supporting local farms and purchasing organic food as the two largest motivators for CSA participation. Individuals in the study who did not participate in a CSA were doing so because they prefer to shop at farmers’ markets. The authors find this interesting and believe this is because the two markets offer similar products, and therefore, consumers only need to use one or the other. The authors found that individuals with higher incomes are less likely to participate in a CSA, which they believe is due to higher income individuals eating out more often and less time available to pick up the products and maintain a CSA membership. Individuals who believe CSAs are environmentally beneficial are more likely to participate in a CSA, as well as individuals who are vegetarian. Those participating in CSAs are more likely to get information from other individuals as well as through websites and newspapers.

Table 4 highlights the primary contributions from the above studies. Like studies focusing on food choices, individuals who are choosing to purchase products at direct-to-consumer markets are interested in a mix of private and public attributes, such as taste and quality and economic benefit, respectively.

Table 4: Primary contribution from studies exploring direct-to-consumer market choice

<b>Authors</b>	<b>Article</b>	<b>Primary Contribution</b>
Bond, Thilmany, and Keeling Bond (2008)	“Understanding Consumer Interest in Product and Process-Based Attributes for Fresh Produce”	The majority of respondents (96%) preferred supermarkets or supercenters for general grocery shopping, but only 66% utilized these markets for produce. The other 33% preferred direct markets due to higher rankings for taste, flavor, safety, and variety.

<b>Authors</b>	<b>Article</b>	<b>Primary Contribution</b>
Gumirakiza, Curtis, and Bosworth (2014)	“Who Attends Farmers' Markets and Why? Understanding Consumers and their Motivations”	Individuals who are motivated to come to the farmers’ market to purchase produce are married, female, home gardeners, agricultural enthusiasts, CSA members, and individuals with food safety concerns. The more frequently an individual attend the farmers’ market, the more likely they are to come to purchase produce. The atmosphere of the market matters more to individuals interested in socializing.
Keeling Bond, Thilmany, and Bond (2009)	“What Influences Consumer Choice of Fresh Produce Purchase Location?”	Consumers who value supporting local producers and businesses always or occasionally shop at direct markets. Consumers concerned with high quality products are also more likely to always shop at direct markets. Consumers who do not purchase produce at direct markets care more about the atmosphere of the market.
Nganje, Hughner, and Lee (2011)	“State-Branded Programs and Consumer Preferences for Locally Grown Produce”	Attributes favored by basic grocery store respondents are all private attributes. However, farmers’ market respondents answered with a mix of private and public attributes.
Peterson, Taylor, and Baudouin (2015)	“Preferences of locavores favoring community supported agriculture in the United States and France”	Individuals who are focused on knowing the origin of their food are more likely to participate in a CSA.
Vassalos, Gao, and Zhang (2017)	“Factors Affecting Current and Future CSA Participation”	Consumers interested in supporting local farms, purchasing organic food, supporting the environment, and individuals who are vegetarian are more likely to participate in a CSA. High income individuals are less likely to participate, perhaps due to greater frequency of eating out and less available time to participate in the transactions necessary to belong to a CSA.
Zepeda (2009)	“Which little piggy goes to market? Characteristics of US farmers' market shoppers”	Individuals more likely to shop at farmers’ markets are more likely to favor nutrition over cost, buy organic, garden, cook, and exercise. Individuals who believe price is the most important factor of food are 17% less likely to shop at a farmers’ market according to this study.

### *Summary and Takeaways*

Overall, a mix of private and public attributes are dictating why consumers are choosing to purchase local food and shop at direct-to-consumer markets. Most often, individuals value private attributes such as quality, taste, and freshness, and public attributes such as supporting farmers and the local economy. These studies help inform the variables important to include when looking at food and market choice. However, many of these product attributes are experience or credence dimensions, meaning the actual attributes of the products cannot be assessed until after the products are consumed or unless they are certified by an outside organization. In order for the consumer to understand these attributes fully, they must rely on information, commonly shown through product labels and state branding programs. Although previous studies incorporate private and public attributes to better understand consumer food shopping choices, the use and trust of information is not often included in these analyses. However, we think the use and trust of information is important as it provides more nuanced insight into how experience and credence dimensions influence decisions. In short, such attributes cannot be known either prior to purchase or without some sort of certification, except in the cases where direct interaction with producers is possible.

## THEORETICAL MODEL

The economic theory behind what drives consumers to make a particular decision underlies the empirical approach of this study. Traditional utility theory and Lancaster's (1966) additions focused on characteristic demand theory, are used to explore several research questions. In addition, the economic theory on information will be integrated. This theoretical framework allows us to explore the hypothesis that individuals are choosing to purchase Colorado Proud products and shop at direct markets because these products exhibit certain types of attributes in which individuals are interested. It also supports the hypothesis that individuals may use agricultural information sources differentially to inform their decisions.

Utility theory drives consumer demand as it shows how individuals choose to consume different goods based on their preferences for the goods (Nicholson & Snyder, 2008). As simple, two-good example relevant for this study is:

$$utility = U(x, y) \tag{1}$$

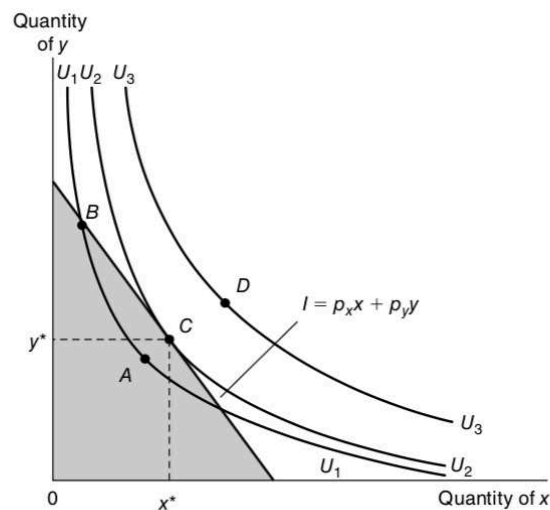
where  $x$  is the quantity consumed of a Colorado Proud product and  $y$  is the quantity consumed of a product produced outside of Colorado, for example. In the case for both goods, more is better than less. Consumers will choose to consume more of  $x$ , more of  $y$ , or more of both if given the chance. Bundles of the goods are represented by indifference curves, which are sets of goods where the individual receives the same amount of utility regardless of how much of each good he or she has (Nicholson & Snyder, 2008). Examples of indifference curves are shown as lines  $U_1$ ,  $U_2$ , and  $U_3$  on Figure 5. Individuals will choose to consume at a point along on the highest indifference curve because this gives them the greatest amount of utility.



Although an individual would like to consume infinite amounts of both  $x$  and  $y$ , they are constrained by their income. This constraint is represented as:

$$I = p_x x + p_y y \quad (2)$$

where  $I$  is the amount of income an individual has,  $p_x$  is the price of good  $x$ ,  $x$  is the quantity of good  $x$ ,  $p_y$  is the price of good  $y$ , and  $y$  is the quantity of good  $y$ . Because they are constrained by the amount of income they have, consumers choose the quantity of goods in which they will spend all their income but still have an optimal bundle where the trade-off between the two goods equals the rate at which they can be exchanged for each other (Nicholson & Snyder, 2008). In Figure 5, the consumer wants to consume the bundle of goods represented by the indifference curve  $U_3$  at point  $D$ . However, their budget constrains them to consume on indifference curve  $U_2$  at point  $C$ . As another alternative, point  $A$  is also attainable, but this point is inefficient because the consumer can consume more of both good  $x$  and good  $y$  at point  $C$ .



Source: Nicholson & Snyder, 2008

Figure 5: Graphical representation of utility maximization

For this thesis, the goods and markets being investigated can be considered close substitutes. Although these goods may appear in all ways as the same good when thinking in

terms of traditional utility theory, the characteristics or attributes that define the goods in the mind of the consumer are what make them different, and therefore, change the consumers demand for the goods. This is where it is important to consider how characteristic demand theory, developed by Lancaster (1966), adapts traditional utility theory to integrate more potential factors that ultimately drive consumer decisions.

Traditional utility theory says that individuals receive utility from goods directly. However, Lancaster (1966) introduces the idea that individuals do not receive utility from the goods themselves, but they instead receive utility from the bundle of characteristics or attributes of the goods. An example of this might be the choice to purchase a Colorado Proud labeled apple. The apple has the traditional attributes associated with its consumption like taste, color, texture, and size, as well as a broader set of potential outcomes, such as the perceived economic benefit to the farmer and environmental benefits given by eating a locally produced apple. Individuals rank which characteristics are most important to them and choose which products feature those important characteristics. However, goods are able to possess more than one characteristic. Therefore, Lancaster (1966) finds that when an individual consumes a good, they are likely to experience many characteristics.

Lancaster's (1966) theory presents three main deviations from traditional utility theory:

1. Goods do not give the consumer utility. Instead, the goods have characteristics that are the source of utility to the individual.
2. A single good can possess several characteristics. Also, a single characteristic can be found in several different goods.
3. When goods are consumed in combination with each other, different characteristics can be experienced than when goods are consumed individually.

Lancaster (1966) also sets up a simplistic model to understand how this model works mathematically. In order to simplify this model, there are two goods and two characteristics being investigated. This is represented in equation form as:

$$\begin{aligned}
 & \text{Maximize } U(z_1, z_2) \\
 & \text{subject to } p_1x_1 + p_2x_2 \leq I \\
 & z_1 = B_1x_1 + B_2x_2 \\
 & z_2 = B_1x_1 + B_2x_2 \\
 & z, x_1, x_2 \geq 0.
 \end{aligned} \tag{3}$$

In this equation, we want to maximize the amount of utility associated with two product characteristics ( $z_1$  and  $z_2$ ). Therefore, the maximization problem is measured in characteristic-space. In the constraints,  $x_1$  represents the quantity of good 1 being consumed,  $x_2$  represents the quantity of good 2 being consumed,  $p_1$  is the price of good  $x_1$ ,  $p_2$  is the price of good  $x_2$ , and  $I$  is the total amount of income available. This equation represents the income constraint found in traditional utility theory and is measured in goods-space.  $B_1$  represents the matrix of possible characteristics for good  $x_1$  and  $B_2$  represents the characteristics for good  $x_2$ . Equations exist for both characteristic  $z_1$  and  $z_2$  because both goods can feature the characteristic and contribute to the amount of each characteristic. These equations also bridge the characteristic-space with the goods-space. Non-negativity holds for all  $x$  and  $z$  variables, as you cannot consume a negative amount of the good or have a negative number of characteristics. In order to solve this system of equations, the utility function would have to be converted into goods-space or the budget constraint would have to be converted into characteristic-space (Lancaster, 1966). Once a solution is reached, a characteristic frontier can be developed to understand which combination of  $z_1$  and  $z_2$  characteristics are plausible given the constraints. The consumer then makes an

efficient choice (a combination which falls on the characteristic frontier) and a private choice (a combination which falls on the characteristic frontier that is preferred to the individual) (Lancaster, 1966).

Characteristic demand theory can also be represented graphically for further understanding. In Figure 6 and Figure 7, the graphs are represented in terms of characteristic-space, where  $z_1$  is one characteristic represented on the horizontal axis and  $z_2$  is a different characteristic represented on the vertical axis. In order to simplify the graphs for better understanding of the characteristic demand theory, the income constraint is not binding in either of the graphs, meaning the consumer is able to consume along the highest indifference curve. In Figure 6, good  $x_1$  and good  $x_2$  are assumed to have the same characteristics as each other, making them perfect substitutes. Because the two goods are identical, the consumer will choose to consume at point A because at this point, the individual achieves a higher utility.

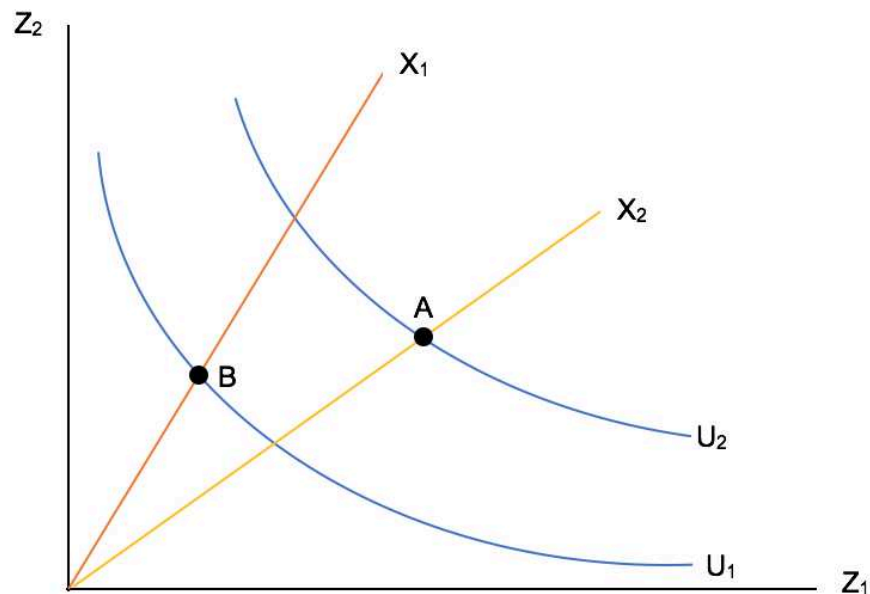


Figure 6: Graphical representation of identical products

However, two goods can also be considered close substitutes, meaning the two products are similar to each other but differ in terms of some valued characteristics (Lancaster, 1966). This is common in the literature when looking at demand for local food or participation in direct markets. Local and non-local goods can often have the same private attributes associated with each other. However, local goods tend to also be associated with public attributes. Although the goods in many ways feature the same characteristics, if the individual is inclined to value public attributes, the inclusion of these important characteristics is what alters the individual's demand for the local good.

Figure 7 represents two goods that are close substitutes but that are differentiated in a particular way. A good example of this is a Colorado Proud apple versus an apple produced outside of Colorado. As seen in the literature review, locally produced goods may be perceived to contain certain characteristics (or attributes) such as supporting the local economy or having higher quality/freshness than non-local products. The two goods will be very similar; however, the Colorado Proud apple may have unique characteristics only achievable in the mind of the consumer because it was grown within the state. Instead of the individual choosing the good that gives them the highest utility (as in traditional utility theory), he or she will choose a combination of characteristics shown by the goods that allows them to achieve their highest potential utility. In Figure 7, the characteristic frontier (presented as a dotted line) shows the combinations of  $z_1$  and  $z_2$  that are achievable given the constraints. The consumer will want to be at point B because at this point he or she achieves the highest utility while also achieving a combination of characteristics  $z_1$  and  $z_2$  that are both efficiently and privately optimal.

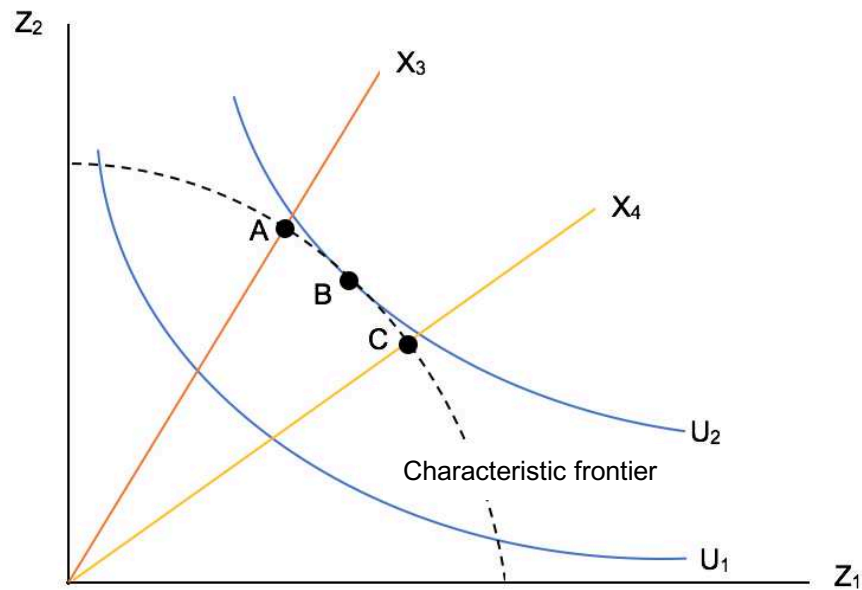


Figure 7: Graphical representation of goods with different characteristics

The last factor to include in my theoretical model is based on the theory of economic information. According to Nicholson and Snyder (2008), using information as an economic factor in traditional economic models is a relatively current trend in economic modeling. Unlike other economic resources, information tends to be less tangible and less defined. Information can come from a variety of sources and may not be equally used or consumed across different users. Information can also be considered a pure public good because it can be offered freely (nonrival) and one's use of it does not diminish someone else's use of the same information (nonexclusive) (Nicholson & Snyder, 2008). When individuals lack all the necessary information to make a decision, their decision will be made in uncertainty. As the individuals are given new information, they are able to make a better decision.

One interesting empirical example of the role of information is choices about the choice to purchase Colorado Proud products. A consumer walks into a market, and she is presented with two peppers; in this first example, one is labeled with the Colorado Proud sticker and the other is not. The pepper with the sticker on it is giving her more information about the product. She may

know from previous experiences if Colorado peppers are likely to be higher quality, have better taste, and are yielding economic returns to a local farmer. Therefore, she may choose to purchase the Colorado Proud pepper because these attributes are important to her as a consumer. The reasons she was able to know these product attributes is because she had more information from the label. However, as shown in the literature review, an important tenant of a consumer using the information is whether or not they trust the information given to them. It is also important to consider how trust plays a factor in the individual's decision to use the information or not. Now, let's assume there are two different peppers in a store, one produced in Colorado and one not produced in Colorado, and neither of them are designated with any sort of label. The same person walks into the store, sees the two peppers, and does not have enough information to make an informed decision. Although the pepper produced in Colorado may have different characteristics than the pepper produced elsewhere, the consumer is not receiving any information to make the optimal decision. So, integrating information into our model of consumer should provide richer findings on what drives consumer choice.

## ECONOMETRIC APPLICATION

The theoretical framework discussed in the previous section can now be parameterized as a model for each of the research questions addressed in this thesis. First, a literature review of similar previous studies is outlined, allowing for an informed decision on the model choice and variables used to parameterize the models. Next, the theoretical background of the methodology is addressed. Then, a description of the model used to address the research question as well as a description of the variables follows, allowing for an understanding of how the model is to be parameterized.

### *Choice to Buy Colorado Proud Products*

The first question addressed in this analysis assesses the factors that affect Colorado consumers' choice to buy Colorado Proud products. As seen in the literature review, local products are often associated with unique characteristics or attributes. The theoretical model continued with this idea, showing that individuals are motivated to choose goods that exhibit characteristics in which they are interested. Understanding the choice about purchasing a particular good is expected to be at least partially determined by the individual's opinion about characteristics associated with that good. Because consumer demand is changing, it is important to understand which of these factors and characteristics can influence people's decision to buy local goods. Therefore, a model will be specified that helps us to understand the probability that an individual will be a Colorado Proud shopper.

### *Background on Previous Methodologies*

Previous studies are key to understanding which econometric model to utilize as well as which characteristics are important to consider within the model. Best and Wolfe (2009) used a



probit model to understand how a dataset of 675 southeastern Americans were interested in buying local dairy products. Their dependent variable was whether people were interested in buying local milk (1 if interested, 0 if not interested). Their independent variables included product attributes (such as whether they believe local milk is a unique product), attitudes (such as how they feel toward local products), and demographics (such as gender and marital status).

Cranfield, Henson, and Blandon (2012) conducted a survey of 1,139 Canadian consumers to understand what attitudinal, behavioral, and demographic factors influenced local food purchasing. The dependent variable in their analysis was an individual's propensity to buy local food that was measured on a seven-point scale. Because the dependent variable was classified in this way, the authors used a bivariate probit regression to address their research question. The authors focused on incorporating independent variables that focus on the individual's demographics, product attributes (such as the quality/safety of local food), attitudes (such as the individual's opinion on the benefits of buying local), and behaviors (such as whether or not the individual gardens). The attitudes, attributes, and behaviors tended to be better predictors of an individual's likelihood of purchasing local as compared to the demographic variables (Cranfield, Henson, & Blandon, 2012).

Zepeda and Li (2006) wanted to find which factors increase the probability that an individual will be a local food shopper using a dataset of 956 U.S. shoppers. In this study, the dependent variable is whether or not the respondent makes direct market purchases often (1 if yes, 0 if no). Independent variables in this study include attitudes (such as whether or not nutrition/health is the most important characteristic of food and how much an individual enjoys cooking), behaviors (such as frequency of organic food purchases and whether or not the individual gardens), and demographic variables (such as gender and income).

Lastly, Zepeda and Nie (2012) attempt to predict the probability that an individual will belong to a certain cluster and whether or not they will be a local/organic food shopper. This study's methodological approach is to first perform a cluster analysis to segment different groups based on certain characteristics, and then to use those groups as the dependent variable in a multivariate analysis. The survey respondents were segmented based on behavioral factors (such as whether or not they are a vegetarian), attitudes (such as whether or not they think freshness is the most important food characteristic), and product attributes (such as food safety).

Table 5 features an overview summary of the four articles highlighted above. A probit model is utilized by many of these studies because it effectively measures the marginal effect of a variety of factors on how the probability that an individual will participate in an activity (Best & Wolfe, 2009; Cranfield, Henson, & Blandon, 2012; Zepeda & Li, 2012). Another commonality across the reviewed studies is their choices of independent variables. All of the studies focused on behavioral factors of the individual, attitudes the individual has about food, product attributes or qualities of the food, and demographic variables. In other words, attitudes, behaviors, product attributes, and demographics are all considered factors that may be relevant to explaining what increase an individual's probability of purchasing a particular product. Because of this, the independent variables included in the model to answer my research question will similarly focus on these variables since previous studies have shown how these factors are important in predicting an individual's likelihood to purchase local food. These factors also align well with Lancaster's (1966) characteristic demand theory, as characteristics influence individuals' choices, not necessarily the products themselves.

Table 5: Methodological literature review for first research question

<b>Authors</b>	<b>Model type</b>	<b>Research objective</b>	<b>Dependent variable</b>
Best and Wolfe (2009)	Probit	Understand consumers in the Southeastern U.S.'s interest in buying local dairy products	Interest in buying local milk (yes/no)
Cranfield, Henson, and Blandon (2012)	Bivariate probit	Survey of Canadian consumers to see which factors (attitudinal, behavioral, and demographic) influence local food purchasing	Propensity to buy local food (7-point scale)
Zepeda and Li (2006)	Probit	Understand which factors increase the probability that an individual will buy local food	Shops at farmers' markets once a month, member of a CSA, or buy from farms directly (yes/no)
Zepeda and Nie (2012)	Cluster analysis and multivariate regression	Predict the probability an individual will belong to a certain cluster and whether or not they will be a local/organic food shopper	Groups segmented via the cluster analysis

### *Econometric Theory*

A probit model is utilized in many previous studies because the probit model depicts the individual's decision about whether or not they should participate in something, or in the case for this research question, whether or not they should buy Colorado Proud products. The probit model assumes this choice depends on an individual's utility ( $U_i$ ) (Gujarati, Porter, & Gunasekar, 2009), and as  $U_i$  increases, the likelihood that an individual chooses to purchase Colorado Proud products increases. According to Gujarati, Porter, and Gunasekar (2009), this utility is shown as:

$$U = \beta_1 + \beta_2 x_i \quad (4)$$

where  $U$  is the amount of utility an individual gets from purchasing Colorado Proud and  $x_i$  are the explanatory variables that influence whether or not an individual will purchase these products (the independent variables in the model). According to the theoretical model, these explanatory variables would be made up of characteristics of interest to the individual and related to Colorado Proud, such as the individual's perceived value of certain attributes and demographics.

The threshold level for utility, labeled as  $U^*$ , shows the point where an individual will switch over from choosing to purchase Colorado Proud products to choosing not to purchase Colorado Proud products. When  $U > U^*$ , the individual will purchase Colorado Proud products because the actual amount of utility they are experiencing is greater than the switching point. If the opposite is true ( $U < U^*$ ), then the individual will not purchase Colorado Proud products. Because utility cannot actually be observed for individuals, we can instead use probabilities to determine if the threshold value is likely less than or equal to the utility (Gujarati, Porter, & Gunasekar, 2009). This equation is shown as:

$$Pr_i = Pr(Y = 1|x) = Pr(U^* \leq U) = \Phi(\beta_1 + \beta_2 x_i) \quad (5)$$

The probability that an individual will purchase Colorado Proud (meaning the dependent variable will be 1) is based on the independent variables (x) that influence the dependent variable (y). This model is a cumulative distribution function, which means that the expected value of any random number is determined by the probability that the expected value is going to actually happen (Nicholson & Snyder, 2008). In order to determine what an individual will choose to purchase, it is necessary to understand the variables that will influence their decision. This is where Lancaster's (1966) characteristic demand theory becomes important, particularly when utilizing the previous literature to understand what other individuals have deemed as important characteristics of local food demand and should be included in our econometric model.

### *Econometric Model*

The econometric model estimated to address this question is as follows:

$$Pr_{CO\ Proud\ Pur=1} = \Phi(\text{demographics, attitudes, behaviors, product attributes, and agricultural information}) \quad (6)$$

The dependent variable (*coproud\_pur*) is classified as 1 if respondents have heard of and purchased Colorado Proud products and 0 if they have not heard of and purchased Colorado Proud products. The independent variables included in the model allow for either an increase or decrease in the probability that an individual will have heard of and purchased Colorado Proud products. Demographic variables included are the amount of time an individual has lived in Colorado (*lived\_co*) and their gender (*gender*). We hypothesize that the more years an individual has lived in Colorado, the more likely they will be to purchase Colorado Proud products due to having more exposure to or experience with the Colorado Proud brand. We also hypothesize that gender will have a positive effect on an individual's likelihood to purchase Colorado Proud because gender is classified as a dummy variable where females are 1 and males are 0, and previous research shows that females tend to be more actively involved in their household's food planning.

Attitudes about Colorado products are hypothesized to include perceptions about the food safety of Colorado products (*safety\_co*) and the amount of confidence an individual has in a product actually being local (*local\_confidence*) and are integrated as a means to control for consumer confidence. As food safety concerns garner increasing interest as a food issue, we hypothesize that individuals who view Colorado products as having high food safety are more likely to purchase Colorado Proud products because they are more trusting of those products. The same hypothesis holds for individuals who have high amounts of confidence in local products actually being locally supplied. We believe these individuals will be more likely to purchase Colorado Proud products also due to their trust in the authenticity of the product.

Behaviors include how the respondents are motivated by their understanding of the nutritional content of Colorado products (*motivate\_nutrition*) and by labels shown on Colorado

products (*motivate\_labels*), as well as whether or not they have their own garden (*garden*). We hypothesize that individuals who are more motivated by understanding the nutritional content of Colorado products and by seeing labels on Colorado products will be more likely to purchase Colorado Proud products. The Colorado Proud program's main channel for sharing information is through their product label (see Figure 4), so we believe that individuals who are motivated by labels may be familiar with the Colorado Proud label and look for it when purchasing products. We also speculate that individuals who home garden are more likely to purchase Colorado Products because they value locally-grown products.

Product attributes included in this model are whether or not individuals believe local means the product is produced in Colorado (*local\_co*). As shown in the literature review, there is no clear definition for local. Consumers are left to decide what they consider local. We hypothesize that individuals who believe local means the product is produced within the state are more likely to purchase Colorado Proud products these individuals see local and Colorado Proud as one in the same. Lastly, the use and trust in agricultural information was also included. The level of trust in information from the Colorado Department of Agriculture (CDA) (*aginfo\_cda*), the industry (*aginfo\_industry*), farmers themselves (*aginfo\_farmers*), and social media (*aginfo\_social*) were all included because these sources are perceived to have the most influence over products labeled as Colorado Proud.

The CDA regulates the Colorado Proud program, and one way the CDA chooses to disseminate information is through social media. Westerman, Spence, and Van Der Heide (2013) find that social media is growing in use as a source of information for individuals. However, individuals are judging the credibility of information provided on social media based upon the author of the information. We believe that as individuals have more trust in the Colorado

Department of Agriculture, the more likely an individual will be to purchase Colorado Proud products due to the fact that the Colorado Department of Agriculture regulates the Colorado Proud brand, and they may be judged as a credible provider of information. However, we believe that as an individual's trust in social media decreases, the likelihood that they buy Colorado Proud products increases. Trust in information from farmers themselves and industry individuals were also included because these are the individuals using the Colorado Proud logo on their products and stocking these products at markets. The more likely an individual is to trust the source of the product, the more likely they are going to be to want to purchase the product.

### *Interest in Vegetables or Fruits Identified as Colorado Grown*

The next question addressed in this analysis follows the first. In the first question, we wanted to know what factors are affecting Colorado consumer's choice to buy Colorado Proud products. In the second question, we are attempting to understand how different factors affect their interest in a more specific Colorado product as it focuses on purchasing fruits and vegetables grown in Colorado. This question helps to understand how to reach potential Colorado Proud consumers and what characteristics are motivating them to do so. Information may be pertinent if the gap between their current behavior and expressing is based on uncertainty (a lack of information).

### *Econometric Theory*

In order to assess this question, the Heckman two-step method is used because it is designed for when two decisions and the models specified to represent them (indicated in the two different steps of the Heckman procedure) are seemingly related. Heckman (1979) states that when samples are not random and appear to be related to each other, a specification error will occur meaning the models will not reflect what is happening in reality. In order to fix this error,

the Heckman procedure can be utilized to show the model in the first and second step are related to each other. The first step of the Heckman model is the selection step, and it estimates the probability that an individual will purchase Colorado Proud products utilizing a probit model (Gujarati, Porter, & Gunasekar, 2009). The second step is the outcome step, and it estimates how certain factors affect an individual's interest in purchasing Colorado grown fruits and vegetables if available and identified as Colorado grown. The outcome step incorporates a variable known as the inverse Mills ratio, a variable calculated in the selection step and included in the outcome step to see whether or not the two steps are related to each other (Gujarati, Porter, & Gunasekar, 2009).

In this analysis, the selection equation estimates the same probit model as highlighted above: the factors that affect consumer's choice to buy Colorado Proud products. In a follow-up research question addressed in this section, we explore further what factors influence a Colorado consumer's interest in specifically buying Colorado grown fruits and vegetables. Since it is first important to understand whether or not the consumer has heard of and is purchasing Colorado Proud, we begin with the equation:

$$Pr (y_{k1} = 1) = \beta_{11} + \beta_{21}X_{k1} + u_{k1} \quad (7)$$

where  $Pr (y_{k1} = 1)$  is the probability that the dependent variable, Colorado Proud purchases, will be equal to 1,  $x_{k1}$  are the explanatory variables for the first step of the Heckman procedure, and  $u_{k1}$  represents the error term for the first step equation. All parts of the equations are denoted with a subscript 1 to indicate they belong to the first step of the Heckman model.

The outcome step addresses the factors that affect an individual's interest in purchasing Colorado grown products and is represented with the following equation:

$$y_{k2} = \beta_{12} + \beta_{22}X_{k2} + u_{k2} \quad (8)$$



where  $y_{k2}$  represents an individual's interest in buying fruits and vegetables identified as Colorado grown,  $x_{k2}$  are the explanatory variables included in the second step of the Heckman model,  $B$  are the estimated parameters for the outcome model, and  $u_{k2}$  is the error term. All parts of the equations are denoted with a subscript 2 to indicate they belong to the second step of the Heckman model. The outcome equation will also have the inverse mills ratio included. This is shown as:

$$\lambda_k = \frac{\alpha(Z_k)}{1-A(Z_k)} = \frac{\alpha(Z_k)}{A(-Z_k)} \quad (9)$$

where, according to Heckman (1979),  $\alpha$  and  $A$  are the probability density function (PDF) and cumulative distribution function (CDF) of the standard normal distribution, and

$$Z_k = -\frac{x_{k1}\beta_1}{(\sigma_{12})^{\frac{1}{2}}} \quad (10)$$

The  $\lambda_k$  value represents the Inverse Mills Ratio (Heckman, 1979). This value takes numbers from the selection equation (represented by the 1 in the subscripts) to calculate the ratio, and is then inserted into the outcome equation. If the value for the inverse mills ratio is statistically significant, this indicates that the two equations are indeed related. If the Heckman procedure had not been utilized, the model may have had a misspecification error (Heckman, 1979).

### *Econometric Model*

The following equation is the Heckman two-step estimation used for this paper, with the selection equation shown as equation 11 and the outcome equation shown as equation 12.

$$\text{Selection: } Pr_{CO\ Proud\ Pur=1} = \Phi(\text{demographics, attitudes, behaviors, product attributes, and agricultural information}) \quad (11)$$

$$\text{Outcome: } y = \beta_1 + \beta_2(\text{demographics}) + \beta_3(\text{attitudes}) + \beta_4(\text{behaviors}) + \beta_5(\text{information}) + u_{2k} \quad (12)$$

Parameterization for the selection equation was highlighted in a previous section. The outcome equation explores factors that differentiate whether individuals would be interested in purchasing Colorado grown products if available. The literature review guided our understanding that demographics, attitudes, product attributes, and behaviors are likely important to an individual's likelihood to purchase a local product. Therefore, we want to consider these factors as well when we are considering how an interested individual may choose to purchase these products. Additionally, we want to know what their current attitudes/motivations are and how these motivations might influence their interest in local products. As seen in the economic information theory, information will also be important in this analysis because individuals are less certain about what they are purchasing. New information will give them the ability to make a more informed decision about what they will purchase.

The dependent variable measures if individuals would buy more vegetables (*veggies\_co*) or more fruits (*fruits\_co*) if they were identified as Colorado grown on a five-point scale. The demographic variable included in the outcome equation is age. We predict that as age increases, an individual's interest in purchasing fruits and vegetables also increases due to having more exposure to Colorado products. Attitudes about food represent the most common category of independent variables included in this analysis. These variables include motivations to purchase Colorado produce by seeing chefs use Colorado products (*motivate\_chefs*), understanding the nutritional benefits of Colorado products (*motivate\_nutrition*), understanding the economic benefit of buying Colorado produce (*motivate\_economic*), feeling confident that producers use high food safety processes (*motivate\_safety*), having more knowledge of Colorado produce farmers (*motivate\_understand*), understanding the Colorado growing season better (*motivate\_season*), seeing better labels on products (*motivate\_labels*), experiencing better flavor

from Colorado produce (*motivate\_flavor*), seeing a better price point on Colorado products (*motivate\_price*), and having more pre-prepped Colorado products available for purchase (*motivate\_prep*). We hypothesize that higher ratings on each of these motivations will have a positive effect on an individual's interest in purchasing Colorado grown fruits and vegetables.

The behavior included in this analysis is whether or not an individual has ever lived on a farm (*ever\_farm*). We hypothesize that if an individual has lived on the farm, they will have more interest in purchasing Colorado grown products, because individuals with farming experience may understand more about the qualities of fresh produce and have more experience directly with it. Lastly, the model includes how individuals trust and use information sources such as the CDA (*aginfo\_cda*), industry leaders (*aginfo\_industry*), farmers themselves (*aginfo\_farmers*), and social media (*aginfo\_social*), as well as whether or not individuals would use point-of-sale information from store managers, labels, and the produce calendar (*method\_pos*), information from media platforms such as TV, radio, and newspapers (*method\_media*), and information from social media or websites (*method\_int*). We hypothesize that the use of information from point-of-sale information will have a positive effect on the individuals as this information is provided directly at the store and is may be influential to the consumer. We also believe the use of information from the internet will also have a positive effect on consumers as the internet is a common source of information today. However, we believe the use of information from media will have a negative effect as consumers may not be using this information source as often with the increase of information on the internet. Overall, the methods these interested consumers are more likely to use may be helpful to understand how to disseminate information to consumers interested in purchasing Colorado Proud products.

### *Propensity to Spend Food at Home Expenditures at Direct Markets*

The last question attempts to answer what factors influence consumer's spending at direct markets. Consumers are not only choosing what type of a product to purchase, but they are also making decisions on where to purchase the products. Different retail outlets exhibit different characteristics. Therefore, individuals are also using ideas shown in characteristic demand theory to make a decision on where they wish to purchase their produce. However, not all individuals are purchasing products at direct markets, so it is important to develop an econometric model that will assess differences among those individuals who have expenditures at direct markets compared to those who do not because we want to understand how factors are affecting all consumers.

### *Background on Previous Methodologies*

Previous studies help us understand which model type of use and what variables others have used in their analyses. Fox, Montgomery, and Lodish (2014) used a type-2 tobit model to understand how consumers choose to purchase products at different retail locations based on certain attributes. The dependent variable is monthly household expenditures at different type of retail stores (drug store, grocery stores, and mass merchandisers). The independent variables in this study include attributes of the different retail stores.

In Keeling Bond, Thilmany, and Bond's (2009) study, they attempt to see how attributes effect an individual's probability of purchasing food from direct markets. The dependent variable in this model is the frequency of direct market purchases, categorized by consumers who never purchase direct (the base category), consumers that always purchase direct, and consumers that occasionally purchase direct. Because this dependent variable is a categorical variable, the authors use a multinomial logit model to address their research objective. Independent variables

used in this analysis include demographics (such as region and market size), attribute of the market (such as convenience of the market), product attributes (such as safety of the product), attitudes (such as the importance of the product being organic or the importance of the taste of the product), and information sources and the credibility of information (such as the desirability of information from newspapers and the credibility of information from extension personnel).

McCracken and Brandt (1987) and Nelson (1996) both focus on assessing expenditures other than food in their studies. The main takeaway from McCracken and Brandt (1987) is their model choice. The dependent variable used to parameterize their model is food away from home expenditures per household at different locations. Some households will have zero expenditures at certain locations, while others will have a greater than zero value of expenditures. The authors utilize a tobit model because of the censored data. Nelson (1996) also applies a tobit model to his analysis. The dependent variables in his model are expenditures for different quarterly goods, such as women's apparel, public transportation, and new vehicles.

Thilmany, Bond, and Bond (2008) focus on what an individual's willingness to pay for the local attribute is in their study using national data. The dependent variable used in this study is the premium as a percentage of the base price from survey participant's stated willingness to pay. The authors use a linear tobit model because of the dependent variable is censored (Thilmany, Bond, & Bond, 2008). Independent variables consist of demographics, product/process attributes (such as brand name and locally grown), location attributes (such as convenience), and attitudes (such as economic support for agriculture).

Lastly, Zepeda (2009) utilizes the same dataset as mentioned in the 2006 study in the previous section to see which characteristics lead to an individual being a farmers' market shopper. The dependent variable in the analysis was whether or not the individual shopped at the

farmers' market at least once a month (1 = yes, 0 = no), and Zepeda (2009) addressed the research objective with a probit model. Independent variables included attitudes (such as whether or not the individual valued freshness over taste), behaviors (such as how often the individual buys organic per shopping trip), and demographics (such as age).

Table 6 highlights the model used, objective, and dependent variable for these above studies. A major theme across these studies is using a tobit model to assess their research questions, especially when the dependent variable was an amount of expenditures on a particular item (Fox, Montgomery, & Lodish, 2014; McCracken & Brandt, 1987; Nelson, 1996; Thilmany, Bond, & Bond, 2008). Another major theme is in the choice of independent variables. Similar to what was found for the previous research questions, most studies focusing on local food choice or expenditures at direct markets focused on using independent variables that were demographics, attitudes, behaviors, and attributes. These characteristics are what consumers are wanting to see at markets and are ultimately driving the decision they are making to purchase at direct markets, as shown in Lancaster (1966). These independent variables are what we utilize to answer this research question.

Table 6: Methodological literature review for third research question

<b>Authors</b>	<b>Model type</b>	<b>Research objective</b>	<b>Dependent variable</b>
Fox, Montgomery, and Lodish (2014)	Type-2 Tobit	Understand how consumers choose to purchase at different retail locations based on attributes	Store expenditures
Keeling Bond, Thilmany, and Bond (2009)	Multinomial logit	See how attributes effect an individual's probability of purchasing food from direct markets	Frequency of direct market purchases
McCracken and Brandt (1987)	Tobit	Understand how household's food away from home expenditures changes based on the location the food is purchased	Food away from home expenditures

<b>Authors</b>	<b>Model type</b>	<b>Research objective</b>	<b>Dependent variable</b>
Nelson (1996)	Tobit	Explore how variations in household purchases occur over time	Annual expenditures
Thilmany, Bond, and Bond (2008)	Linear Tobit	Finds individual's willingness to pay for the local attribute	Stated willingness to pay for product
Zepeda (2009)	Probit	Assess which characteristics lead to an individual being a farmers' market shopper	Shops at farmers' market once a month (yes/no)

*Econometric Theory*

The tobit model is known as a censored model, which means the dependent variable is observed in only some cases. Even though the dependent variables may not be observed, the independent variables are still observed. This is common with survey data (Gujarati, Porter, & Gunasekar, 2009). In this analysis, survey respondents were asked what percentage of their food at home dollars they spend at direct-to-consumer markets. Some respondents chose to answer with a numerical value greater than one, indicating that their household spends money at direct-to-consumer markets, and therefore, the variable is observed. However, some survey participants responded that they do not have any expenditures at direct-to-consumer markets, meaning their value for this question is zero, and they do not observe the variable. However, their response of zero expenditures still needs to be included in the model and cannot be ignored or dropped from the dataset. If the data was dropped, it would be like saying the individual chose not to answer this particular question, yet it is important to include the zero responses because a zero response actually provides some information on differences among residents. If the zero observations were not included, this would cause the data to be biased and inconsistent (Gujarati, Porter, & Gunasekar, 2009).

Mathematically, the tobit model is represented as:

$$Y_j = \beta_1 + \beta_2 X_j + u_j \text{ when } RHS > 0 \tag{13}$$

$$\textit{Otherwise, } Y_i = 0$$

where  $X_j$  represents the explanatory variables used in the model. This top equation will only apply if individuals responded to the dependent variable with a value greater than 0. If they instead responded with zero, then the equation is equal to zero. Tobit models are commonly used for expenditure models because individuals often answer that they have \$0 of expenditures on a particular item (Fox, Montgomery, & Lodish, 2014; McCracken & Brandt, 1987; Nelson, 1996). Tobit models properly handle censored data, where ordinary least squares would estimate a line that was biased and inconsistent.

However, a negative binomial regression (NBR) can also handle this data in a specific way. Shaw (1988) points out that Poisson and negative binomial regression models are used when a dataset contains non-negative integers (also known as count data), meaning the dependent variable can only be a positive value. When individuals are asked to answer what their expenditures are in a dollar value for a particular good, the value of that good will either be zero or positive, and there is no chance that they will have a negative value for expenditures. The negative binomial regression is a variation of the Poisson model (Lee, 1986). In a Poisson model, the variance and the mean of a variable are equal. However, Ver Hoef and Boveng (2007) conclude the negative binomial regression is most commonly used when the data is over-dispersed, meaning the variance is greater than the mean. A negative binomial regression is useful when answers for an amount of expenditure have a wide variance.

### *Econometric Model*

The dependent variable in this model is the percentage share of the individual's food at home expenditures spent at direct markets (*fooddollar\_direct*). In order to get a measure of the overall share of household food dollars spent at direct markets, the data was aggregated across



three categories (farmers' markets, CSAs, and direct farm purchases). For the purposes of this paper, the eight individuals who responded that they spend 100% of their food dollars at direct market were removed from the dataset as this seemed unrealistic, and there was concern they misunderstood the question. These responses biased the data, creating an overestimation for the share of food dollars spent at direct markets. A large number of individuals responded that they spend 0% of their food at home expenditures at direct markets. Because of this, the data is highly censored on 0. In order to address this modeling issue, both a tobit model and a negative binomial regression model are used. Tobit is a common model choice to use for this type of data because of the theoretical concepts mentioned above in regards to expenditures, and because the literature review shows tobit as a best practice methodology for these types of questions. The negative binomial regression is also utilized because when data is over dispersed, meaning the mean is smaller than the variance, it may be appropriate. The mean of the dependent variable used to address this question is 4.45. However, the variance is 60.71. This gives good evidence as to why it might be helpful to run both a tobit and a negative binomial regression for this question because both methods are addressing issues related to the data in different ways.

The equation I will be estimating for this question is as follows:

$$Y_j = \beta_1 + \beta_2(\text{demographics}) + \beta_3(\text{behaviors}) + \beta_4(\text{attributes}) + \beta_5(\text{attitudes about food}) + \beta_6(\text{agricultural information}) + u_j \quad (14)$$

Demographic variables included in this analysis are age (*age*), amount of time an individual has lived in Colorado (*lived\_co*), gender (*gender*), and annual income (*annual\_inc*). Annual income was included in this model because the dependent variable is expenditures, and the amount of income one has would directly dictate how much they are able to spend on certain products. We hypothesize annual income will have a positive effect on how much individuals

spend at direct markets because as an individual has more money, he or she will be able to spend more money to purchase products that match the characteristics they are interested in. We also hypothesize that age and the amount of time an individual has lived in Colorado will have positive effects on their direct market purchasing because individuals who are older and have lived in Colorado longer have more experience with direct-to-consumer markets. Gender is also hypothesized to have a positive effect because gender is classified as female, and females are often the individual within a household making food purchasing decisions.

Behaviors included in this model are whether or not the individual has their own garden (*garden*), which was used in several previous studies. We hypothesize that if individuals garden, this will have a positive effect on the amount of money they spend at direct markets because they value freshly grown produce and may use direct markets as a supplement for their own garden. The product attribute included in this model is whether or not individuals believe food is offered at a reasonable price in Colorado (*reasonable\_price*). We hypothesize that if an individual believes that food is offered at a reasonable price in Colorado, the amount of expenditures spent at direct markets will be positively influenced because individuals will be more likely to trust they are paying a fair price directly to the farmer.

The largest set of variables included in this study are attitudinal variables. These are how safe individuals believe Colorado products are (*safety\_co*), how safe products at direct markets are (*safety\_direct*), how much confidence the individual has that a product is actually local (*local\_confidence*), the importance of price (*imp\_price*), freshness (*imp\_fresh*), organic (*imp\_organic*), having proven health benefits (*imp\_health*), and supporting the local economy (*imp\_economy*). We expect all of these variables to have mixed effects. The importance of freshness, organic, health benefits, and local economic benefits are all characteristics often

associated with direct markets. Individuals who value these factors are likely to spend more of their food at home expenditures at direct markets. However, we hypothesize that individuals who value price are less likely to spend their food at home dollars at direct markets. The perception (whether it is correct or not) is that the price of food purchased at direct-to-consumer markets is higher than the price of food purchased at supercenters or grocery stores. Therefore, individuals who place a high value of importance on price are less likely to shop at direct-to-consumer markets.

Lastly, trust in information variables were also included in this model. How individuals trust information from the overall industry (*aginfo\_industry*) and from farmers (*aginfo\_farmers*) were included because these two sources will most likely have an impact at the direct market, and the two effects may have opposite signs if those two sources are considered competing alternatives for information. We believe information from industry will have a negative impact on how individuals choose to spend at direct markets. This is because industry information is more likely to be presented in retail outlets like supermarkets or supercenters than at direct markets. However, we expect information from farmers to have a positive effect on how much individuals spend at direct markets because it signals that consumers value that they are able to directly communicate with the farmer when they shop at direct markets.

## DATA

Data for this paper was collected through the Public Attitudes about Agriculture in Colorado survey conducted by the Colorado Department of Agriculture and the Colorado State University Department of Agricultural and Resource Economics. This survey has taken place every five years since 1996. This survey asks Coloradans to answer questions on a variety of topics, including how long an individual has lived in the state, how safe food produced by Colorado farmers and ranchers is, their likelihood of trusting information from particular sources, what local means to them, their confidence in a product actually being local, factors that are important to their purchasing decision, motivations for purchasing more Colorado produce, and their awareness of Colorado Proud products.

To support data collection, CSU researchers hired TNS ([www.tns-usa.com](http://www.tns-usa.com)). Between August 24 and September 6, 2016, a total of 1,000 respondents took the Internet based survey. The sample in this dataset is representative of Colorado's demographic profile according to the U.S. Census data. The only area where this dataset is not representative is in the 18-24-year-old male demographic, and the market research group confirmed this to be expected as this group tends to be less engaged overall in responding to surveys. The average length of residency in Colorado in the dataset was 16 years, a decrease from the 2011 survey results. This is believed to be because Colorado continues to see high rates of in-migration to the state. The average respondent age was 48 years old. The average age of Coloradans is 37, but the survey was only able to be answered by individuals 18 years or older, so it was expected that the average age of respondents would be higher than the state's average age. Slightly more females than males responded to the survey (58% females versus 42% males), but this is believed to be due to

females having a larger role in food purchasing within households. Lastly, the median income range of survey respondents was between \$50,000 and \$75,000. The state’s median income in 2015 was \$55,000, which falls into the above category.

### *Summary Statistics*

Table 7 provides descriptive statistics for the independent and dependent variables. The number of observations differs between the variables as some variables allowed for respondents to answer that they did not know, which was classified as a blank entry.

Table 7: Summary statistics for all variables

<b>Variables</b>	<b>Description</b>	<b>Obs.</b>	<b>Mean</b>	<b>St. Dev.</b>
DV1: coproud_pur	Have you heard of and purchased Colorado Proud products? 1 = yes, 0 = no	992	0.596	0.490
DV2: fooddollar_direct	Approximately what share of your household food dollars is spent at direct markets (farmers’ market, farm stands, and CSAs)? Percentage variable	992	4.459	7.792
DV3: veggies_co	Would you buy more vegetables if they were identified as being from Colorado? 5 = definitely yes, regardless of price, 4 = probably yes, regardless of price, 3 = depends on the relative prices, 2 = probably yes, depends on the relative prices, 1 = definitely no, regardless of price	992	3.764	0.839
DV4: fruits_co	Would you buy more fruits if they were identified as being from Colorado? 5 = definitely yes, regardless of price, 4 = probably yes, regardless of price, 3 = depends on the relative prices, 2 = probably yes, depends on the relative prices, 1 = definitely no, regardless of price	992	3.796	0.870
garden	Does your household raise any of its own food products? 1 = yes, we raise a garden in season, 0 = no	992	0.346	0.476

<b>Variables</b>	<b>Description</b>	<b>Obs.</b>	<b>Mean</b>	<b>St. Dev.</b>
ever_farm	Have you ever lived or worked on a farm/ranch? 1 = yes, 0 = no	992	0.197	0.398
age	What is your age?	992	48.171	16.63
lived_co	How many years have you lived in Colorado? 1 = fewer than 5, 2 = 6-10 years, 3 = 11-15 years, 4 = 16-20 years, 5 = 20+ years	992	3.342	1.349
gender	What is your gender? 1 = female, 0 = male	992	0.575	0.494
annual_inc	What is your household's annual income before tax? 1 = under \$20,000, 2 = \$20,000 to under \$40,000, 3 = \$40,000 to under \$50,000, 4 = \$50,000 to under \$75,000, 5 = \$75,000 to under \$100,000, 6 = \$100,000 to under \$125,000, 7 = \$125,000 to under \$150,000, 8 = \$150,000+, blank = prefer not to answer	966	4.398	2.067
reasonable_price	Do you agree or disagree that agriculture provides food at a reasonable price in Colorado? 1 = agree, 0 = disagree, blank = don't know	840	0.917	0.274
safety_co	In your opinion, how safe is the food that Colorado farmers and ranchers produce? 4 = almost always safe, 3 = usually safe, 2 = sometimes safe, 1 = almost never safe, blank = don't know	932	3.196	0.639
aginfo_cda	How likely are you to trust information about agriculture from the Colorado Department of Agriculture (CDA)? 5 = very likely, 4 = somewhat likely, 3 = not very likely, 2 = not at all likely, 1 = not aware of this source	992	4.171	0.811
aginfo_industry	How likely are you to trust information about agriculture from the food industry? 5 = very likely, 4 = somewhat likely, 3 = not very likely, 2 = not at all likely, 1 = not aware of this source	992	3.346	0.853

<b>Variables</b>	<b>Description</b>	<b>Obs.</b>	<b>Mean</b>	<b>St. Dev.</b>
aginfo_farmers	How likely are you to trust information about agriculture from farmers and ranchers themselves? 5 = very likely, 4 = somewhat likely, 3 = not very likely, 2 = not at all likely, 1 = not aware of this source	992	4.067	0.766
aginfo_social	How likely are you to trust information about agriculture from social media? 5 = very likely, 4 = somewhat likely, 3 = not very likely, 2 = not at all likely, 1 = not aware of this source	992	2.652	0.845
local_co	When you shop for fruits, vegetables, meat, dairy, and other food products, does local mean the product is produced in Colorado? 1 = yes, 0 = no	992	0.750	0.433
local_confidence	When purchasing food products labeled as local, how confident are you that they are actually local? 5 = very confident, 4 = somewhat confident, 3 = fairly confident, 2 = some doubts, 1 = not confident at all, blank = don't know	955	3.816	0.958
imp_price	When you shop for fruits, vegetables, meats, dairy, and other food products, how important is the price in your decision? 5 = very important, 4 = somewhat important, 3 = not very important, 2 = not at all important, 1 = never considered this issue	992	4.427	0.768
imp_fresh	When you shop for fruits, vegetables, meats, dairy, and other food products, how important is the freshness of the product in your decision? 5 = very important, 4 = somewhat important, 3 = not very important, 2 = not at all important, 1 = never considered this issue	992	4.661	0.711

<b>Variables</b>	<b>Description</b>	<b>Obs.</b>	<b>Mean</b>	<b>St. Dev.</b>
imp_organic	When you shop for fruits, vegetables, meats, dairy, and other food products, how important is it that the product is organically grown in your decision? 5 = very important, 4 = somewhat important, 3 = not very important, 2 = not at all important, 1 = never considered this issue	992	3.517	1.062
imp_health	When you shop for fruits, vegetables, meats, dairy, and other food products, how important is it that the product has proven health benefits in your decision? 5 = very important, 4 = somewhat important, 3 = not very important, 2 = not at all important, 1 = never considered this issue	992	4.043	0.894
imp_economy	When you shop for fruits, vegetables, meats, dairy, and other food products, how important is it that it supports the local economy in your decision? 5 = very important, 4 = somewhat important, 3 = not very important, 2 = not at all important, 1 = never considered this issue	992	4.061	0.905
motivate_chefs	Would seeing Colorado chefs and getting recipes for your kitchen motivate you to buy and eat more Colorado fruits and vegetables? 3 = very motivated, 2 = somewhat motivated, 1 = not at all motivated, blank = don't know	939	1.710	0.739
motivate_nutrition	Would understanding more nutritional benefits of eating Colorado produce motivate you to buy and eat more Colorado fruits and vegetables? 3 = very motivated, 2 = somewhat motivated, 1 = not at all motivated, blank = don't know	947	2.057	0.685
motivate_economic	Would understanding the economic benefit of buying Colorado produce motivate you to buy and eat more Colorado fruits and vegetables? 3 = very motivated, 2 = somewhat motivated, 1 = not at all motivated, blank = don't know	951	2.165	0.633



<b>Variables</b>	<b>Description</b>	<b>Obs.</b>	<b>Mean</b>	<b>St. Dev.</b>
motivate_safety	Would feeling confident that Colorado producers implement food safety practices motivate you to buy and eat more Colorado fruits and vegetables? 3 = very motivated, 2 = somewhat motivated, 1 = not at all motivated, blank = don't know	955	2.370	0.633
motivate_understand	Would developing a deeper understanding of Colorado produce farms and farmers motivate you to buy and eat more Colorado fruits and vegetables? 3 = very motivated, 2 = somewhat motivated, 1 = not at all motivated, blank = don't know	947	2.021	0.692
motivate_season	Would understanding the Colorado produce harvest season motivate you to buy and eat more Colorado fruits and vegetables? 3 = very motivated, 2 = somewhat motivated, 1 = not at all motivated, blank = don't know	955	2.116	0.700
motivate_labels	Would finding better point of sale identification of Colorado produce (labels, QR codes, etc.) motivate you to buy and eat more Colorado fruits and vegetables? 3 = very motivated, 2 = somewhat motivated, 1 = not at all motivated, blank = don't know	952	2.085	0.704
motivate_flavor	Would tasting better flavor in Colorado produce motivate you to buy and eat more Colorado fruits and vegetables? 3 = very motivated, 2 = somewhat motivated, 1 = not at all motivated, blank = don't know	946	2.490	0.607
motivate_price	Would seeing a better price on Colorado produce motivate you to buy and eat more Colorado fruits and vegetables? 3 = very motivated, 2 = somewhat motivated, 1 = not at all motivated, blank = don't know	963	2.630	0.545

<b>Variables</b>	<b>Description</b>	<b>Obs.</b>	<b>Mean</b>	<b>St. Dev.</b>
motivate_prep	Would finding more Colorado produce prepped and ready to eat motivate you to buy and eat more Colorado fruits and vegetables? 3 = very motivated, 2 = somewhat motivated, 1 = not at all motivated, blank = don't know	955	2.040	0.729
method_pos	Would you use grocery store managers, produce labels, or the produce calendar as a method to get information about Colorado food and agricultural products? 1 = yes, 0 = no, blank = don't know	969	0.956	0.203
method_media	Would you use TV, radio, or newspaper advertisements as a method to get information about Colorado food and agricultural products? 1 = yes, 0 = no, blank = don't know	965	0.824	0.380
method_int	Would you use social media or websites as a method to get information about Colorado food and agricultural products? 1 = yes, 0 = no, blank = don't know	954	0.738	0.439

## RESULTS

The empirical results are presented below, focusing on what can be inferred from the signs and statistical significance of explanatory variables. Findings will be discussed starting with the more general (choice of Colorado Proud) followed by a more detailed focus on the types and location of such purchases.

### *Factors that Affect Choice to Buy Colorado Proud Products*

Results for the first research question are shown in Table 8. The three results with the highest magnitude of effect are *local\_co*, *local\_confidence*, *motivate\_labels*, and *gender*. An individual who believes local products are defined as products that are produced within the state of Colorado are 6.3% more likely to purchase Colorado Proud products, and similarly, the more confidence an individual has that products labeled as local are labeled truthfully are 6.2% more likely to purchase Colorado Proud products. Individuals motivated by labels are 5.8% more likely to buy Colorado Proud products, and females are 5.4% more likely to purchase Colorado Proud products. Other statistically significant results had marginal effects of less than 5%, as shown in Table 8.

There are several demographics that appear to correlate with a respondent's interest in purchasing Colorado Proud products. According to the results, the longer a respondent has lived in Colorado, the more likely they are to choose to buy Colorado Proud products. This result matches our hypothesis. Females are also more likely to choose to buy Colorado Proud products, which is likely because females are more typically involved in a household's food planning and match with results from some previous studies (Cranfield, Henson, & Blandon, 2012; Zepeda & Nie, 2012).

Table 8: Probit results for the first research question

<b>Variables</b>	<b>Coefficient</b>	<b>Marginal Effect</b>
Constant	-2.912*** (0.436)	
Years of Residency in CO ( <i>lived_co</i> )	0.099*** (0.034)	0.027***
Gender ( <i>gender</i> )	0.196** (0.093)	0.054**
Safety of CO Food ( <i>safety_co</i> )	0.186** (0.078)	0.048**
Trust Information from CDA ( <i>aginfo_cda</i> )	0.090 (0.070)	0.024
Trust Information from Industry ( <i>aginfo_industry</i> )	0.013 (0.065)	0.004
Trust Information from Farmers ( <i>aginfo_farmers</i> )	0.089 (0.073)	0.023
Trust Information from Social Media ( <i>aginfo_social</i> )	-0.153*** (0.058)	-0.041***
Definition of Local Products ( <i>local_co</i> )	0.245** (0.106)	0.063**
Confidence in Local Products ( <i>local_confidence</i> )	0.215*** (0.052)	0.062***
Motivated by Nutrition ( <i>motivate_nutrition</i> )	0.136* (0.071)	0.035*
Motivated by Labels ( <i>motivate_labels</i> )	0.233*** (0.069)	0.058***
Individual has a Garden ( <i>garden</i> )	0.165* (0.096)	0.046*

*N* = 884

Numbers in parenthesis are standard errors.

\*, \*\*, and \*\*\* indicate significance at the 10% level, 5% level, and 1% level, respectively.

Chi-squared = 118.54

We also explored how consumers' attitudes and behaviors may influence their choice to buy a locally labeled product. As one's confidence about Colorado food safety increase, so does their likelihood to purchase Colorado Proud products. Respondents who believe local products are defined as products that are produced within the state of Colorado are more likely to be Colorado Proud shoppers. In this sample of Colorado consumers, when asked what local meant to them, the majority of people answered that they perceive local as products produced within the

state. The numerical breakdown of these results is shown in Figure 8. This may indicate that individuals purchasing state branded products can be used as a proxy for local food shoppers, a common topic of debate among researchers. Similarly, the more confidence the individual has that the product is actually local, the more likely they are to purchase Colorado Proud products, matching our hypothesized result.

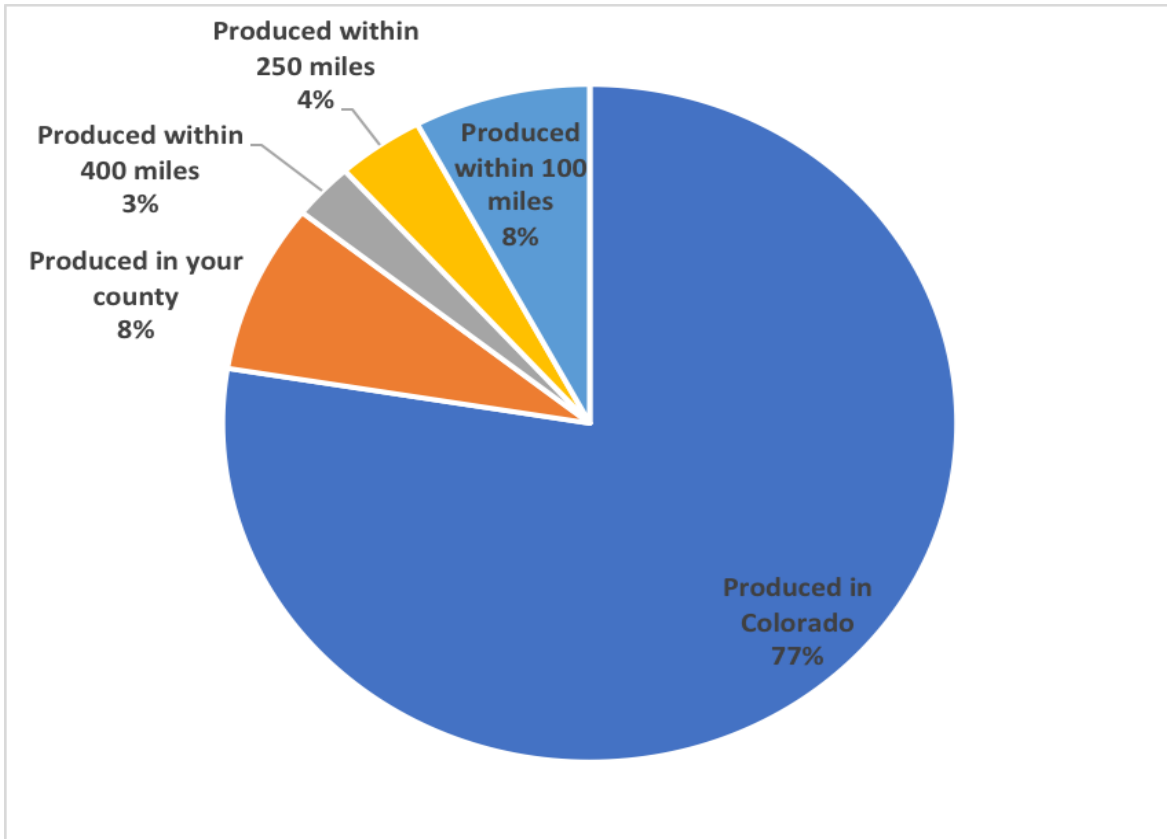


Figure 8: Survey responses about what local food means

Unlike our hypothesis, consumer's use and trust with respect to agricultural information from the CDA, the food industry, and from farmers themselves were not statistically significant predictors of an individual's likelihood to purchase Colorado Proud products. An individual's trust and use in social media, on the other hand, matched our hypothesis: as an individual's trust and use of social media decreases, they are more likely to purchase Colorado Proud products. Respondents who are motivated to eat more Colorado produce because they are able to find

better point of sale identification (such as labels and QR codes) are also more likely to purchase Colorado Proud products. We also found that individuals who are motivated to eat more Colorado fruits and vegetables through their understanding of nutritional benefits of Colorado produce are more likely to purchase Colorado Proud products. Lastly, people who garden are more likely to purchase Colorado Proud products.

*Factors that Affect Interest in Vegetables or Fruits Identified as Colorado Grown*

This study also sought to investigate the factors that make Colorado consumers interested in specifically purchasing fruits or vegetables identified as Colorado grown. In the survey, vegetables and fruits were split into two different dependent variables, meaning there are results for each dependent variable. To make the results easier to interpret, we combined the results into one table (Table 9) with headings to divide which model refers to vegetables and which refers to fruits. As expected, the results of the two models were very similar, likely due to the fact that people associate fresh produce (fruits and vegetables), regardless of the variety or type of each. The selection portion of the Heckman two-step model is the same model used to address the first research question. Therefore, the results of the selection portion will not be analyzed here as they were analyzed in the above section.

Table 9: Heckman results for second research question

Variables	Vegetables	Fruits
<i>Results of the selection equation for Heckman two-step</i>		
Constant	-2.978*** (0.442)	-2.978*** (0.442)
Years of Residency in CO ( <i>lived_co</i> )	0.096*** (0.034)	0.096*** (0.034)
Gender ( <i>gender</i> )	0.195** (0.094)	0.195** (0.094)
Safety of CO Food ( <i>safety_co</i> )	0.183** (0.079)	0.183** (0.079)

<b>Variables</b>	<b>Vegetables</b>	<b>Fruits</b>
Trust Information from CDA ( <i>aginfo_cda</i> )	0.084 (0.071)	0.084 (0.071)
Trust Information from Industry ( <i>aginfo_industry</i> )	0.026 (0.067)	0.026 (0.067)
Trust Information from Farmers ( <i>aginfo_farmers</i> )	0.069 (0.074)	0.069 (0.074)
Trust Information from Social Media ( <i>aginfo_social</i> )	-0.154*** (0.059)	-0.154*** (0.059)
Definition of Local Products ( <i>local_co</i> )	0.251** (0.108)	0.251** (0.108)
Confidence in Local Products ( <i>local_confidence</i> )	0.222*** (0.053)	0.222*** (0.053)
Motivated by Nutrition ( <i>motivate_nutrition</i> )	0.176** (0.073)	0.176** (0.073)
Motivated by Labels ( <i>motivate_labels</i> )	0.228*** (0.071)	0.228*** (0.071)
Individual has a Garden ( <i>garden</i> )	0.175* (0.097)	0.175* (0.097)
<i>Results of the outcome equation for Heckman two-step</i>		
Constant	3.999*** (0.612)	4.010*** (0.623)
Age ( <i>age</i> )	0.002 (0.002)	0.002 (0.002)
Individual has Lived on Farm ( <i>ever_farm</i> )	0.138 (0.088)	0.132 (0.089)
Trust Information from CDA ( <i>aginfo_cda</i> )	-0.056 (0.064)	-0.003 (0.065)
Trust Information from Industry ( <i>aginfo_industry</i> )	-0.071 (0.055)	-0.032 (0.056)
Trust Information from Farmers ( <i>aginfo_farmers</i> )	0.074 (0.063)	-0.03 (0.649)
Trust Information from Social Media ( <i>aginfo_social</i> )	-0.038 (0.052)	-0.102* (0.053)
Motivated by Chefs ( <i>motivate_chefs</i> )	-0.033 (0.060)	-0.085 (0.061)
Motivated by Nutrition ( <i>motivate_nutrition</i> )	-0.152** (0.076)	-0.047 (0.078)
Motivated by Economic Benefits ( <i>motivate_economic</i> )	0.075 (0.077)	-0.01 (0.078)
Motivated by Food Safety ( <i>motivate_safety</i> )	0.117 (0.074)	0.073 (0.075)
Motivated by Understanding of CO Farms ( <i>motivate_understand</i> )	-0.044 (0.073)	-0.039 (0.074)
Motivated by CO Growing Season ( <i>motivate_season</i> )	0.135** (0.064)	0.167** (0.065)

<b>Variables</b>	<b>Vegetables</b>	<b>Fruits</b>
Motivated by Labels ( <i>motivate_labels</i> )	-0.005 (0.072)	0.025 (0.073)
Motivated by Flavor ( <i>motivate_flavor</i> )	0.148** (0.073)	0.162** (0.074)
Motivated by Price ( <i>motivate_price</i> )	-0.244*** (0.076)	-0.170** (0.077)
Motivated by seeing Prepped Items ( <i>motivate_prep</i> )	0.029 (0.058)	0.048 (0.058)
Use Information from Point-of-Sale ( <i>method_pos</i> )	0.135 (0.277)	0.219 (0.281)
Use Media for Information ( <i>method_media</i> )	0.029 (0.117)	-0.009 (0.118)
Use Internet for Information ( <i>method_int</i> )	0.108 (0.093)	0.163* (0.094)
Inverse Mills' Ratio	-0.527** (0.218)	-0.559** (0.222)
<i>Observations</i>	844	844
<i>Wald Chi-Squared</i>	37.14	37.77

*Numbers in parenthesis are standard errors.*

*\*, \*\*, and \*\*\* indicate significance at the 10% level, 5% level, and 1% level, respectively.*

The inverse mills' ratio is statistically significant for both the vegetable and fruit model, which indicates that the selection and outcome portions for both the vegetable and fruit model are indeed related. If we would not have included the selection portion of the equation, the outcome portion would have had a misspecification error, as shown in Heckman (1979). A few of the results are statistically significant only in one of the two regressions. These results will be discussed first, followed by results that are statistically significant in both models.

The less likely a respondent is to trust agricultural information from social media, the more likely they are to buy more fruit identified as from Colorado. However, we hypothesized this variable to be positive because we assumed individuals purchasing a product new to them would seek out information from any source to inform their decision. The more consumers are motivated by understanding the nutritional benefits of eating Colorado produce, the less likely they are to purchase more Colorado vegetables. This is the opposite of what we hypothesized and



may be due to the lack of information about Colorado vegetable health benefits. Lastly, consumers who use both social media and websites are more likely to have an interest in purchasing Colorado fruits that are identified as Colorado grown.

Factors were also found to be statistically significant for both Colorado grown fruits and vegetables. Individuals who are motivated to buy and eat more Colorado produce through their understanding of the Colorado produce harvest season are more likely to be interested in purchasing Colorado grown fruits and vegetables. Respondents who are motivated to buy and eat more Colorado produce through tasting better flavor in Colorado produce are more likely to be interested in purchasing Colorado grown products. Lastly, respondents who are motivated to buy and eat more Colorado fruits and vegetables by seeing a better price on Colorado produce are less likely to be interested in purchasing fruits and vegetables identified as Colorado grown.

*Factors that Affect Propensity to Spend Food at Home Expenditures at Direct Markets*

Results for the tobit and negative binomial regression models are shown side-by-side in Table 10. Comparative results serve as a type of robustness check of varying specifications by showing the significance of variables does not vary by specification. First, the negative binomial regression model will be discussed, followed by the differences in the tobit model.

Based on results of the negative binomial regression model, as age increases, a respondent's propensity to spend their food at home expenditures at direct markets decreases, which is opposite of what we hypothesized would happen. Of the studies that focused specifically on direct markets nationally, Keeling Bond, Thilmany, and Bond (2009) and Zepeda (2009) both found age to not be a statistically significant predictor of direct market participation. Gumirakiza, Curtis, and Bosworth (2014) focused their study on Nevada and Utah consumers

and also found age not to be a statistically significant predictor of direct market participation. In our case, as Coloradoans age, they are less likely to spend their food at home dollars at direct markets, instead opting to shop at other types of markets because of convenience or familiarity, for example. More data would have to be collected on these variables to understand their effect on market participation.

Table 10: Tobit and negative binomial regression results for third research question

<b>Variables</b>	<b>Tobit</b>	<b>NBR</b>
Constant	-21.68* (11.248)	-0.652 (1.513)
Individual has a Garden ( <i>garden</i> )	2.161** (1.044)	0.192 (0.143)
Age ( <i>age</i> )	-0.069** (0.030)	-0.013*** (0.004)
Years of Residency in CO ( <i>lived_co</i> )	-0.383 (0.422)	-0.008 (0.055)
Gender ( <i>gender</i> )	0.579 (1.075)	-0.026 (0.142)
Annual Income ( <i>annual_inc</i> )	0.302 (0.235)	0.031 (0.032)
CO Food is Reasonably Priced ( <i>reasonable_price</i> )	-0.828 (1.941)	-0.143 (0.282)
Safety of CO Food ( <i>safety_co</i> )	1.576* (0.937)	0.204* (0.122)
Safety of Food at Direct Markets ( <i>safety_direct</i> )	2.646*** (0.763)	0.284*** (0.097)
Trust in Information from Industry ( <i>aginfo_industry</i> )	-0.519 (0.631)	-0.021 (0.082)
Trust in Information from Farmers ( <i>aginfo_farmers</i> )	1.279 (0.795)	0.127 (0.106)
Confidence in Local Products ( <i>local_confidence</i> )	-0.138 (0.732)	0.052 (0.102)
Importance of Price ( <i>imp_price</i> )	-2.525*** (0.781)	-0.306*** (0.099)
Importance of Freshness ( <i>imp_fresh</i> )	1.889* (1.085)	0.023 (0.132)
Importance of Organic ( <i>imp_organic</i> )	1.373** (0.538)	0.185** (0.073)
Importance of Health Benefits ( <i>imp_health</i> )	-0.211 (0.695)	-0.043 (0.094)
Importance of Local Economy Support ( <i>imp_economy</i> )	1.549**	0.272***

	(0.751)	(0.100)
Inverse Mills' Ratio	-0.686	0.021
	(3.499)	(0.465)
<i>Observations</i>	753	753
<i>Chi-squared</i>	84.05	67.37

*Numbers in parenthesis are standard errors.*

*\*, \*\*, and \*\*\* indicate significance at the 10% level, 5% level, and 1% level, respectively.*

The two food safety variables included in this analysis were also found to be statistically significant, meaning the greater confidence individuals have in the safety of food produced by Colorado producers, their propensity to spend their food at home dollars at direct markets increases. Similar results were found for results about direct markets: the greater confidence individuals have in the safety of food from direct markets, their propensity to spend their food at home dollars at those direct markets also increases. This also matches to the hypothesized result. Respondents who place a high importance on price are less likely to spend their food at home dollars at direct markets, which may be due to certain perceptions (accurate or not) associated with direct markets. Individuals who place a high importance on organic products are also more likely to spend their food at home dollars at direct markets. The last importance factor that was statistically significant in this analysis is the importance of supporting the local economy. The more importance an individual places on supporting the local economy, the more likely they are to shop at direct markets.

Table 10 also shows the results for the tobit model used to address the final research question. The results of the tobit model are very similar to the negative binomial model, meaning that the specification of the model is not important to which variables are statistically significant and that results from one type of model were not indicative of only using that particular model. The only difference between the two models are that garden and the importance of freshness were statistically significant in the tobit model, but not in the negative binomial regression

model. These results from the tobit model show that respondents who place a high importance on the freshness of the product are more likely to spend their food at home dollars at direct markets. Also, according to the tobit model results, respondents who have their own home garden have an increased propensity to shop at direct markets. Both of these results matched our hypothesis. One issue of concern with the tobit regression is the large constant value. This was one reason the negative binomial regression was chosen as it corrected for the large constant value due to the large difference in the variance and mean as addressed in the previous section. But, for interpretative purposes, the models appear to be consistent with respect to the significance and sign of most key findings.

## DISCUSSION & IMPLICATIONS

Our results indicate that consumers who are shopping for Colorado Proud products, Colorado grown vegetables and fruits, and at direct markets are influenced by private and public attributes, behaviors, demographics, and attitudes. These different factors can be defined as search, experience, and credence dimensions that the consumers are using when purchasing Colorado Proud products and shopping at direct markets. However, these results indicate that consumers purchasing Colorado Proud products use or are motivated by different dimensions when compared to consumers interested in purchasing Colorado grown vegetables and fruits and shopping at direct market. As mentioned earlier, Colorado Proud is the broadest form of local branding because it attempts to be inclusive of all types of agricultural businesses interested in demarcating their products as locally produced. The differences we find between these three consumer groups may be because individuals are informing their purchasing decisions in different ways depending on the type of product they are purchasing and where they are purchasing it. Local food can be measured in a number of ways, and these results show how local food consumers are different based on how they are consuming local food.

Table 11 breaks down the results from the four models and organizes them by which factors are search, experience, and credence dimensions. Colorado Proud consumers and consumers interested in purchasing Colorado grown vegetables are using experience dimensions the most, and this may be because they are choosing to purchase Colorado Proud products or Colorado grown vegetables based on their experiences surrounding local food and use their experiences to choose to make future purchases. Consumers interested in purchasing Colorado fruits are using search dimensions the most, which may indicate that they are considering these

products as they see them in retail locations and are using outward information about the product to make future purchases. Lastly, direct market shoppers are mostly using credence dimensions, and this may be because consumers are able to interact with producers at direct markets and therefore can act as the certifier of a credence dimension associated with a product as well as any future purchases.

Table 11: Dimensions based on the models' results

	<b>Purchase Colorado Proud products</b>	<b>Interested in purchasing Colorado vegetables</b>	<b>Interested in purchasing Colorado fruits</b>	<b>Shop at direct markets</b>
<b>Search dimensions</b>	Motivated by labels	Motivated of price	Motivated by price	Importance of price
	Trust in social media	Motivated by knowing growing season	Trust in social media	
			Use of internet for information	
			Motivated by knowing the growing season	
<b>Experience dimensions</b>	Safety of Colorado products	Motivated by flavor	Motivated by flavor	Safety of Colorado Products
	Years of residency in Colorado	Motivated by nutrition	Motivated by knowing the growing season	
	Has a garden	Motivated by knowing growing season		
	Motivated by nutrition			Safety of direct markets
	Motivated by labels			
	Definition of local			
<b>Credence dimensions</b>	Confidence in local	Motivated by nutrition	Motivated by knowing the growing season	Safety of direct markets
	Safety of Colorado products			Safety of Colorado products
	Motivated by labels	Motivated by knowing growing season		Importance of organic
	Motivated by nutrition			Importance of supporting the local economy

Experience dimensions that are positively influencing consumers to purchase Colorado Proud products are whether or not Colorado products are safe, how the individual is motivated by nutrition, how the individual is motivated by labels, the number of years of residency in Colorado, whether or not the individual has a garden, and what the individual's definition of local is. Safety, nutrition, and labels are all factors that consumers will understand more deeply after they have consumed the product. The safety of food products was also found to be a statistically significant indicator of local food purchases in Cranfield, Henson, and Blandon's (2012) study and Lusk and Briggemann's (2009) study. This may indicate that consumers who have a positive experience in regards to the safety of Colorado products are more likely to purchase Colorado Proud products. Consumers who have purchased products before based on the label may use it as an experience dimension, as they have previous experience with the Colorado Proud labeled products and look for the label as it indicates certain qualities the consumer wants.

Years of residency in Colorado is an experience dimension because an individual who has lived in Colorado longer has had more opportunities to interact with Colorado Proud products, a similar finding to Jekanowski et al.'s (2000) study of Indiana consumers. Gardening is an experience dimension because individuals who garden are familiar with fresh produce and have experienced it firsthand. Similar research has found gardening to be connected to local food purchases as well (Cranfield, Henson, and Blandon, 2012; Zepeda and Li, 2006). This could also indicate that a consumer segment of Colorado Proud could be found in individuals who garden. Targeting marketing campaigns towards participants of community garden programs or CSU Master Gardener programs could be a way to involve the consumer more deeply in the Colorado Proud program. Lastly, an individual's own definition of local is an experience dimension

because individuals are using their participation with local food, local markets, and Colorado Proud to form their own opinion of what they believe is considered local. We find that individuals who believe local food is food that is grown within the state are more likely to purchase Colorado Proud products, which may indicate that consumers are equating Colorado Proud with local food.

Credence dimensions that are positively influencing consumers who are purchasing Colorado Proud products are confidence in local products, how the individual is motivated by labels, how the individual is motivated by nutrition, and whether or not Colorado products are safe. The individual's confidence in local products is a credence dimension because a third party is coming in and advertising products as local. Without this information from an outside party, the individual would not know if the product is local. As Tonkin et al. (2016) find, truthful information about a product can instill consumer confidence in the product. The more confidence consumers have in products labeled as local, the more likely they are going to purchase Colorado Proud products. Motivation through labels and nutrition are also credence dimensions because information presented on product labels and about product nutrition are measured by third party organizations and disseminated to the consumers via informational labels or nutritional labels. Information presented on product labels or about product nutrition cannot be known by the consumer because they are unable to certify information about the products themselves. Instead, they require a third party certify information for them. Third party certification gives the individual confidence, as seen in Martin et al. (2016) and Costanigro, Deselnicu, and Kroll (2014). Lastly, the safety of Colorado products is a credence dimension because the individual is trusting the product when they purchase it at the market and cannot tell by looking at the product whether or not it is safe to consume.



Search dimensions that are influencing consumers who are purchasing Colorado Proud products are how the individual is motivated by labels and their trust in social media. Consumers who are motivated by seeing labels on products are more likely to purchase local, and this may support the use of a Colorado Proud label to indicate information to the consumer. During a consumer's search, they may use the label to inform their purchasing decision as the information presented on a label is something they can utilize by looking at the product. Their trust in social media is also a search dimension because social media can be used as a way to find information about products. However, the less an individual trusts social media, the more likely they are to purchase Colorado Proud products, which may be because individuals are not finding credible information on social media in general (Westerman, Spence, & Van Der Heide, 2013).

Coloradans interested in purchasing Colorado grown vegetables are utilizing experience dimensions the most, including how the individual is motivated by flavor, nutrition, and understanding the growing season. Motivation by flavor is an experience dimension because the flavor of a Colorado grown vegetable can only be known through actually consuming the product. Individuals who are motivated by flavor are more likely to purchase Colorado grown vegetables because if consumers believe a product from Colorado has better flavor than products from elsewhere, individuals that are motivated by the flavor are going to want to purchase that product. Cranfield, Henson, and Blandon (2012) found that the more importance individuals place on the taste of fresh food products, the more likely they are to purchase local food because consumers value the quality of the products (Cranfield, Henson, & Blandon, 2012). Lusk and Briggeman (2009) also found respondents highly value taste over other factors of food.

Motivation by understanding the growing season is also an experience attributes because individuals who have experience with when harvest seasons for different vegetables are, they are

going to understand when they can purchase certain products. Lastly, motivation by understanding nutrition is also an experience dimension because as individuals eat Colorado vegetables, they experience the nutritional benefits of the products. However, our results found that individuals who are motivated by nutritional benefits are less likely to purchase Colorado grown vegetables. This may be because these consumers are still seeking to understand how Colorado produce may improve their diets, or they are more motivated by the type of vegetable than where it grows. Perhaps to overcome this obstacle, the CDA could look into a partnership with the USDA through their MyPlate program, which gives consumers information on the daily recommended portions of fruits and vegetables, protein, grains, and dairy (U.S. Department of Agriculture, 2018). A “Colorado MyPlate” could be designed with products sourced solely from Colorado to highlight how produce from across Colorado can meet individuals’ nutritional needs, similar to what has been done in other states.

The search dimensions that individuals who are interested in Colorado vegetables are how individuals are motivated by price and understanding the growing season. Price is a factor the consumer can see when they are shopping in a retail market that can inform their purchasing decisions without having to actually experience the product. In these results, consumers who are motivated by price are less likely to purchase Colorado grown vegetables, which may be due to certain perceptions (accurate or not) about the prices of locally grown foods. Because price is a search dimension, the price of a Colorado vegetable can be easily compared to the price of a non-Colorado vegetable. Information on growing seasons are also search dimensions because of the Colorado produce calendar provided by groups like the Colorado Fruit and Vegetable Growers Association (CFVGA) and Colorado Proud. This information source communicates to

consumers when certain Colorado vegetables are in season and available to purchase. Consumers can use this resource as a way to search for products available in retail locations.

Lastly, credence dimensions that are influencing individuals who are interested in purchasing Colorado vegetables are how individuals are motivated by nutrition and understanding the growing season. Motivation by nutrition is a credence dimension because a third party has to inform consumers about the actual nutritional value of products. The CFVGA and Colorado Proud provide information on produce harvest seasons through the produce calendar. Understanding growing seasons are also a credence dimension because the CFVGA and Colorado Proud are certifying this information that would otherwise may not be able to be understood by Colorado consumers.

Results of the factors that are influencing individuals interested in purchasing Colorado fruits are similar to individuals interested in purchasing Colorado vegetables with a few exceptions. Unlike Colorado vegetables, individuals interested in Colorado fruits are using search dimensions the most, including how individuals are motivated by price, their trust in social media, their use of the internet as an information resource, and how individuals are motivated by understanding the Colorado growing season. As an individual trust in social media decreases, their interest in purchasing Colorado fruits increases, which is the same effect we found when it comes to Colorado Proud shoppers and social media. This indicates that using social media may not be the best way to reach interested Colorado fruit shoppers as their search does not appear to be positively influenced by social media. However, individuals interested in Colorado fruits are using the internet as an information resource, which indicates that their search for information on Colorado fruits is in part taking place online.

Experience dimensions that are influencing Coloradans interested in purchasing Colorado grown fruit are how individuals are motivated by flavor and understanding the growing season. Similar to what was discussed when looking at Colorado grown vegetables, individuals who experience better flavor in Colorado fruits are influenced to buy more Colorado grown fruits, and consumers who have experience with when certain Colorado fruits are in season are more likely to purchase Colorado grown fruits as well. The only credence dimension found to be important for consumers interested in purchasing Colorado grown fruits is being motivated by understanding produce growing seasons, which again is information that is provided by groups such as the CFVGA and Colorado Proud.

For the decision to shop at direct markets, we find that credence dimensions are the factors that are influencing consumers to shop at direct markets, including the importance of organic, the importance of supporting the local economy, the safety of Colorado products, and the safety of products from direct markets. Individuals who place high importance on organic are spending more money at direct markets, similar to what Nganje, Hughner, and Lee (2011) and Keeling Bond, Thilmany, and Bond (2009) found in their studies. Although organic has become widespread at many other retail locations, direct markets may be more trustworthy, as the producer is available to certify his or her products as organic. Similar sentiments can be related to individuals who find high importance in supporting the local economy as these individuals' propensity to spend at direct markets also increases. Similar studies also found this factor to be statistically significant in predicting direct market participation (Thilmany, Bond, & Bond, 2008; Keeling Bond, Thilmany, & Bond, 2009). Individuals shopping at direct markets are more likely to have face-to-face interaction with the producers they are supporting, and therefore it may be easier to see a direct connection to the local economy if the producer directly shares information

on how their farm is growing, investing in workers, or spending money to improve their farm and its offerings. Lastly, as individuals find Colorado food and direct market purchases have high food safety, their propensity to shop at direct markets increases as well. Food safety is a credence dimension in this case because the producer can relate to the consumer how their farm values food safety and the measures they take to ensure their food is safe. Individuals would not be able to look at a farmer's product and determine whether or not it was safe, but farmers themselves can certify the safeness of their products, which may allow consumers to trust the information because it is being delivered first hand.

The safety of Colorado products and of direct markets can also be considered experience dimensions because individuals can understand whether or not a product maintained high food safety after they have consumed the product and may lead to their likelihood of repurchasing from a particular producer or a particular market. The only search dimension found to be statistically significant in this analysis was the importance of price. Individuals who place a high importance on price are less likely to spend their food at home dollars at direct markets. Price is one indicator that can be used as a search dimension because individuals can see and compare prices as they are at the market without having to actually purchase the product or without having someone else certify the information. We believe individuals are influenced negatively by price due to certain perceptions (accurate or not) associated with direct markets, which is in line with what other studies have found as well (Nganje, Hughner, & Lee, 2011; Thilmany, Bond, and Bond, 2008; Keeling Bond, Thilmany, and Bond, 2009).

We also explore how the different types of consumers are related to each other using the inverse mills ratio as a measure of comparison in the Colorado vegetables, fruits, and direct market models. When comparing shoppers of Colorado Proud and direct markets, the inverse

mills ratio is not statistically significant, indicating these two consumer groups are unique and that direct market shoppers may not find value in information provided by Colorado Proud. One way to address this discrepancy may be through a more nuanced state branding program, as shown in New York. This state has two state branding programs, Taste NY and New York State Grown and Certified. Both programs are operated by the New York Department of Agriculture and provide information through labels. Taste NY follows the more traditional state branding program model (“Taste NY,” 2018). New York State Grown and Certified on the other hand focuses purely on produce and is described as a food certification program that allows consumers to buy produce that is guaranteed to be high quality, local, safe, and environmentally responsible (“Introducing a New Standard for New York State Agriculture,” 2018). Consumers looking specifically for high quality, safe, environmentally responsible products may be more inclined to use a program such as New York State Grown and Certified, whereas consumers looking to purchase a product produced within the state are more likely to look for products under the Taste NY program. If a program like this were implemented in Colorado, direct market shoppers may be more apt to utilize the information provided because it would provide them with information that they could not get elsewhere.

When consumers interested in Colorado vegetables and fruits are compared to Colorado Proud shoppers, the inverse mills ratio is statistically significant for both, meaning these consumers are related to each other and may be interested in using information provided by Colorado Proud. This may indicate that Colorado Proud is the type of programing that potential Colorado vegetable and fruit shoppers are interested in utilizing and may be the best way to disseminate information to future consumers about locally grown fruits and vegetables.

## CONCLUSIONS

Consumer demand for local food and participation in direct markets have spurred some changes in the food system over the last couple of decades. Although local food is defined and measured in a variety of ways, the most common theme across previous studies and the findings within this study are that something is considered local because it meets both private and public attributes that the consumer is looking for in their products or markets. Overall, the change in consumer demand is not necessarily because they are demanding a different product or market, but instead, the change is because consumers are wanting to see certain attributes represented in their products and markets, and many of these attributes consumers are wanting to see are related to local food and local markets. As Lancaster (1966) pointed out in his characteristic demand theory, consumers are not receiving utility from a product, but they are instead gaining utility through the characteristics of that product, so local food may provide bundles not well met by more traditional food markets.

Many previous studies found that a mix of private and public attributes as well as certain behaviors and attitudes are important to consumers who have a higher demand for local products, and this study is no exception to those findings. However, this study focuses on breaking these attributes out into search, experience, and credence dimensions, which allows for a further understanding of how consumers purchasing Colorado Proud products, consumers interested in purchasing Colorado grown vegetables and fruits, and consumers shopping at direct markets differ. Colorado Proud shoppers and Coloradans interested in purchasing local vegetables are influenced by experience dimensions, whereas direct market shoppers are using credence dimensions and Coloradans interested in purchasing local fruits are using search dimensions.

Looking at shoppers in this way allows for us to understand more deeply why different segments of local food shoppers vary and why certain marketing efforts may be unsuccessful with certain groups.

This study also focuses on understanding how consumers use information. Although an individual's trust in certain information sources were not found to be important to an individual's likelihood of purchasing local or their propensity for spending money at direct markets, we did find that individuals motivated by labels and by a greater understanding of Colorado produce seasons are factors that are correlated with local food purchases and interest. Since programs such as Colorado Proud and the Colorado Fruit and Vegetable Growers Association are providing information about local food through labels and produce calendars, respectively, our results help indicate that consumers are using these information materials to inform their decisions. Labels and the produce calendar are also unique because they can be categorized as a search, experience, and credence dimension, making them useful in all stages of the purchasing process.



## LIMITATIONS

Our study is not without limitations. Given that the CDA Public Attitudes survey has been ongoing since 1996, it is not possible to influence many of the questions. Accordingly,, we are lacking a few variables previous studies have included in their analysis, one being how convenience plays into an individual's choice in food and market location. Understanding how an individual values convenience would help us take the individual's preferences into account. Because there may be more transaction costs associated with searching out Colorado Proud products and direct-to-consumer markets, individuals who highly value convenience may be opposed to participating in these activities. This may especially be true for individuals who are not located physically close to a direct-to-consumer market.

Another set of variables that would be interesting to include in this analysis are different behavioral variables, such as whether or not the individual enjoys cooking, how often they cook, and demographics such as how many adults and children are in the individual's household. These variables were found to be statistically significant at predicting local food and direct market purchases in previous literature. Lastly, we think it would be helpful to include different information sources to try and capture what sources individuals are using to inform their choices. One inclusion in particular that we think would be interesting are advice from friends or family.

## FUTURE RESEARCH

As mentioned, the Public Attitudes about Agriculture in Colorado survey is conducted every five years. Future surveys could allow for a time series comparison of how individual's likelihood for purchasing Colorado Proud products and individual's propensity to spend at direct markets are changing in the state of Colorado. The econometric models could be evaluated every five years using the same variables and then compared and contrasted to each other as a means to understand how consumer demand in Colorado may be changing.

Another interesting approach for future research would be to delve more deeply into how consumers are using search, experience, and credence dimensions. This study focused on different types of local food shoppers, however, differences in how search, experience, and credence dimensions play into a consumer's purchasing decision would also be found at different retail locations. A specific survey could be developed allowing us to work with more specific results which could help us understand more deeply how consumers at different types of retail locations are using these three types of dimensions. This information could also be useful to producers as they may be able to target consumers using the types of dimensions that are most used in a particular retail location.

Lastly, the Colorado Proud program has existed for almost 20 years, making it one of the longer running state branding programs in the United States. According to Onken and Bernard (2010), only thirteen state branding programs across the U.S. are older than Colorado's program. The program also has a high awareness throughout the state (89% having at least heard of the program). However, no formal case studies were found within the reviewed literature focusing on Colorado's state branding program. Because of the longevity, high awareness, and lack of

formalized studies, the Colorado Proud program may make for an interesting case study to understand more about what makes the program successful as well as measure empirically its impact to the overall Colorado economy. This may provide more information on how consumers are using search, experience, and credence dimensions involving Colorado Proud and local products as well as why this program and others like it are useful to the local food system.

## REFERENCES

- After falling in the late 1990s and early 2000s, supermarkets' share of at-home food spending has stabilized. (2016, September 1). Retrieved from <https://www.ers.usda.gov/data-products/chart-gallery/gallery/chart-detail/?chartId=78913>
- Best, M. J., & Wolfe, K. L. (2009). A Profile of Local Dairy Consumers in the Southeast and the Potential Dairies to Market Value-Added Products Locally. *Journal of Food Distribution Research*, 40(1).
- Bond, C. A., Thilmany, D., & Keeling Bond, J. (2008). Understanding Consumer Interest in Product and Process-Based Attributes for Fresh Produce. *Agribusiness*, 24(2), 231–252.
- Carroll, K. A., Bernard, J. C., & Pesek Jr., J. D. (2013). Consumer Preferences for Tomatoes: The Influence of Local, Organic, and State Program Promotions by Purchasing Venue. *Journal of Agricultural and Resource Economics*, 38(3), 379–396.
- Caswell, J. A. (1998). How Labeling of Safety and Process Attributes Affects Markets for Food. *Agricultural and Resource Economics Review*, 27(2), 151–158.
- Colorado Department of Agriculture. (2017). *Colorado Proud*. Broomfield, CO: Colorado Department of Agriculture.
- Colorado Department of Public Health and Environment. (2014). *Fruit and Vegetable Consumption in Colorado*.
- Costanigro, M., Deselnicu, O., & Kroll, S. (2015). Food Beliefs: Elicitation, Estimation, and Implications for Labeling Policy. *Journal of Agricultural Economics*, 66(1), 108–128.

- Costanigro, M., Thilmany McFadden, D., Kroll, S., & Nurse, G. (2011). An In-Store Valuation of Local and Organic Apples: The Role of Social Desirability. *Agribusiness*, 27(4), 465–477.
- Cranfield, J., Henson, S., & Blandon, J. (2012). The Effect of Attitudinal and Sociodemographic Factors on the Likelihood of Buying Locally Produced Food. *Agribusiness*, 28(2), 205–221.
- Curtis, J. (2000). Branding a state: The evolution of Brand Oregon. *Journal of Vacation Marketing*, 7(1), 75–81.
- Darby, K., Batte, M. T., Ernst, S., & Roe, B. (2008). Decomposing Local: A Conjoint Analysis of Locally Produced Foods. *American Journal of Agricultural Economics*, 90(2), 476–486.
- Farmers Markets and Direct-to-Consumer Marketing. (2016). Retrieved from <https://www.ams.usda.gov/services/local-regional/farmers-markets-and-direct-consumer-marketing>
- Fox, E. J., Montgomery, A. L., & Lodish, L. M. (2004). Consumer Shopping and Spending across Retail Formats. *The Journal of Business*, 77(S2), S25–S60.
- Goldberg, J. P., & Sliwa, S. A. (2010). *Communicating actionable nutrition messages: challenges and opportunities* (Session 4: Getting balanced nutrition messages across). Symposium on “Nutrition: Getting the balance right 2010.”
- Grunert, K. G. (2002). Current issues in the understanding of consumer food choice. *Trends in Food Science and Technology*, 13, 275–285.
- Gujarati, D. N., Porter, D. C., & Gunasekar, S. (2009). *Basic Econometrics* (Fifth). McGraw Hill Education.

- Gumirakiza, J. D., Curtis, K. R., & Bosworth, R. (2014). Who Attends Farmers' Markets and Why? Understanding Consumers and their Motivations. *International Food and Agribusiness Management Review*, 17(2).
- Hand, M. S., & Martinez, S. (2010). Just What Does Local Mean? *Choices: The Magazine for Food, Farm, and Resource Issues*, 25(1).
- Heckman, J. J. (1979). Sample Selection Bias as a Specification Error. *Econometrica*, 47(1), 153–161.
- Hobbs, J. E., & Goddard, E. (2015). Consumers and trust. *Food Policy*, 52, 71–74.
- Huffman, W. E., Rousu, M., Shogren, J. F., & Tegene, A. (2004). Who Do Consumers Trust for Information: The Case of Genetically Modified Foods? *American Journal of Agricultural Economics*, 86(5), 1222–1229.
- Introducing a New Standard for New York State Agriculture. (2018). Retrieved from <https://certified.ny.gov/>
- Jekanowski, M. D., Williams, D. R., & Schiek, W. A. (2000). Consumers' Willingness to Purchase Locally Produced Agricultural Products: An Analysis of an Indiana Survey. *Agricultural and Resource Economics Review*, 29, 43–52.
- Keeling Bond, J., Thilmany, D., & Bond, C. (2009). What Influences Consumer Choice of Fresh Produce Purchase Location? *Journal of Agricultural and Applied Economics*, 41(1), 61–74.
- Lancaster, K. J. (1966). A New Approach to Consumer Theory. *Journal of Political Economy*, 74(2), 132–157.
- Lee, L.-F. (1986). Specification Test for Poisson Regression Models. *International Economic Review*, 27(3).

- Low, S. A., Adalja, A., Beaulieu, E., Key, N., Martinez, S., Melton, A., ... Jablonski, B. B. R. (2015). *Trends in U.S. Local and Regional Food Systems* (No. AP-068). U.S. Department of Agriculture, Economic Research Service.
- Lusk, J. L., & Briggeman, B. C. (2009). Food Values. *American Journal of Agricultural Economics*, 91(1), 184–196.
- Martin, M. J., Hill, R. L., Van Sandt, A., & Thilmany, D. D. (2016). Colorado Residents Trusted Sources of Agricultural, Biotechnology, and Food Information. *AgBioForum*, 19(1), 34–43.
- McCracken, V. A., & Brandt, J. A. (1987). Household Consumption of Food-Away-from-Home: Total Expenditure and by Type of Food Facility. *American Journal of Agricultural Economics*, 69(2), 274–284.
- Nelson, J. A. (1996). The Frequency of Consumer Expenditure: An Empirical Analysis. *The Journal of Consumer Affairs*, 30(2), 322–347.
- Nganje, W. E., Hughner, R. S., & Lee, N. E. (2011). State-Branded Programs and Consumer Preferences for Locally Grown Produce. *Agricultural and Resource Economics Review*, 40(1), 20–32.
- Nicholson, W., & Snyder, C. (2008). *Microeconomic Theory: Basic Principles and Extensions* (10th ed.). Thomson Higher Education.
- Nurse, G., Onozaka, Y., & Thilmany McFadden, D. (2012). Consumer Motivations and Buying Behavior: The Case of the Local Food System Movement. *Journal of Food Products Marketing*, 18(5), 385–396.

- Onken, K. A., & Bernard, J. C. (2010). Catching the “Local” Bug: A Look at State Agricultural Marketing Programs. *Choices: The Magazine for Food, Farm, and Resource Issues*, 25(1).
- Onozaka, Y., Nurse, G., & Thilmany McFadden, D. (2010). Local Food Consumers: How Motivations and Perceptions Translate to Buying Power. *Choices: The Magazine for Food, Farm, and Resource Issues*, 25(1).
- Patterson, P. M. (2006). State-Grown Promotion Programs: Fresher, Better? *Choices: The Magazine for Food, Farm, and Resource Issues*, 21(1), 41–46.
- Peterson, H. H., Taylor, M. R., & Baudouin, Q. (2015). Preferences of locavores favoring community supported agriculture in the United States and France. *Ecological Economics*, 119, 64–73.
- Ruth, T. K., & Rumble, J. N. (2016). Branding the Berries: Consumers’ Strawberry Purchasing Intent and their Attitude toward Florida Strawberries. *Journal of Applied Communications*, 100(2), 28–42.
- Shaw, D. (1988). On-Site Samples’ Regression: Problems of Non-negative Integers, Truncation, and Endogenous Stratification. *Journal of Econometrics*, 37, 211–223.
- Taste NY. (2018). Retrieved from <https://taste.ny.gov/>
- Thilmany, D., Bond, C. A., & Bond, J. K. (2008). Going Local: Exploring Consumer Behavior and Motivations for Direct Food Purchases. *American Journal of Agricultural Economics*, 90(5), 1303–1309.
- Thilmany McFadden, D. (2015). What Do Mean by “Local Foods”? *Choices: The Magazine for Food, Farm, and Resource Issues*, 30(1).



- Todd, J. E., & Scharadin, B. (2016). *Where Households Get Food in a Typical Week: Findings from USDA's FoodAPS* (pp. 1–27). Economic Research Service/USDA.
- Tonkin, E., Webb, T., Coveney, J., Meyer, S. B., & Wilson, A. M. (2016). Consumer trust in the Australian food system -- The everyday erosive impact of food labeling. *Appetite*, 103, 118–127.
- U.S. Department of Agriculture. (2018, January 26). MyPlate. Retrieved from <https://www.choosemyplate.gov/MyPlate>
- United States Department of Agriculture, Census of Agriculture. (2015). *Local Food Marketing Practices Survey*.
- U.S. Department of Agriculture, National Agricultural Statistics Service. (2016). *Direct Farm Sales of Food: Results from the 2015 Local Food Marketing Practices Survey* (No. ACH 12-35).
- U.S. Department of Agriculture, National Agricultural Statistics Service. (2017). *2016 Certified Organic Survey* (No. 2017–6).
- Vassalos, M., Gao, Z., & Zhang, L. (2017). Factors Affecting Current and Future CSA Participation. *Sustainability*, 9(478).
- Ver Hoef, J. M., & Boveng, P. L. (2007). Quasi-Poisson vs. Negative Binomial Regression: How Should We Model Overdispersed Count Data? *Ecology*, 88(11), 2766–2772.
- Ver Ploeg, M., Macino, L., Todd, J. E., Clay, D. M., & Scharadin, B. (2015). *Where Do Americans Usually Shop for Food and How Do They Travel to Get There? Initial Findings From the National Household Food Acquisition and Purchase Survey* (pp. 1–21). Economic Research Service/USDA.

Westerman, D., Spence, P. R., & Van Der Heide, B. (2014). Social Media as Information

Source: Recency of Updates and Credibility of Information. *Journal of Computer-Mediated Communication*, 19(2), 171–183.

Zepeda, L. (2009). Which little piggy goes to market? Characteristics of US farmers' market shoppers. *International Journal of Consumer Studies*, 33, 250–257.

Zepeda, L., & Li, J. (2006). Who Buys Local Food? *Journal of Food Distribution Research*, 37(3).

Zepeda, L., & Nie, C. (2012). What are the odds of being an organic or local food shopper? Multivariate analysis of US food shopper lifestyle segments. *Agriculture Human Values*, 29, 467–480.