6-2016

A Hedonic Analysis of Community Supported Agriculture Share Prices in Midwestern United States

Binod Khanal
University of Nebraska-Lincoln, binod_khanal54@yahoo.com

A Hedonic Analysis of Community Supported Agriculture Share Prices in Midwestern United States

by

Binod Khanal

A THESIS Presented to the Faculty of

The Graduate College at the University of Nebraska-Lincoln

In Partial Fulfillment of Requirements

For the Degree of Master of Science

Major: Agricultural Economics

Under the Supervision of

Professor Azzeddine Azzam

Lincoln, Nebraska

June 13, 2016

A Hedonic Analysis of Community Supported Agriculture Share Prices in Midwestern United States

Binod Khanal, M.S.

University of Nebraska-Lincoln, 2016

Advisor: Professor Azzeddine Azzam

As concerns mount over the consequences of conventional food production for health, the environment, and animal welfare, consumers are increasingly demanding what they perceive as more nutritious, safer, and ethically produced food. Local food in general and community supported agriculture in particular have emerged as promising alternatives that could allay those concerns and, judging by recent growth, the share of local food in total food sales will most likely continue to grow. This represents an opportunity and a challenge for both incumbent farms serving the local food market as well entrants who are looking to capitalize on the growth in demand for local food. Understanding the drivers of that demand is crucial not only for effective private strategies for production, marketing, and entry decisions; but also for public policies for promoting local food.

This thesis sheds light on what drives demand for local food by developing a hedonic model that estimates the consumer valuations of attributes of produce supplied by community supported agriculture farms (CSAs). Data from the LocalHarvest.org website were used to estimate the hedonic model that relates CSA share prices to several attributes of 466 CSAs located in seven Midwestern states: Illinois, Iowa, Kansas, Minnesota, Missouri, Nebraska, and South Dakota.

Findings reveal that the most statistically valued CSA attributes are home delivery commanding a premium of about $18, and belonging to the fifth quintile of CSA membership size ($15.00). Next are increased vegetable variety (between $0.80 and $1.20), and USDA organic certification (worth about $10 but sensitive to model specification). Farming practices, such as integrated pest management, and distance to the nearest metropolitan area were not statistically significant as would have been expected, given the stereotypical attributes of locavores (preference for sustainable production practices and shorter food miles).

An implication for CSA private strategies is for farms is to adopt home-delivery marketing strategy, move up the membership scale, offer more vegetable variety, and to a lesser extent seek USDA organic certification. Such strategies come at a cost, however, and their adoption depends on the costs and benefits (premiums) of investing in those attributes. Moving the membership scale, for example, may or may not be advisable depending on the scale of the farm. It just might be that the size of membership is optimal for the size of the farm in the short-run, but that is an empirical question. Concerning public policy, since home delivery is the attribute with the most sizable premium, a public policy for subsidizing home delivery to low income families (mostly families without vehicles and with low paid jobs) may be one instrument that would by far not only improve the bottom line of CSAs but also provide the families access to fresh vegetables.

ACKNOWLEDGMENTS

I would like to express my deep gratitude to Professor Azzeddine Azzam, my advisor. He provided support and guidance throughout the research process. It was a great learning experience since the time we began discussing the thesis topic almost two year ago. I am indebted to you, Professor.

I am grateful to Drs. Chris Gustafson and Georgia Jones, my other committee members, for their careful editing of the thesis and their inputs along the process. Dr. Gustafson provided many insightful comments and Dr. Georgia Jones provided valuable input related to health and nutrition.

My family members were always there to support and encourage me. I feel blessed to have such a wonderful family. Friends from the Nepalese community were always there for me teaching me how to succeed abroad. Finally, I would like to thank the faculty members, staff, and students in our department who helped me along the way and made me feel welcome.

TABLE OF CONTENTS

TABLE OF CONTENTS iv
LIST OF TABLES v
LIST OF FIGURES v
CHAPTER I: INTRODUCTION 1
1.1. STATEMENT OF THE PROBLEM 1
1.2 OBJECTIVES 4
1.3 METHODOLOGY 4
1.4 ORGANIZATION OF THE STUDY 4
CHAPTER II: LOCAL FOOD AND COMMUNITY SUPPORTED AGRICULTURE (CSA) 5
2.1. LOCAL FOOD 5
2.2. CSA 6
2.3. PUBLIC POLICIES FOR LOCAL AND REGIONAL FOOD SYSTEMS 7
CHAPTER III: REVIEW OF LITERATURE 10
3.1. BENEFITS OF LOCAL FOOD AND CSA 11
3.1.2. Economic Benefits 11
3.1.3 Health, Nutrition and Food Security 11
3.1.4. Environmental Benefits 13
3.2. WILLINGNESS TO PAY FOR LOCAL FOOD AND CSA PRODUCE 14
CHAPTER IV: THE HEDONIC MODEL 17
CHAPTER V: DATA AND DESCRIPTION OF VARIABLES 20
4.1. DATA 20
4.2. DESCRIPTION OF VARIABLES 21
CHAPTER VI: ECONOMETRIC ESTIMATION AND RESULTS 25
CHAPTER VI: SUMMARY AND CONCLUSIONS 29
REFERENCES 32

LIST OF TABLES

Table No.	Name of the table	Page number
1	Number of CSA farms in the US sine 1986	**6**
2	Number of CSA farms and per 100000 population by state – 2015	**21**
3	Variable names and description	**22**
4	Descriptive statistics	**23**
5	Econometric estimation of hedonic regression model	**27**

LIST OF FIGURES

Figure No.	Name of the figure	Page number
1	Location of CSA farms in the study	**20**

CHAPTER I: INTRODUCTION

1.1. STATEMENT OF THE PROBLEM

Agro-industrial food production is increasingly being criticized for using production practices that are blamed for causing serious public health problems, environmental degradation, and unethical treatment of animals (Stagl, 2002; Halden and Schwab, 2008; Napolitano et al., 2008). Human reproductive disorders and various neuro-disorders have been linked to commonly used chemicals, like organophosphate and carbamates; and skin diseases have been associated with exposure to several chemicals and pesticides (Greene, 2006; Frazier, 2007). Usage of genetically modified animals and plants is under increasing scrutiny because of their alleged potential harm to the ecosystem and human health (Altieri, 2000; Horrigan et al., 2002; Dunfield and Germida, 2004; Pimental et al., 2005). Environmental consequences due to conventional agriculture include air, soil, and water pollution and biodiversity degradation.

In response, health cautious consumers are increasingly turning to "safer" alternatives like organic or "naturally grown" food, which is perceived to be more environmentally friendly than conventionally produced food. The share of local (Johnson et al., 2013) and organic food (Batte et al., 2007; Campbell et al., 2010; Campbell *et al.*, 2013) in total food consumption has been growing continuously in the US. In 2012, the sale of local food was $6.1 billion (Low et al., 2015) which was 0.4 percent of total food sales but have grown by about 60 percent since last decade from 1997 to 2007 (Timmons and Wang, 2010), prompting federal, state and local government policy to promote production and consumption of local

food. Likewise, the sale of organic food products is estimated at $35 billion in 2014, compared to $13 billion (in real dollar) in 2005 (USDA, 2014). Fruits and vegetables constitute the highest share of the organic market followed by dairy products. For THE local food market, vegetables, fruits and nuts made 50 percent of the total sales ($6.1 billion) in 2012 (Low et al., 2015).

As local food gained popularity among consumers, it has become a frequent subject of academic research, with more than 60 articles published between 2000 and 2015. The major thrust of most articles is consumers' willingness to pay for local food as compared to conventional food. Findings suggest that that the major drivers of consumers' willingness to pay a premium for local foods include freshness and tastefulness, organic farming, boosting the rural economy and ability to know the farmers (Darby et al., 2006; Martinez et al., 2010; Baily, 2013). The rest of the articles focus on the relationship of local food systems to the environment, food access and nutrition, social aspects of strengthened relationship between agricultural producers and consumers (Low et al., 2015), environmental friendliness of local food, as measured by food miles and less or no synthetic inputs (NRDC, 2007; Thompson et al., 2008); and economic benefits of local food (Mansury and Hara, 2007; Swenson; 2011; Schmit et al. 2013).

From a marketing perspective, there are two categories of local food: food sold through intermediaries and food sold directly to consumers. Community Supported Agriculture (CSA), the subject of this thesis, belongs to the second category. A more recent innovation in local food marketing, CSA is part of a social

movement (Cone and Myrhe, 2000; Stagl, 2002) and an economic movement (Brown and Miller, 2008). A special feature of CSA is shared risk, whereby members contract and pay up front for produce delivery and farmers are expected to provide a share of the produce each week during the contract period. The number of CSA farms (CSAs) has been increasing since they first started in the mid 1980s. As of January 2016, there were 6572 CSAs listed in LocalHarvest.org, a website dedicated to local food (LocalHarvest.org, 2016). Stagl (2002) reported 1000 CSAs in 1999 and Martinez et al. (2010) reported 1144 CSAs in 2005.

Though CSAs are gaining popularity, they are not evenly distributed in all regions of the country. They are concentrated in the west coast and the Northeastern part of the country, and around large cities (Lass et al., 2003; Strochlic and Shelly, 2004). This may explain why most CSA-related research is carried out in those parts of the country (Conner, 2003; Pole and Gray, 2013). The few CSA studies in the Midwest have been confined to Iowa and Minnesota. The number of studies, however, is still relatively small. Since the first study in 1998 (Cooley and Lass, 1998), there have been 6 studies.

Of particular interest to this thesis is the work by Connolly and Klaiber (2014). The work is the first to report on consumers' willingness to pay (WTP) or premiums for specific attributes of CSAs in four Northeastern states. For data, the authors used share prices and attributes of 453 CSAs reported in the LocalHarvest.org website. They found that the attribute that commanded a high premium was USDA organic certification, estimated at 7 percent.

1.2 OBJECTIVES

The objectives of this thesis are twofold: 1) to carry out the same analysis conducted by Connolly and Klaiber (2014) using share prices and attributes of CSAs in Midwestern United States, and 2) To draw some implications for private strategies and public policies related to community supported agriculture in the region.

1.3 METHODOLOGY

A hedonic model is used to estimate consumer valuations of several attributes of CSAs. The data used for estimation cover seven Midwestern states: South Dakota, Minnesota, Nebraska, Kansas, Missouri, Iowa, and Illinois.

1.4 ORGANIZATION OF THE STUDY

The next chapter describes the local food system and CSA in the US. Chapter 3 reviews the pertinent literature on CSAs. Chapter 4 presents the hedonic model; Chapter 5 describes the data, followed by econometric estimation and results in chapter 6. Chapter 7 summarizes and concludes.

CHAPTER II: LOCAL FOOD AND COMMUNITY SUPPORTED AGRICULTURE (CSA)

2.1. LOCAL FOOD

The extent to which local food has become popular can be inferred from the introduction of the word 'locavore" in the New Oxford American Dictionary in 2007. The dictionary defines "locavore" as 'a local resident who tries to eat only food grown or produced within a 100-mile-radius'. In the wider literature, local food has been defined in several ways depending on purpose, geography, and data availability (Martinez et al., 2010). Some believe that localness is determined by distance the food travels before reaching final consumers. Others base localness on local ownership, which can be a state (Jekanowski, et al., 2000) or county or surrounding counties (Selfa and Quazi, 2005; Adams and Adams, 2011). Yet others associate localness with natural, organic, and special foods marketed on a local or regional basis (Low et al., 2015).

Adopting a marketing perspective, Martinez et al. (2010) defined two broad types of local food systems: Direct to Consumers (DTC) marketing, and intermediated marketing. Through DTC, producers sell products directly to consumers. Such producers comprise CSAs, farmers' markets, farm stands and on-farm sales. Through intermediated marketing, produce reaches consumers via some media, like restaurants and retail stores, and institutions like hospitals and schools. Martinez et al. (2010) report a 120 percent increase in DTC sales of local food between 1997 and 2007. CSA has evolved into one of the more popular means through which consumers are participating in local food systems (Brown and Miller, 2008; Hardesty, 2008).

2.2. CSA

Community supported agriculture emerged in Europe back in the 1960s. Japan is also among the first countries to have CSA or '*teikei*', which literally means 'partnership' but allegorically, means 'food with the farmers face on it' (Wells and Gradwell, 2001). According to Tegtmeier and Duffy (2005), Jan VanderTuin brought the concept of CSA to the US from Switzerland in 1984. Since then CSAs have grown from 2 to almost 13,000 in 2012 (Table 1).

Table 1: Number of CSA farms in the US since 1986

Year	Approximate number of CSAs
1986	2
1999	368
2001	761
2005	More than 1700
2007*	12549
2012*	12617

Source: Press and Arnould (2011). *Leffew (2014)

Initially, the idea behind CSA was to establish connections between consumers and farmers in a community (Pole and Gray, 2013; Ernst, 2014). The farms provided local organic products in exchange for a fee and clients' work at the time of harvest (Ernst, 2014). Currently, few CSAs require subscribers to work on the farm at harvest time. Farmers and subscribers are increasingly connected through the web. Members and prospective members are informed through the internet about the produce available

in the coming season and share prices[1], newsletters and even recipes for preparing new dishes using CSA produce. According to Ernst (2014), 85 percent of CSA members rated electronic communication 'very important' or 'important'. Along with websites and newsletters, use of social networking sites like *Facebook* is also gaining popularity among the CSAs.

Unlike CSAs of initial years, today's CSAs produce not only vegetables and fruits but also food of animal origins, flowers, herbs, and processed products like honey, maple syrup and wine. They use tunnel and hoop houses, row covers for the production of vegetables and herbs for stability of production and to maintain availability of the produce to members. Moreover, since freshness of produce is highly valued by members, delivery is a key for the success of CSA operators. Members can pick up their share directly from the farm or pick up centers on the allocated day. Some CSA operators also deliver produce directly to members.

2.3. PUBLIC POLICIES FOR LOCAL AND REGIONAL FOOD SYSTEMS

In recent years, local and regional food systems have garnered support directly and indirectly from state, federal, and local policies. Low et al. (2015) and Martinez et al. (2010) reviewed the state, federal, and local policies that support the local food system- both DTC and intermediately marketed. The Agricultural Act of 2014 includes several policies and provisions for promoting local food systems, which prompted several states to pass legislation for the promotion and expansion of the local food system through a combination of regulations and fiscal incentives. Regulations include provisions of

[1]A share refers to the box of CSA produce that consumers are supposed to receive as per the contract upfront of the season depending on the weather situation during the growing period.

public safety and health, relevant zoning laws, and sales tax and fiscal incentives include allocation of budgets and grants that help to promote the local food.

The Farmers' Market and Local Food Promotion Program provides $30 million per year for 2014-18. The funds are targeted to promote DTC and intermediated marketing channels (USDA ERS, 2014). The Specialty Crop Block Grants also include funding for projects related to locally and regionally marketed food like farm-to-school programs. The Value Added Producer Grant has increased the annual mandatory funding from $15 million to $63 million for 2014-18. Local food producers also benefit from programs not directly intended for them, like Rural Business Development Grants. The Farm Storage Facility Loan program has also been helpful to establish cold storage, sorting bins, washing stations and other food safety related equipment (USDA FSA, 2014). Fresh fruits and vegetables from DTC and other local food are highly prioritized for the Supplemental Nutrition Assistantship Program participants through the Food Insecurity Nutrition Incentive Grant program. The Healthy-Hunger Free Kids Act of 2010 created Farm to School Program within USDA to increase access to local foods by schools. School districts are encouraged to source locally produced food for school meals by providing funds for this plan. North Dakota, South Dakota, Nebraska, Missouri, Minnesota, Iowa, Wisconsin and Illinois are the Midwest states that comprise the School Nutrition Association (Martinez et al, 2010). The Know Your Farmer Know Your Food program strengthens USDA's support to local and regional food systems through an initiative.

There are several state and sub-state local food policies and programs like State Support for Increased Access to Local Food, State Legislation on Farmers' Markets,

State Support for Local Food Infrastructure, Urban Agriculture and Community Gardens, etc. These programs and policies help to promote local and regional food and local food institutions and infrastructure in one way or the other (Martinez et al., 2010).

CHAPTER III: REVIEW OF LITERATURE

Until recently, most of the literature on CSA and other local foods was descriptive, documenting the characteristics of CSAs, their operators, and the types of produce supplied to members. Lass et al. (2003) and Tegtmeier and Duffy (2004) surveyed CSA operations countrywide and several Midwestern states respectively and presented descriptive analyses of CSA members, farming characteristics and product attributes. CSA farmers were younger than average US farmers, and more likely to be college graduates. Likewise, 53 percent of CSA farmers were female (Tegtmeier and Duffy, 2004), compared to 57 percent of CSA farmers reported by Lass et al (2003). In Tegtmeier and Duffy's (2004) survey, 98 percent of CSA farms produced organic product. In Lass et al.'s (2003), more than 80 percent produced organic products and half of those farmers produced certified organic. Woods et al. (2009) reported 66 percent of CSA farms were organic, of which 16 percent were certified organic. According to Connolly and Klaiber (2014), 26 percent of CSA farms in the Northeastern states were certified naturally grown and 14 percent were certified organic.

Memberships per CSA farm in the Midwest ranged from 34 (Tegtmeier and Duffy, 2004) to 50.5 (Lass et al., 2003). The price of a full share per season in the Midwest was $ 412 compared to $520 in the Northeast (Connolly and Klaiber, 2014). On average, farms provided 30 types of vegetables and 3 types of fruits (Lass et al., 2003). The major methods of distribution were picking up from drop sites, on farm pick up and home delivery. Other products provided by CSAs included honey, processed bakery products, grain flour, medicinal herbs and animal and dairy products.

3.1. BENEFITS OF LOCAL FOOD AND CSA

Dunning (2013) surveyed the literature on benefits of local food and classified them into economic benefits (to consumers and producers), environmental benefits, and health benefits. Other literature focuses on various social benefits, like social belonging, for example (Press and Arnould, 2011; Pole and Gray, 2013; Galt, 2013; Zepeda et al., 2013; Ravenscroft et al., 2013; Castellano, 2015; Lagane, 2015). The next subsection focuses on the economic benefits of local food related to health, nutrition, food security, and the environment.

3.1.2. Economic Benefits

There are several studies exploring the economic benefits of local versus conventional food systems (Stewart, 2006; King et al., 2010). Cooley and Lass (1998) reported that the benefits to consumers from CSA ranged from 60-150 percent of the CSA share price compared to retail prices for organic produce. In an Iowa CSA study, Bregendahl (2006) highlighted the catalytic role of the local food system in terms of spurring innovation, networking, and expansion of local food business. Revenues per acre were found to be higher among CSAs than among their conventional counterparts (Lass et al., 2003; LeRoux et al., 2010). The difference is attributed to the CSA marketing approach.

3.1.3 Health, Nutrition and Food Security

It is widely accepted that as part of a balanced diet fruits and vegetables are a rich source of vitamins and minerals, maintaining health and helping fight chronic

disease. Several studies correlated the lack of vegetables and fruits in regular diets to high prevalence of obesity and several chronic diseases like cancer (Van Duyn and Pivonka, 2000; AICR, 2007; Tetens and Alinia, 2009; Leone et al., 2012). Interestingly, an increase in the number of CSAs was found to be negatively correlated with obesity rates, suggesting that availability of healthy and nutritious food may decrease obesity (Ilunga and Saghaian, 2015). Specifically, an increase of one CSA per 1000 population within a county was associated with a 0.34 percent decrease in the obesity rate. There is a huge potential of local food in increasing the availability of and subsequent consumption of fruit and vegetable (Larson et al., 2009).

The freshness of fruits and vegetables from CSAs is one of the reasons why nutrient content of these products may be better than regular products which travel miles and take more time to reach consumers (Serafini et al., 2002; Vallejo, 2003). There is also evidence that easy access to healthy and fresh products promotes healthier dietary choices (Morland et al., 2002; Moore et al, 2008). An additional benefit of a local food system like CSA is that it enhances food security at the community level through various government programs that promote ties between consumers and local food producers (Kantor, 2001; Thilmany and Watson, 2004).

Another important contribution of CSA is variety, which the American Dietary Guidelines recommend for better health (USDA and USDHSS, 1995). Oberholtzer (2004) reported an increase of 76 percent in the variety and 58 percent in the amount of produce consumed after membership of CSA. There was also significant change in the dietary habits of CSA members in a study conducted in New York (Cohen *et al.*, 2012). Perez *et al.* (2003) and Landis *et al.* (2010) found that CSA participants were more

likely to eat more fruits and vegetables and cook creatively as well. Variety was also found to be instrumental in membership retention.

3.1.4. Environmental Benefits

Among the several movements tied to the local food movement is the environmental movement, which sees local food as a means of reducing Green House Gas (GHG) emissions (Guptil and Wilkins, 2002). It is believed that emissions can be reduced by producing food traditionally, using less input in transportation, production and preparation (Gaytan, 2003). In that vein, the term "local food" is often used synonymously with sustainable agriculture, using less chemical synthetics and fertilizers in crop, vegetable, and fruit production.

Food miles are often used as a gauge for measuring the effect of local food on the environment. The idea is that the shorter the distance between producers and consumers the better. There is evidence for (Pirog et al., 2001; Saunders and Hayes, 2007) and against (Weber and Matthews, 2008; Schnell, 2013) the reliability of food miles as a measure of environmental friendliness of local food. Canning *et al.* (2010) reported that processing, packaging, and selling food requires ten times more energy than the energy consumed in transporting food. Hence, since local food requires less processing and packaging, the energy consumed for these purposes are much lower than for conventional food. Likewise, in the case of CSAs, as they use less synthetic chemicals and fertilizers, there is a huge reduction in the use of energy.

3.2. WILLINGNESS TO PAY FOR LOCAL FOOD AND CSA PRODUCE

In their survey of the literature on WTP for local food in general, Adams and Salois (2010) found that before the 1990s WTP for local food was weak, even negative. After the 1990s, WTP for local food witnessed a significant positive change.

Most of the findings from WTP studies of local food in general and CSA products in particular reported similar results. Govindasamy et al. (2002) found in New Jersey that freshness, convenience, and price were factors that determined the purchase of local food by market patrons. According to a 2003 national survey, interest of consumers in healthy, safe and fresh foods increased the chance of buying CSA produce and local food (Zepeda and Li, 2006). Goland (2002) surveyed CSA shareholders in Ohio and found that desire for fresh produce (96 percent of respondents), organic produce (77 percent) and locally grown produce (65 percent) were important reasons for joining CSAs. O'hara and Stagl (2002) and Pole and Gray (2012) found that freshness and organic nature ranked the highest for motivating people to join CSA in New York. Similar results were reported in California (Perez et al., 2003) and the United Kingdom (Cox et al., 2008). CSA farmers themselves reported that consumers rated high-quality, fresh and healthy food the highest followed by getting to know the farmers, guarantee of food safety, opportunity to take part in the food system, and inexpensive, organically produced food (Tegtmeier and Duffy, 2004).

Support for the local economy and environmental sustainability are also important to CSA members (Zepeda and Leviten-Reid, 2004; Zepeda and Nie, 2012). Goland (2002) found the desire of CSA shareholders to support small and local farmers and general concerns about the environment as one of the important reasons for buying

CSA produce. Lang (2008) found that satisfied members of CSA were those who support alternative agriculture and environmental attributes. Landis et al. (2010) also found that consumers in North Carolina valued supporting local (95% of respondents) farms as the most important motivation factor behind joining CSA operations.

Healthier and improved nutrition (80% of respondents) and organic or decreased exposure to pesticides (73%) were the main motivating factors after supporting local farm to join CSA in North Carolina (Landis et al., 2010). Few studies show an association between concern for food safety and preference for local food, but Low et al. (2015) argued that concern about the food source by most consumers was a strong indicator of consumers' awareness of food safety. Consumers of local food are quite concerned about the presence of synthetic chemicals in the food (Crandall et al., 2011) and for these consumers CSA is one of the best options because a large proportion of CSA farms claimed to be organic and naturally grown (Tegtmeier and Duffy, 2004 and Lass et al., 2003).

Several studies suggested distance to the local food outlet is very important for consumers to buy local food (Holmes and Yan, 2012; McGuirt et al., 2014). Connolly and Klaiber (2014) showed that an increase of one mile from the metro area leads to a significant decrease in the price per share of the CSA product. Goland (2002) also found that among CSA members in Ohio, 50 percent indicated that convenience of the CSA farm picking point is an important factor in choosing CSA products. Research by University of Maryland suggested that convenience of the drop-sites and time of delivery were very important factors for the retention rate of the shareholder (UMD, 2010). For Indiana, Burnett et al. (2011) report that the shorter the distance the higher

the price premium, indicating higher marginal implicit price for products produced within a county than within a state, though the difference is not significant. The study by Pole and Kumar (2015) in New York also considered the distance travelled by the food showing environmental concern.

Consumers are also attracted by the organic growing of CSA products (Kolondisky and Pelch, 1995). Connolly and Klaiber (2014) reported that consumers were willing to pay for organic attributes even if the food was already local. There are several studies reported consumers' willingness to pay a premium for various organic products like fruits, vegetables and animal products (Thompson and Kidwell, 1998; Corsi and Novelli, 2002). In Vermont, Kolodinsky and Pelch (1997) found perception of organic food was a key determinant of CSA membership.

CSA membership was reported to be highly correlated with higher education, preference for organic products, and social and political awareness (Zepeda and Leviten-Reid, 2004; Pole and Kumar). The CSA survey results by Landis et al. (2010) in North Carolina also showed that CSA members are more likely to be married (84 percent of respondents), highly educated (98 percent had bachelors, 37 percent had master's and 23 percent had doctoral degree) and the majority (about 70 percent) were high income (more than $60,000 annually) families. Connolly and Klaiber (2014) reported a positive and significant WTP for number of weeks of operation, work on farm, organic product, distance to city, and availability of products other than vegetables.

CHAPTER IV: THE HEDONIC MODEL

The basic idea behind the hedonic model, pioneered by Lancaster (1966), is that a good is a bundle of various attributes and, as such, consumers derive utility from all of the attributes. Rosen (1974) defined hedonic prices as implicit prices of the attributes constituting the product. Hedonic analysis of prices has been applied to a variety of products, including wine (Steiner, 2004; Schamel, 2006), eggs (Karipidis et al., 2005; Satimanon and Weatherspoon, 2010; Kim and Chung, 2011), frozen fish (Kristofersson and Rickertsen 2007; Roheim et al., 2011), organic products (Lin et al., 2008; Smith et al., 2009) and vegetables (Connolly and Klaiber, 2014; Xu et al., 2015). Hedonic price analysis has also been applied to non-food like housing (Hill, 2013; Hoen et al., 2014; Liu and Jakus, 2015; Baltagi et al., 2015), land (Kling et al., 2015), automobiles (Grilichis, Z, 1961; Matas and Raymond, 2009), and computers (Bajari and Benkard, 2005).

4.1. Theoretical Model

The underpinnings of the theory underlying the hedonic model used in this thesis were constructed by Feenstra (1995) and adapted by Connolly and Klaiber (2014) to study share prices of CSAs in the Northeastern states of the US, such that CSA share price is determined by the intersection of consumer demand for and CSA supply of the characteristics associated with CSA farms and, hence, their produce. The advantage of the model is that the share price depends mainly on the attributes of each CSA farm, attributes that are readily available on the LocalHarvest.org website.

Formally, on the demand side, the utility of a representative consumer derives from having a share in the i^{th} CSA is represented by the indirect utility function:

$$V_i = \ln \Phi_0 (m) + \ln \Phi_i (p_i, \boldsymbol{z_i}) + \epsilon_i \quad (1)$$

where m is income, $\Phi_i (p_i, \boldsymbol{z_i}) = q_i$ is the quality-adjusted price of the bundle, p_i is the share price charged by the i^{th} CSA, $\boldsymbol{z_i}$ is a vector of CSA characteristics, and ε_i captures other non-observable factors affecting utility.

Inverting $\Phi_i (p_i, \boldsymbol{z_i}) = q_i$ yields $p_i = \pi_i (q_i,)$ such that the marginal value of the attribute $\boldsymbol{z_i}$ is given by:

$$\frac{\partial pi}{\partial \boldsymbol{z_i}} = \frac{\partial \pi i(qi, \boldsymbol{z_i})}{\partial \boldsymbol{z_i}} \quad (2)$$

The marginal value indicates the increase in the share price p_i that a consumer would be willing to pay for an increase in characteristic $\boldsymbol{z_i}$, keeping the quality adjusted price q_i and utility constant.

By Roy's identity, the share purchased by a CSA subscriber is given by:

$$xi = -\left(\frac{\frac{\partial Vi}{\partial pi}}{\frac{\partial Vi}{\partial m}} \right) \quad (3)$$

On the supply side, a CSA attempts to maximize profits per share p_i and attributes $\boldsymbol{z_i}$:

$$\max xi, \boldsymbol{z_i} \, [pi.xi - xi.ci(\boldsymbol{w}, \boldsymbol{z_i})] \quad (4)$$

where $ci(w, z_i)$ is the unit cost of producing x_i given the vector input prices $\boldsymbol{w}$. In equilibrium, the share price is equal to the marginal cost of supplying produce for a share:

$$pi = ci(\boldsymbol{w}, \boldsymbol{z_i}) \quad (5)$$

Summing (5) across shares and dividing by the number of subscribers M, yields

$$p = c(\boldsymbol{w}, \boldsymbol{z}) \tag{6}$$

where

$$p = \sum pi/M$$

and

$$c(\boldsymbol{w}, \boldsymbol{z_i}) = \sum \frac{ci(\boldsymbol{w}, \boldsymbol{z_i})}{M}$$

Differentiation of p in (6) with respect to $\boldsymbol{z}$ yields

$$\frac{\partial p}{\partial \boldsymbol{z}} = \frac{\partial c(\boldsymbol{w}, \boldsymbol{z})}{\partial \boldsymbol{z}} \tag{7}$$

Assuming unit cost function takes the linear form

$$c(\boldsymbol{w}, \boldsymbol{z}) = \alpha + \boldsymbol{\beta z} + \boldsymbol{\gamma w},$$

where $\boldsymbol{\beta}$ and $\boldsymbol{\gamma}$ are vectors of coefficient. Substitution of the unit cost function into (6) yields the hedonic equation for a CSA farm share price

$$p = \alpha + \boldsymbol{\beta z} + \boldsymbol{\gamma w}, \tag{8}$$

such that

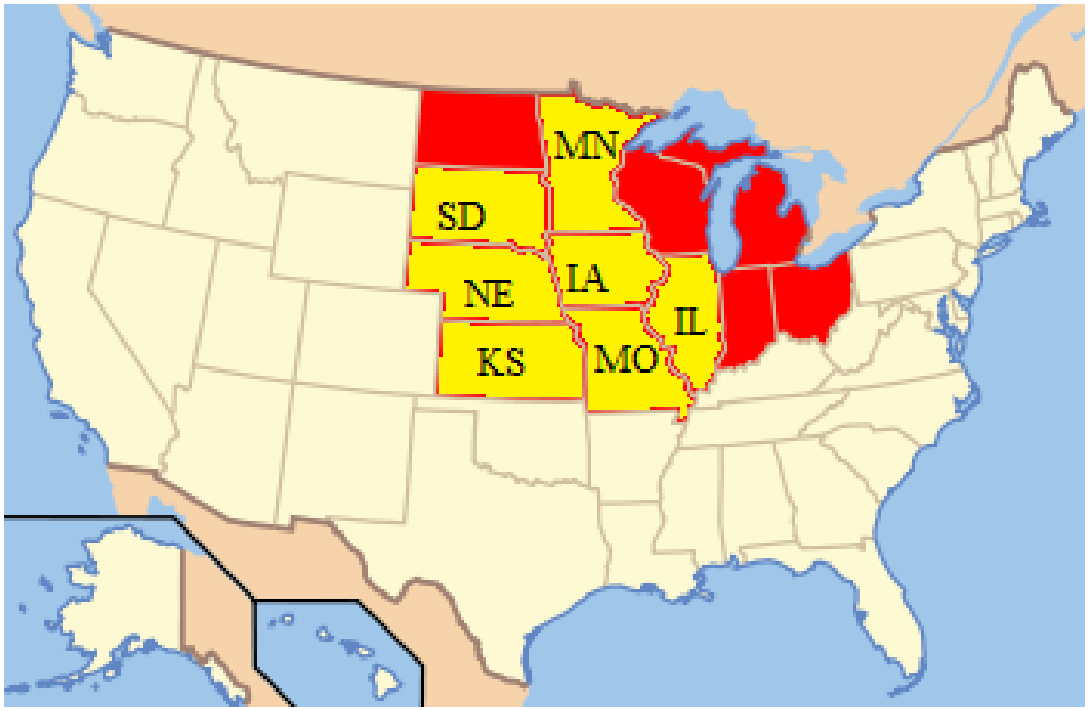
$$\frac{\partial p}{\partial z} = \boldsymbol{\beta}$$

where $\boldsymbol{\beta}$ is the vector of shadow prices of the characteristics, **z**, where the shadow prices are equal to the marginal cost of supplying the CSA characteristics. As such, the observed CSA share price is a combination of the shadow prices of the CSA attributes, and the shadow prices are equal to the consumer's marginal valuations of the characteristic **z** as shown in equation (2). The next chapter discusses the data used to estimate equation (8). The chapter after that presents the econometric results.

CHAPTER V: DATA AND DESCRIPTI OF VARIABLES

4.1. DATA

Data for CSA operations were collected for seven states in the US Midwest (Figure 1) from July to December 2015. The states are Minnesota (MN), South Dakota (SD), Nebraska (NE), Iowa (IA), Kansas (KS), and Missouri (MO). The primary source of data was the LocalHarvest.org website where CSA farmers provide and update information on their operations, products, and farm attributes. Data on distance to the closest metropolitan area from the farm location were obtained from Google map.



Map source: https://en.wikipedia.org/wiki/Midwestern_United_States

Figure 1: Location of states in the study (in yellow) within the Midwest (red and yellow) region of the United States.

Table 2 gives the total number of CSA operations by state.

Table 2: Number of CSA farms and per 100000 population by state - 2015

ID	State	No. of CSAs	No. of CSAs per 100000 population*
1	Nebraska	29	1.53
2	South Dakota	24	2.80
3	Kansas	61	2.88
4	Iowa	112	3.58
5	Minnesota	188	3.42
6	Illinois	183	1.42
7	Missouri	125	2.05
	Total	722	2.23

Source: www.localharvest.org for number of CSA farms *2015, July from US Census Bureau.

Of the 722 farms, 151 were discarded because they did not report share prices, 24 farms were not considered because they did not engage in direct marketing, and 81 were dropped because they had one or more missing attributes. The final sample consists of 466 observations.

4.2. DESCRIPTION OF VARIABLES

Table 3 lists the variables followed by a brief description. With the exception of distance from miles from the city (DISTCITY), which was constructed from Google Map all variables were obtained from the LocalHarvest.org website. Table 4 presents descriptive statistics.

Table 3: Variable names and descriptions

SN	Variable name	Description
1	PRICE	Monthly share price
2	NE	Nebraska dummy variable (DV=1 for the presence of a variable and zero otherwise)
3	SD	South Dakota (DV)
4	KS	Kansas (DV)
5	IA	Iowa (DV)
6	MN	Minnesota (DV)
7	IL	Illinois (DV)
8	MO	Missouri (DV)
9	MONTHS	Months of operation
10	AGE	Age of the farm in years (in year 2015)
11	TYPE*[2]	Single and multiple farms
12	IPM	Integrated Pest Management(DV)
13	CERTORG	USDA Certified Organic dummy (DV)
14	CNG	Certified Natural Grown(DV)
15	SHARES	Number of shares
16	WORKREQ	Work requirement (DV)
17	VEG	Vegetable (DV)
18	NUMVEG	Number of vegetables produced
19	MEAT	Meat (DV)
20	BREADPRO	Bread and processed food(DV)
21	FRUITS	Fruits (DV)
22	FLOWERHERB	Flowers or herb or both (DV)
23	TOTALVAR	Total number products produced
24	DAIRY/EGGS	Egg and dairy (DV)
25	WEEK	Number of days in a week shares are delivered
26	HOMEDLVR	Home delivery (DV)
27	DISTCITY	Distance from nearest metropolitan city
28	SUMMONTH	Active summer months

*TYPE is designated as single if all the activities and carried out by a single family with hired labor, and designated as multiple if many CSA farms operate under one name.

[2] Certified Naturally Grown (CNG) offers peer-review certification to farmers producing food for their local communities by working in harmony with nature, without relying on synthetic chemicals or GMOs. CNG does not come under USDA organic certification program.

Table 4: Descriptive statistics

Variable	Mean	SD	Min	Max
PRICE ($)	107.79	32.61	8.33	250
NE	0.05	0.21	0	1
SD	0.04	0.19	0	1
KS	0.06	0.24	0	1
IA	0.15	0.36	0	1
MN	0.28	0.45	0	1
IL	0.27	0.44	0	1
MO	0.15	0.37	0	1
AGE (years)	7.30	6.21	0	40
SINGLE (1/0)	0.92	0.27	0	1
IPM(1/0)	0.25	0.43	0	1
CERTORG (1/0)	0.16	0.36	0	1
CNG (1/0)	0.11	0.31	0	1
SHARES (number)	78.31	155.74	1	2300
WORKREQ (1/0)	0.05	0.21	0	1
VEG	0.93	0.26	0	1
NUMVEG	21.57	9.73	0	46
MEAT (1/0)	0.37	0.48	0	1
BREADPRO (1/0)	0.35	0.48	0	1
FRUITS (1/0)	0.70	0.46	0	1
FLOWERHERB	0.82	0.39	0	1
TOTALVAR	4.07	1.65	1	8
DAIRY/EGGS (1/0)	0.51	0.52	0	1
WEEK	1.76	1.29	.25	7

HOMEDLV (1/0)	0.17	0.37	0	1
DISTCITY (miles)	49.63	37.00	1	232
SUMMONTH	4.80	1.44	1	12

Source: Calculated by the author

The proportions of CSA farms from each state in the sample are as follows: Nebraska, 5 percent; South Dakota, 4 percent; Kansas, 6 percent; Iowa, 15 percent; Minnesota, 28 percent; Illinois, 27 percent; and Missouri, 15 percent. The average age of CSA operations was 7.3 years in 2015 and the average distance from a metropolitan area was 50 miles with a range of 1 mile (located in the city) to 232 miles. About 17 percent of CSAs made direct home delivery and the rest had either a common pickup point or pick up at the farm on designated days. On average, farms were active for 4.8 months a year, charged $ 107.79 per share per month, and had 78.31 members with a range from 1 to 2300 members.

With respect to farming practices, 16 percent of the farms produced certified organic products, 11 percent certified naturally grown products, and 25 percent used Integrated Pest Management. Deliveries to members were made over 1.76 days a week on average.

CHAPTER VI: ECONOMETRIC ESTIMATION AND RESULTS

The hedonic model represented by equation (6) in chapter 4 calls for regressing share prices on farm characteristics and input prices. As input prices are not reported in the LocalHarvest.org website, dummy variables associated with the states where the farms are located are assumed to capture the variation in input prices. This allows re-writing the hedonic model as

$$p_j = \alpha + \boldsymbol{\beta_j z_j} + \boldsymbol{\gamma_j x_j} + \epsilon_j \qquad (8')$$

where *j* indexes farms, α is the intercept, $\boldsymbol{\beta}$ and $\boldsymbol{\gamma}$ are coefficient vectors, $\mathbf{z}$ is a vector of farm characteristics, and $\mathbf{x}$ of variables other than farm characteristics, including the state dummy variables. In addition, the variable SHARES was classified into quintiles because the number of subscribers, covering a wide range (1 to 2300); is not normally distributed. The first quintile was used as the reference indicator in estimation. The remaining 4 quintiles are labeled 2SHARE, 3SHARE, 4SHARE, and 5SHARE, respectively.

Three versions of model (8') were estimated. Model 1 follows Connolly and Kaliber (2014) and uses is a semi-log specification (has the log of the share price as the dependent variable). Model 2 and 3 are linear regression models with share prices untransformed. Model 3 considers the separate effects of each product supplied by each farm rather than simply the effect of the total number of products supplied as in Model 1 and 2. Parameter estimates are in table 4. Heteroskedasticity was present and corrected for in all three models. The standard errors reported are heteroskedastic robust standard errors. A check for multicollinearity using the variance inflation factor indicated no multicollinearity in all three models. In each model, the reference state is Nebraska. the conventional cut-off level of significance used was 0.05.

Table 5: Parameter estimates of the hedonic model

Variables	Model 1 Y=lnPrice	Model 2 Y=Price	Model 3 Y=Price
SD	0.189**	19.51**	20.86**
	(0.089)	(8.57)	(8.39)
KS	.035	2.78	2.46
	(0.113)	(7.89)	(7.85)
IA	0.112*	8.28	8.61
	(0 .067)	(5.93)	(5.91)
MN	.210***	21.28***	21.43***
	(0.067)	(5.82)	(5.77)
IL	0.100	12.60**	12.66**
	(0.070)	(6.04)	(5.95)
MO	0.185**	20.41***	20.31***
	(0.077)	(6.82)	(6.89)
CERTORG	0.087**	7.72*	7.90*
	(0.040)	(4.01)	(4.05)
CNG	0.086*	6.88	7.19
	(0.046)	(4.56)	(4.62)
SINGLE	-0.022	-1.58	-1.57
	(0.048)	(4.67)	(4.82)
IPM	0.015	-0.48	-0.777
	(0.031)	(3.00)	(2.99)
AGE	-0.003	-0.166	-0.19
	(0.003)	(0.215)	(0.21)
MEAT			-0.089
			(3.46)
PROBREAD			2.18
			(3.32)
FRUIT			0.96
			(3.13)
FLOWERHERB			7.52*
			(4.33)
DAIRY/EGGS			2.20
			(2.95)
WORKREQ	-0.015	-4.96	-4.89
	(0.070)	(6.26)	(6.16)
TOTALVAR	0.019*	1.43	
	(0.010)	(0.89)	
NUMVEG	0.011***	0.858***	0.79***
	(.002)	(0.183)	(0.19)
WEEK	-0.011	0.444	0.52
	(0.02)	(1.33)	(1.32)
HOMEDLV	0.168***	18.26***	17.84***
	(0.038)	(4.32)	(4.34)
DISTCITY	-0.0003	-0.040	-0.036
	(0.0004)	(0.037)	(0.036)
2SHARE	0.087*	6.58	6.10
	(0.048)	(4.00)	(4.13)
3SHARE	0.091*	6.40	6.19
	(0.047)	(3.89)	(3.89)
4SHARE	0.143***	15.16***	14.91***
	(0.054)	(4.54)	(4.55)
CONSTANT	4.35***	85.50***	83.27***
	(0.103)	(9.28)	(9.44)
R-squared	0.234	.247	0.253
F-stat	6.12	6.77	5.90

*, ** and *** indicate significance level at 10 percent, 5 percent and 1 percent respectively. Figures in parentheses are heteroskedastic robust standard errors.

In model 1, the states with statistically significant dummy variables are Nebraska (captured by the constant), Minnesota, and Missouri, with the latter two having higher share prices than Nebraska. USDA Certified Organic (CERTORG) is also statistically significant confirming, as in Connolly and Klaiber (2014), that USDA Certified Organic commands a premium, in this case about $9.46 (0.089*108.79), which is higher than the $7 premium reported by the authors for the Northeastern states. The variables 4SHARE, NUMVEG, and HOMEDLV are all statistically significant at the 1 percent level, showing an implicit shadow price of $15.56 of for farms in the fifth quintile, $1.20 for increased vegetable variety, and $18.28 when the produce is home-delivered.

Model 2 has the untransformed share price as the dependent variable. Results are similar to those of Model 1 except that CERTORG is statistically significant at the 10 percent, not the 5 percent level. HOMEDLV still commands the highest premium ($18.26), followed by 4SHARE ($15.16); NUMVEG ($0.89). Share prices in Minnesota, Missouri, South Dakota, and Illinois were $21.28, $20.41, $19.51, and $12.60 on average higher than per month share prices in Nebraska.

In Model 3, food varieties were broken down into various components like egg and dairy, processed food, herbs and flowers and fruits. Again, home delivery had the highest implicit price, followed by the fifth quintile of CSA membership, and more vegetable variety.

In sum, the most consistently statistically valued attributes across the three models are home delivery (worth about $18), the fifth quintile of CSA membership (about $15), and more vegetable variety (between $0.80 and $1.20). USDA organic certification was statistically significant at the 5 percent level in Model 1 but only at the

10 percent level in Models 2 and 3 (worth about $10 using Model 1 results). Concerning the premium associated with home delivery, this means share prices on CSA farms with a pick-your-own marketing strategy would be $18 lower. The statistical insignificance of IPM and DISCITY is noteworthy.

With respect to IPM, on interpretation is that CSA members are either not willing to pay for "sustainable" farm practices and/or are willing to pay but are not informed about such practices. With respect to DISCITY, lack of association with share prices could possibly be an indication that CSA members are not willing to pay a premium to shorter food miles, which are often used to evaluate the environmental friendliness of food. To get a definitive answer on marginal implicit shadow price for shorter food miles, however, one needs data on distances between the location of CSAs and their respective members, not simply data on the distance between CSAs and the nearest metropolitan area. The former data are not readily available.

CHAPTER VI: SUMMARY AND CONCLUSIONS

As concerns mount over the consequences of conventional food production for health, the environment, and animal welfare, consumers are increasingly demanding what they perceive as more nutritious, safer, and ethically produced food. Local food in general and community supported agriculture in particular have emerged as promising alternatives that could allay those concerns and, judging by recent growth, the share of local food in total food sales will most likely continue to grow in the future. This represents an opportunity and a challenge for both existing farms serving the local food market as well potential entrants who are looking to capitalize on the growth in demand for local food. Understanding the drivers of that demand is crucial not only for effective private strategies for production, marketing, and entry decisions; but also for public policies for promoting local food.

This thesis sheds light on what drives demand for local food by estimating consumers' valuations of attributes of produce supplied by community supported agriculture farms (CSAs). Data from the LocalHarvest.org website were used to estimate three versions of a hedonic model that relates CSA share prices to several attributes of 466 CSA farms from seven Midwestern states: Illinois, Iowa, Kansas, Minnesota, Missouri, Nebraska, and South Dakota. The attributes include organic certification, farming practices, membership work requirement, produce delivery options, age of the farm operation, single or multiple-farm contracts, farming practices, size of membership, vegetable variety, product variety, and distance from the nearest metropolitan area.

Finding reveals the following:

- After adjusting for farm attributes, CSA share prices in Minnesota, Missouri, South Dakota, and Illinois were respectively about $21, $20, $19, and $12 higher per month share prices in Nebraska.
- The most statistically valued CSA attributes are home delivery commanding a premium of about $18 and belonging to the fifth quintile of CSA membership size ($15.00). Next are vegetable variety (between $0.80 and $1.20), and USDA organic certification (worth about $10, but not robust across all models).
- Farming practices, such as integrated pest management, and distance to the nearest metropolitan area were not statistically significant as would have been expected, given the stereotypical attributes of locavores (preference for sustainable production practices and shorter food miles).

With respect to integrated pest management, its lack of significance could be an indication of unwillingness to pay for sustainable production practices. Alternatively, CSA members could just as well not be well informed about the environmental significance of the practice. With respect to distance, lack of association with share prices could also be taken as an indication that CSA members are not willing to pay a premium to shorter food miles, but that is not definitive. To get a more definitive answer, one needs data on distances between the location of CSA farms and their respective members, not simply on the distance between CSAs farms and the nearest metropolitan area. Only data on the latter is readily available.

An implication for CSA private strategies is for farms is to pursue a home-delivery marketing strategy, move up the membership scale, offer more vegetable

variety, and to a lesser extent seek USDA organic certification. Such strategies come at a cost, however, and their adoption depends on the costs and benefits (premiums) of investing in those attributes. Moving the membership scale, for example, may or may not be advisable depending on the scale of the farm. It just might be that the size of membership is optimal for the size of the farm in the short-run, but that is an empirical question worth addressing in future research. Concerning public policy, since home delivery is the attribute with the most sizable premium, a public policy for subsidizing home delivery to low income families (mostly families without vehicles and with low paid jobs) may be one instrument that would by far not only improve the bottom line of CSAs but also provide the families access to fresh vegetables.

REFERENCES

Adams, D. C. and Adams, A. E. (2011). De-placing local at the farmers' market: consumer conceptions of local foods. *Journal of Rural Social Sciences*, 26, 74-100.

Adams, D. C. and Salois, M. J. (2010). Local versus organic: a turn in consumer preference and willingness-to-pay. *Renewable Agriculture and Food Systems*, 25, 331-341.

AICR (2007). Food, nutrition, physical activity, and the prevention of cancer: a global perspective. *American Institute for Cancer Research*.

Altieri, M. A. (2000). The ecological impacts of transgenic crops on agro ecosystem health. *Ecosystem Health*, 6, 13-23.

Bailey, J. M. (2013). Regional food systems in Nebraska: the views of consumers, producers and institutions. Center for Rural Affairs. Accessed online from http://files.cfra.org/pdf/ne-food-systems-report.pdf on 7th June, 2015.

Bajari, P., Benkard, C. L., (2005). Demand estimation with heterogeneous consumers and unobserved product characteristics: A hedonic approach. *Journal of Political Economy*, 113, 1239–1276.

Baltagi, B. H., Bresson, G. and Etienne, J. M. (2015). Hedonic housing prices in prices: an unbalanced spatial lag pseudo-panel model with nested random effects. *Journal of Applied Econometrics*, 30, 509-528.

Batte, M. T., Hooker, N. H., Haab, T. C. and Beaverson, J. (2007). Putting their money where their mouths are: Consumer willingness to pay for multi-ingredient, processed organic food products. *Food Policy*, 32, 145–49.

Bregendahl, C. (2006). The role of collaborative community supported agriculture: Lessons from Iowa, Ames. North central regional center for rural development, accessed online from http://www.soc.iastate.edu/extension/ncrcrd/CSAReport-2006-LessonsFromIowa.pdf on 10th March, 2016.

Brown, C. and Miller, S. (2008). The impacts of local markets: a review of research on farmers markets and community supported agriculture. *American Journal of Agricultural Economics,* 90, 1298-1302.

Burnett, P., Kuethe, T. H. and Price, C. (2011). Consumer preference for locally grown produce: an analysis of willingness-to-pay and geographic scale. *Journal of Agriculture, Food Systems, and Community Development*. Accessed online from http://pubag.nal.usda.gov/pubag/downloadPDF.xhtml?id=53969&content=PDF on 14th March, 2016.

Campbell, B. L., Lesschaeve, I., Bowen,A. J., Onufrey,S. R. and Moskowitz,H. (2010). Purchase drivers of Canadian consumers of local and organic produce. *Horticultural Science,* 45, 1480–1488.

Campbell, B. L., Mhlanga, S. and Lesschaeve, I. (2013). Perception versus reality: Canadian consumer views of local and organic. *Canadian Journal of Agricultural Economics*, 6, 531-558.

Canning, P., Charles, A., Huang, S., Polenske, K. R., and Waters, A. (2010). Energy use in the US food system, US department of agriculture, economic research service.

Castellano, R. L. S. (2015). Alternative food networks and food provisioning as a gender act. *Agriculture and Human Values*, 32, 461-472.

Cohen J. N., Gearhart, S. and Garland, E. (2012). Community supported agriculture: a commitment to a healthier diet. *Journal of Hunger and Environmental Nutrition*, 7, 20-37.

Cone, C. A. and Myhre, A. (2000). Community supported agriculture: a sustainable alternative to industrial agriculture? *Human Organization*, 59(2), 187-197.

Conner, D. S. (2003). Community supported agriculture pricing and promotion strategies: lessons from two Ithaca, NY area farms. Department of applied economics and management, Cornell University, Ithaca.

Connolly, C. and Klaiber, H. A. (2014). Does organic command a premium when the food is already local? *American Journal of Agricultural Economics*, 96, 1102-1116.

Cooley, J. P. and Lass, D. A. (1998). Consumer benefits from community supported agriculture membership. *Review of Agricultural Economics*, 20, 227-237.

Corsi, A. and Novelli, S. (2002). Consumers' willingness to pay price for organic beef meat. Accessed online from

http://ageconsearch.umn.edu/bitstream/24923/1/cp02co26.pdf on 15th February, 2016.

Cox, R., Holloway, L., Venn, L., Dowler, L., Hein, J. R., Kneafsey, M. and Tuomainen, H. (2008). Community ground? Motivations for participation in a community-supported agriculture scheme. *Local Environment*, 13(3), 203-218.

Crandall, P. G., Friedly, E. C., Patton, M., O'Bryan, C., Gurubaramurugeshan, A., Seideman, S., Picke, S. C. and Rainey, R. (2011). Consumer awareness of and concerns about food safety at three Arkansas farmers' markets. *Food protection trends*, 31, 156-165.

Darby, K., Batte, M. T., Ernst, S., and Roe, B. (2006). Decomposing local: a conjoint analysis of locally produced foods. *American Journal of Agricultural Economics*, 90, 476-486.

Dunfield, K. E. and Germida, J. J. (2004). Impacts of genetically modified crops on soil- and plant- associated microbial communities. *Journal of Environmental Quality*, 33, 806-815.

Dunning, R. (2013). Research-based support and extension outreach for local food systems. Center for environmental farming systems. Accessed online from http://www.cefs.ncsu.edu/resources/guides/research-based-support-for-local-food-systems.pdf on 8th March, 2016.

-149.

Ernst, M. (2014). Community supported agriculture. Cooperative extension service, University of Kentucky College of agriculture, food and environment, Center for crop diversification marketing profile, Kentucky.

Feenstra, R. C. (1995). Exact hedonic price indexes. *The Review of Economics and Statistics*, 77, 634-653.

Frazier, L. M. (2007). Reproductive disorders associated with pesticide exposure. *Journal of Agro Medicine*, 12, 27-37.

Galt, R. E. (2013). The moral economy is a double-edged sword: explaining farmers' earnings and self-exploitation in community supported agriculture. *Economic Geography*, 88(4), 341-365.

Gaytan, M. (2003). Globalizing the local: slow food and the collective imaginary, paper presented at the annual meeting of the American Sociological Association, Atlanta, GA, August 16.

Goland, C. (2002). Community supported agriculture, food consumption patterns, and member commitment. *Culture and Agriculture*, 24, 14-25.

Govindasamy, R., Italia, J. and Adelaja, A. 2002. Farmers' markets: consumer trends, preferences, and characteristics. *Journal of Extension*. Accessed online from http://www.joe.org/joe/2002february/rb6.php on 15th March, 2016.

Greene, A. (2006). Opportunities to reduce children's exposures to pesticides: a truly grand challenge. Accessed online from

https://www.organiccenter.org/reportfiles/Greene_AAAS%20Paper.pdf on Jan 24, 2016.

Griliches, Z. (1961). Hedonic prices indexes for automobiles: An econometric analysis of quality change. In Griliches, Z. (Ed.), Price Indexes and Quality Change: Studies in New Methods of Measurement. Harvard University Press, Cambridge, MA, 55–87.

Guptill, A. and Wilkins, J. L. (2002). Buying into the food system: Trends in food retailing in the US and implications for local foods. *Agriculture and Human Values*, 19, 39-51.

Halden, R. U. and Schwab, K. J. (2008). Environmental impact of industrial farm animal production. A report of the Pew commission on industrial farm animal production. Assessed online from http://www.ncifap.org/_images/212-4_envimpact_tc_final.pdf on January 10th 2016.

Hardesty, S. D. (2008). The growing role of local food markets. *American Journal of Agricultural Economics*, 90, 1289-1295.

Hill, R. J. (2013). Hedonic price indexes for residential housing: a survey evaluation and taxonomy. *Journal of Economic Surveys*, 27, 879-714.

Hoen, B., Brown, J. P., Jackson, T., Thayer, M. A., Wiser, R. and Cappers, P. (2015). Spatial hedonic analysis of the effects of US wind energy facilities on surrounding property values. *Journal of Real Estate Financial Economics*, 51, 22-51

Holmes, T. J. and Yan, R. L. (2012). Predicting consumers' preferences for and likely buying of local and organic produce: results of a choice experiment. *Journal of Food Product Marketing*, 18, 369-384.

Horrigan, L., Lawrence, R. S. and Walker, P. (2002). How sustainable agriculture can address the environmental and human health harms of industrial agriculture. *Environmental and Health Perspectives*, 110, 445-456.

Ilunga, Y. T. and Saghaian, S. H. (2015). Impact of access to healthy food and lifestyle on obesity: the evidence from US counties. Selected paper prepared for presentation at the Southern Agricultural Economic Association, Atlanta, Georgia.

Jekanowski, M. D., Williams II, D. R. and Schiek, W. A. (2000). Consumers' willingness to purchase locally produced agricultural products: an analysis of an Indian survey. *Agricultural and Resource Economics Review*, 29, 43-52.

Johnson, R., Aussenberg, R. A., Cowan, T. (2013). The role of local food systems in U.S. farm policy. Congressional Research Service.

Kantor, L. S. (2001). Community food security programs improve food access. *Food Review*, 24, 20-26.

Karipidis, P., Tsakiridou, E., Tabakis, N.M. and Mattas, K. (2005). Hedonic Analysis of Retail Egg Prices. *Journal of Food Distribution Research*, 36(3), 68–73.

Kim, C., and Chung, C. (2011). Hedonic Analysis of Retail Egg Prices Using Store Scanner Data: An Application to the Korean Egg Market. *Journal of Food Distribution Research*, 42, 14–27.

King, R. P., Hand, M. S., Digiacomo, G., Clancy, K., Gomez, M. I., Hardesty, S. D., Lev, L. and Mclaughlin, E. W. (2010). Comparing the structure, size and performance of local and mainstream food supply chains, Economic research service, United States department of agriculture.

Kling, R. W., Findley, T. S., Gahramanov, E. and Theobald, D. M. (2015). Hedonic valuation of land protection methods: implications for cluster development. *Journal of Economics and Finance*, 39, 782-806.

Kolodinsky, J. M. and Pelch, L. L. (1997). Factors influencing the decision to join a community supported agriculture (CSA) farm. *Journal of Sustainable Agriculture*, 10, 129-141.

Kristofersson, D., and Rickertsen, K. (2007). Hedonic price models for dynamic markets. *Oxford Bulletin of Economics and Statistics,* 69, 387–412.

Lagane, J. (2015). Introduction to the symposium: towards cross-cultural views on community supported agriculture. *Agriculture and Human Values*, 32, 119-120.

Lancaster, K. J. (1966). A new approach to consumer theory. *Journal of Political Economy,* 74, 132–157.

Landis, B., Smith, T. E., Lairson, M., Mckay, K., Nelson, H. and O'Briant, J. (2010). Community supported agriculture in the research region of North Carolina: Demographics and effects of membership on household food

supply and diet. *Journal of Hunger and Environmental Nutrition*, 5, 70-84.

Lang, K. B. (2005). Expanding our understanding of community supported agriculture (CSA): An examination of member satisfaction. *Journal of Sustainable Agriculture*, 26, 61-79.

Larson, N. I., Story, M. T. and Nelson, M. C. (2009). Neighborhood environments: disparities in access to healthy food in the US. *American Journal of Preventive Medicine*, 36, 74-81.

Lass, D., Bevis, A., Stevenson, G. W., Hendrickson, J. and Ruhf, K. (2003). CSA across the nation: findings from the 1999 CSA survey. Center for integrated agricultural system, Madison, WI.

Leffew, M. B. (2014). 2007 and 2012 census of agriculture data for direct sales, CSAs, value-added products and agri-tourism for selected southern states and the United States. Center for profitable agriculture, accessed online from https://ag.tennessee.edu/cpa/Information%20Sheets/CPA%20231.pdf on 4th Feb, 2016

Leone, L. A., Beth, D., Ickes, S. B., MacGuire, K., Nelson, E., Smith, R. A., Tate, D. F. and Ammerman, A. S. (2012). Attitudes toward fruit and vegetable consumption and famers' market usage among low-income North Carolinians. *Journal of Hunger & Environmental Nutrition*, 7, 64-76.

LeRoux, M. N., Schmit, T. M., Roth, M. and Streeter, D. H. (2010). Evaluating marketing channel options for small-scale fruit and vegetable producers. *Renewable Agriculture and Food Systems*, 25, 16-23.

Lin, B. H., Smith, T. A., and Huang, C.L. (2008). Organic premiums of U.S. fresh produce. *Renewable Agriculture and Food Systems*, 23, 208–216.

Liu, L. and Jakus, P. M. (2015). Hedonic valuation in an urban high rise housing market. *Canadian Journal of Agricultural Economics*, 63, 259-273

LocalHarvest.org (2016). Accessed online from http://www.localharvest.org/search.jsp?ty=6 on 25 Jan, 2016.

Low, S. A., Adalja, A., Beaulieu, E., Key, N., Martinez, S., Melton, A., Perez, A., Ralston, K., Stwart, H., Suttles, S., Vogel, S. and Jablonski, B. B. R. (2015). Trends in U. S. local and regional food systems. U. S. Department of Agriculture, Economic Research Service.

Mansury, Y. and Hara, T. (2007). Impacts of organic food agri-tourism on a small rural economy: a social accounting matrix approach. *The journal of Regional Analysis and Policy*, 37, 213-222.

Martinez, S., Hand, M., Da Pra, M., Pollack, S., Ralston,K., Smith,T., Vogel,S., Clark,S., Lohr,L., Low,S. and Newman,C. (2010). Local food system: Concepts, impacts and issues. U.S. Department of Agriculture, Economic Research Service.

Matas, A. and Raymond, J. L. (2009). Hedonic prices for cars: an application to the Spanish car market, 1981-2005. *Applied Economics*, 41, 2887-2904.

McGuirt, J. T., Ward, R., Elliott, N. M., Bullock, S. L. and Jilcott Pittts, S. B. (2012). Factors influencing local food procurement among women of reproductive age in rural eastern and western North Carolina, USA. *Journal of Agricultural Food System and Community Development*, 4, 143-154.

Moore, L. V., Roux, A. D., Nettleton, J. A. and Jr Jacobs, D. R. (2008). Associations of the local food environment with diet quality-a comparison of assessments based on surveys and geographic information systems, the multiethnic study of atherosclerosis. *American Journal of Epidemiology*, 167, 917-924.

Morland, K., Wing, S. and Roux, A. D. (2002). The contextual effects of the local food environment on residents' diets; the atherosclerosis risk in communities study. *American Journal of Public Health*, 92, 1761-1767.

Napolitano, F, Pacelli, C, Girolami, A, and Braghieri, A. (2008). Effect of information about animal welfare on Consumer willingness to pay. *Journal of Dairy Science*, 91, 910-917.

NRDC. (2007). Food miles: how far your food travels has serious consequences for your health and the climate. Natural Resources Defese Council. Accessed online from https://food-hub.org/files/resources/Food%20Miles.pdf on 11th February, 2016.

O'Hara, S. U. and Stagl, S. (2002). Endogenous preferences and sustainable development. *Journal of Socio-Economics*, 31, 511-527.

Oberholtzer, L. (2004). Community supported agriculture in mid-Atlantic region: results of a shareholder survey and farmer interview. Accessed online from http://www.smallfarmsuccess.info/CSA_Report.pdf on 9th March, 2016.

Perez, J., Allen, P., and Brown, M. (2003) Community supported agriculture on the central coast: The CSA member experience, Winter research brief No. 1, The center for agro-ecology and sustainable food systems, the university of California, Santa Cruz, CA.

Pimental, D., Hepperly,P., Hanson,J., Douds,D. and Seidel,R. (2005). Environmental, energetic and economic comparisons of organic and conventional farming systems. *Bioscience*, 5, 573-582.

Pirog, R., Pelt, T. V., Enshayan, K. and Cook, E. (2001). Food, fuel and freeways; an Iowa perspective on how far food travels, fuel usage, and greenhouse gas emissions. Accessed online from http://ngfn.org/resources/ngfn-database/knowledge/food_mil.pdf on 12th March, 2016.

Pole, A. and Gray. M. (2013). Farming along? What's up with the 'C' in community supported agriculture. *Agriculture and Human Values*, 30, 85-100.

Pole, A. and Kumar, A. (2015). Segmenting CSA members by motivation: anything but two peas in a pod. *British Food Journal*, 117. 1488-1505.

Press, M. and Arnould, E. J. (2011). Legitimating community supported agriculture through American pastoralist ideology. *Journal of Consumer Culture*, 11, 168-194.

Ravenscroft, N., Moore, N., Welch, E. and Hanny, R. (2013). Beyond agriculture: the counter hegemony of community farming. *Agriculture and Human Values*, 30, 629-639.

Roheim, C. A., Asche, F., and Santos, J. I. (2011).The elusive price premium for ecolabelled products: evidence from seafood in the UK market. *Journal of Agricultural Economics*, 62, 655–668.

Rosen, S. (1974). Hedonic Prices and Implicit Markets: Product Differentiation in Pure Competition. *Journal of Political Economy*, 82, 34–55.

Satimanon, T., and Weatherspoon, D. D. (2010). Hedonic analysis of sustainable food products. *International Food and Agribusiness Management Review*, 13, 57–74.

Saunders, C., and P. Hayes. 2007. Air freight transport of fresh fruit and vegetables. Research report no. 299, Agribusiness and economist research unit, Lincoln University, Christchurch, New Zealand.

Schamel, G. (2006). Geography versus brands in a global wine market. *Agribusiness,* 22, 363–374.

Schmit, T. M., Jablonski, B. B. R. and Mansury, Y. (2013). Impacts of local food system activities by small Direct-to-consumer producers in a regional economy: a case study from Upstate NY. Working paper 13-16, Dyson School of applied economics and management, Cornell University.

Schnell, S. M. (2013). Food miles, local eating, and community supported agriculture: putting local food in its place. *Agriculture and Human Values,* 30, 615-628.

Selfa, T., and Quazi, J. (2005). Place, taste or face to face? Understanding producer-consumer networks in 'local' food systems in Washington state. *Agriculture and Human Values*, 22, 451-464.

Serafini, M., Bugianesi, R., Salucci, M., Azzini, E., Raguzzini, A. and Maiani, G. (2002). Effect of acute ingestion of fresh and stored lettuce on plasma total antioxidant capacity and antioxidant levels in human subjects. *British Journal of Nutrition*, 88, 615-623.

Smith, T. A., Huang, C. L., and Lin, B. H. (2009). Estimating organic premiums in the U.S. fluid milk market. *Renewable Agriculture and Food Systems,* 24, 197–204.

Stagl, S. (2002). Local organic food markets: potentials and limitations for contributing to sustainable development. *Empirica*, 29, 145-162.

Steiner, B. E. (2004). Australian wines in the British wine market: a hedonic price analysis. *Agribusiness*, 20, 287–307.

Stewart, H. (2006). How low has the farm share of retail food prices really fallen? Economic research service, United States department of agriculture.

Strochlic, R. and C. Shelly. (2004). Community supported agriculture in California, Oregon and Washington: Challenges and opportunities. Davis, CA: California Institute for Rural Studies.

Swenson, D. (2011). Measuring the economic impacts of increasing fresh fruit and vegetable production in Iowa considering metropolitan demand. Leopold center for sustainable agriculture, Ames, Iowa.

Tegtmeier, E. and Duffy, M. (2005). Community supported agriculture in the Midwest United States: A regional characterization, Staff general research papers 12577, Iowa state university, Department of economics.

Tetens, I. and Alinia, S. (2009). The role of fruit consumption in prevention of obesity. *Journal of Horticultural Science and Biotechnology, special issue*, no volume, 47-51.

Thilmany, D. and Watson, P. (2004). The increasing role of direct marketing and farmers' markets for western U. S. producers. *Western Economic Forum*, 3, 19-25.

Thompson, E., Harper, A. M. and Kraus, S. (2008). Think globally eat locally, San Francisco food shed assessment. *American Farmland Trust*. Assessed online from http://www.thegreenhorns.net/wpcontent/files_mf/1340378421SanFranciscoFoodShedAssessment.pdf on 15th Feb, 2016

Thompson,G. D.,and Kidwell, J. (1998). Explaining the choice of organic produce: cosmetic defects, prices, and consumer preferences. *American Journal of Agricultural Economics,* 80, 277–287.

Timmons, D. and Wang, Q. (2010). Direct food sales in the US: Evidence from state and county-level data. *Journal of Sustainable Agriculture*, 34, 229–240.

U. S. Department of Agriculture. (2014). *Farm to School Census*, Food and Nutrition Service. Accessed online from http://www.fns.usda.gov/farmtoschool/census/#/ on 2nd Feb, 2015.

UDSA. (2014). Organic market overview. Accessed online from http://www.ers.usda.gov/topics/natural-resources-environment/organic-agriculture/organic-market-overview.aspx on 15th Feb, 2016.

UMD. (2010). Enhancing the community supported agriculture marketing model in Maryland. University of Maryland, Extension. Accessed online from https://extension.umd.edu/sites/default/files/_docs/articles/CRED-01_CSA.pdf on May 10th 2016.

USDA (2014). Organic market overview. Accessed online from http://www.ers.usda.gov/topics/natural-resources-environment/organic-agriculture/organic-market-overview.aspx on 7th March 2016.

USDA and USDHHS. (1995). Eat variety of foods. In Nutrition and health: dietary guidelines for Americans, fourth edition. United States Department of Agriculture and United States Department of Health and Human Services. Accessed online from http://health.gov/dietaryguidelines/dga95/variety.htm on 12th March, 2016.

Vallejo, F., Tomas-Barberan, F. and Garcia-Viguera, C. (2003). Health promoting compounds in broccoli as influenced by refrigerated transport and retail sale period. *Journal of Agricultural Food Chemistry*, 51, 4-5.

Van Duyn, M. A and Pivonka, E. (2000). Overview of the health benefits of fruits and vegetable consumption for the diabetics professional: selected literature. *Journal of American diet association*, 100, 1511-1521.

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

Wells, B. L. and Gradwell, S. (2001). Gender and resource management: community supported agriculture as caring practice. *Agriculture and Human Values*, 18, 107-119.

Woods, T., Ernst, M., Ernst, S. and Wright, N. (2009). 2009 survey of community supported agriculture producers. Center for crop diversification. Accessed online from https://www.uky.edu/Ag/CCD/csareport.pdf on March 14th, 2016.

Xu, X., Loke, M. K. and Leung, P. (2015). Is there a price premium for local food? The case of fresh lettuce market in Hawaii. *Agricultural and Resource Economics Review*, 44, 110-123.

Zepeda, L. and Leviten-Reid, C. 2004. Consumers' views on local food. *Journal of Food Distribution Research*, 35, 1-6.

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

Zepeda, L., and J. Li. (2006). Who buys local food? *Journal of Food Distribution Research,* 37: 1–11.

Zepeda, L., Reznickova, A. A., Russel, W. S. and Hettenbach, D. (2013). A case study of the symbolic value of community supported agriculture. *Journal of Food Distribution Research*, 45, 195-212.