

**THE EFFECTS OF INCORPORATING COMMUNITY SUPPORTED  
AGRICULTURE ON THE PROFITABILITY OF FARMS IN THE  
NORTHEASTERN U.S.**

By

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And approved by

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## **ABSTRACT OF THE THESIS**

### **THE EFFECTS OF INCORPORATING COMMUNITY SUPPORTED AGRICULTURE ON THE PROFITABILITY OF FARMS IN THE NORTHEASTERN U.S.**

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The number of farms in the United States has been in a constant decline for nearly ninety years, while simultaneously there have been increases in the average size of farms and in the total value of agricultural output. While there are many causes of the decline of farms, there seem to be few solutions that help to maintain farm viability. This is especially true of farms in the Northeastern U.S. which face different pressures and risks, particularly those associated with urbanization when compared to farms in other regions in the nation.

Previous studies have shown that direct marketing of agricultural products to consumers is one of the ways to enhance the profitability for farms. This thesis explores that notion by examining a less well-researched direct marketing method known as community supported agriculture (CSA). Specifically, the purpose of this thesis is to analyze whether there are meaningful profit differentials between direct market farms that incorporate CSA into their marketing mix and those that do not. Respondent level data from the 2007 U.S. Census of Agriculture are analyzed to characterize the demographic, economic and structural features of direct market farms that incorporate CSA into their

marketing mix. The eleven states in the greater Northeast region of the U.S. provide the geographic context for the study.

The analysis showed that Northeast CSA farms tended to be small farms which more heavily depended on direct sales to consumers when compared to all U.S. farms. CSA farms were also operated by younger principal operators who were more likely to be female. While looking at the raw data and characterizing farms based on averages was helpful, econometric modeling was used to gain a more accurate view of the effects of CSA incorporation on farm profitability. An ordinary least squares model was estimated to explain the impact on a farms' net cash income of having a CSA in the greater Northeast, while taking into account other factors that impact farm income such as demographic, organizational and socio-economic factors of farms and farmers.

The models revealed a statistically significant, positive effect for the inclusion of a CSA for farms operating in the large family farm category. The results provide some evidence that large family farms in the Northeast could benefit from incorporating a CSA into their marketing mix. Given the study limitations, continued research, perhaps using an expanded dataset or more recent data, could potentially corroborate and expand upon these results.

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## **Chapter 1**

### **Introduction**

#### **1.1 Background**

The number of farms in the United States has declined sharply in recent decades. More than 300,000 farms have been lost in the last forty years alone (USDA-NASS, 2014). At the same time, there has been an increase in the average size of U.S. farms and an increase in total value of agricultural products. Farm product sales reached a record high of \$394.6 billion in 2012 (USDA-NASS, 2014). These trends have been occurring steadily since the 1920s (Dimitri et al., 2005).

There are many challenges facing small scale agriculture, including increasing input prices and growing competition brought about by globalization. In many parts of the U.S, particularly the Northeast, the pressures of urbanization combine with these more ubiquitous pressures to constrain the economic viability of farms. The decreasing economic profitability of small farms has led many farmers to exit agriculture, look for additional employment off of the farm or expand their marketing mix through alternative agricultural enterprises or incorporating non-traditional activities to increase farm income (Govindasamy et al., 1999; Schilling et al., 2012; McGehee, 2007). An increasingly popular and successful strategy for small farmers to increase their farms' economic viability and profitability is through direct marketing of their farm products to consumers. It is generally believed that farmers often receive higher prices for their direct marketed products when compared to wholesale activities (Stephenson and Lev, 2004; Park and Lohr, 2006; Hardesty and Leff, 2010; LeRoux et al., 2010).

One relatively new direct marketing arrangement developed in the United States in 1985 is community supported agriculture (CSA). Simply, CSA is a marketing strategy in which farmers and local consumers enter into an agreement whereby the farmer sells “shares” of the farm output. Consumers receive a portion of the farmer’s harvest throughout the growing season, creating an inter-dependency of the farmer and the local community. Sales of the shares generally occur prior to the start of the season, either in the winter or early spring. The farmer then provides shareholders with a weekly bundle of produce, although some farmers offer egg, meat, or honey shares. The distribution season for weekly bundles generally extends from May through October, although some farms do offer winter shares.

Under the CSA model, farmers have relatively more freedom to concentrate their efforts on the production of crops rather than marketing because sales of their farm products have already occurred. A notable benefit of the CSA model is that it allows farmers and CSA shareholders to share in the risks and rewards of the farm. Also, because shares are purchased prior to the season, farmers receive capital at a time when farms usually have little or no cash flow (Kelvin, 1994; Lass et al., 2004).

The CSA model offers an alternative marketing strategy for farmers with the ability to increase farm income with little change to farm operations (Brown and Miller, 2008). In 1986, there were two farms which incorporated CSA as part of their marketing strategy (McFadden, 2004). According to the 2012 Census of Agriculture, there were more than 12,000 farms which self-identified as having

CSA as part of their marketing mix (USDA-NASS, 2014). Other, possibly more accurate estimates range from between 3000 and 6000 CSA operations (Galt, 2009; Local Harvest, 2014).

Previous studies have analyzed the characteristics of CSA farms, farm operators, and the potential impacts of incorporating the CSA marketing model on profitability. Two national surveys and three regional surveys created a profile of CSA farms and farmer characteristics (Lass et al., 2003a; Lass et al., 2003b; Lass et al., 2001; Tegtmeier and Duffy, 2005; Woods et al., 2011). There have been evaluations of marketing costs and benefits associated with CSA (Hardesty and Leff, 2010; LeRoux et al., 2010), an evaluation of whether CSA farms have market power and the extent to which they exercise that power (Lass et al., 2004), and an analysis of the impacts on net income per acre of alternative management styles within the CSA model (Sanneh et al., 2001).

While these studies point to the benefits of incorporating the CSA business model into a farm's marketing mix, there is a lack of research explicitly examining the impact of incorporating a CSA on farm profitability. While three of the studies compared their findings about farm income to national census data (Lass et al., 2003a; Lass et al., 2003b; Oberholtzer, 2004), no study has analyzed the profit differentials of direct market farms with and without a CSA.

## **1.2 Justification of Research**

This study will fill a gap in the literature about the structure and impact of incorporating CSA into the marketing mix of farms in the Northeast who sell directly to consumers as part of their distribution strategy. This is especially

important when considering the difficulties of farmers maintaining profitability in the Northeast, given the different pressures and risks that they face. The purpose of this research is to analyze whether there are meaningful profit differentials between direct market farms in the greater Northeast that incorporate CSA into their marketing mix and those that do not.

### **1.3 Research Objectives**

There are three primary objectives of this research. First, the study examines the structural, economic and demographic characteristics of CSA farms in the greater Northeast region of the U.S. Second, the study examines whether statistically meaningful differences in financial performance exist between farm direct marketers that have incorporated the CSA model into their farm enterprise and those that have not. Third, the study evaluates whether the profit impacts associated with CSA farms vary across more homogenous subsets of farms using the USDA's Economic Research Service's farm typology.

### **1.4 Organization of Thesis**

Chapter 2 discusses agricultural trends and changes in farm structure within the Northeast and the importance of maintaining farmland. Chapter 3 provides a general background on the CSA concept and describes the organizational structures that CSA farms implement. Chapter 3 also describes the profiles of CSAs across America based on national and regional surveys. Chapter 4 discusses the research design and includes a descriptive analysis of CSA farms based on 2007 Census of Agriculture data, concentrating on farms in the Northeast. The chapter also characterizes CSA farms in the Northeast based

on demographic, economic and structural information. Chapter 5 presents the empirical model, introduces the methodology used to explain farm viability and presents the econometric models used for measuring the effects of incorporating a CSA on profitability. Chapter 6 presents the empirical results from the models and includes a discussion of the results. Chapter 7 presents a summary of the research and the conclusions which were drawn from the results. Chapter 7 also includes the limitations of the research and recommendations for future research on the topic.

## **Chapter 2**

### **Context for a Northeastern Study on Farm Viability**

#### **2.1 Changing Agricultural Landscape**

There has been a great deal of change to the agricultural landscapes in America over the past 100 years. Most notable has been a large shift away from land area dedicated to farmland and an increase in more urban land area, such as residential, commercial, and industrial construction (Vesterby & Krupa, 2001; Hellerstein et al., 2002). As shown in Table 2.1, total land area dedicated to farmland has fluctuated since 1910 but is on a clear downward trend (USDA-ERS, 2013). From 1954 to 2012, the number of farms in the U.S. decreased by more than 50%, from 4,782,416 to 2,109,303. During the same period, total farmland area in the U.S. also decreased by 243 million acres (a loss of 21%). These are significant losses, especially if the need for additional farmland arises due to future food needs.

Several factors have influenced this land transformation. In the early 20<sup>th</sup> century, agricultural production was labor intensive, requiring a large work force comprising both people and animals. During these times, nearly half of all U.S. workers were employed on farms, meaning that the majority of the population lived in rural areas (Dimitri et al., 2005). Technological advancements in the agricultural sector, particularly in mechanization and chemical inputs, helped to spur a large change in the farm workforce, making it possible for far fewer laborers to be more productive. This not only created a smaller demand for farm workers in rural areas, but the increased productivity from new farm

practices

| <b>Table 2.1 : Statistics on Number of U.S. Farms, Average Farm Size and Total Farmland</b> |                        |                                   |                                |
|---------------------------------------------------------------------------------------------|------------------------|-----------------------------------|--------------------------------|
| <b>Year</b>                                                                                 | <b>Number of Farms</b> | <b>Average Farm Size in Acres</b> | <b>Total Farmland in Acres</b> |
| 1954                                                                                        | 4,782,416              | 242                               | 1,158,191,501                  |
| 1959                                                                                        | 3,710,503              | 302                               | 1,123,507,574                  |
| 1964                                                                                        | 3,157,857              | 351                               | 1,110,187,000                  |
| 1969                                                                                        | 2,730,250              | 389                               | 1,063,346,489                  |
| 1974                                                                                        | 2,314,013              | 439                               | 1,017,030,357                  |
| 1978                                                                                        | 2,478,642              | 415                               | 1,029,694,535                  |
| 1982                                                                                        | 2,240,976              | 440                               | 986,796,579                    |
| 1987                                                                                        | 2,087,759              | 461                               | 964,470,625                    |
| 1992                                                                                        | 1,925,300              | 491                               | 945,531,506                    |
| 1997                                                                                        | 1,911,859              | 487                               | 931,95,255                     |
| 2002                                                                                        | 2,128,982              | 441                               | 938,279,056                    |
| 2007                                                                                        | 2,204,792              | 418                               | 922,095,840                    |
| 2012                                                                                        | 2,109,303              | 439                               | 914,527,657                    |

Source: USDA-NASS, 2012 Census of Agriculture

meant that there was less need for land to be reserved for farming. This technological advancement gave rise to ever-increasing economies of scale and contributed to an increase in average farm size while at the same time drastically decreasing the number of farms and farm populations (Dimitri et al., 2005). This transition also coincided with a shift in population from rural to urban areas as people searched for jobs with higher wages in new production and service sectors. Also, an increasingly global marketplace has led to increased

competition in both domestic and export markets which has led to price uncertainties for farmers (Dimitri et al., 2005).

Additionally, numerous studies have found that farmers face additional pressures from urbanization. The research of Berry (1978), Lopez, Adeleja and Andrews (1988) and Daniels and Bowers (1997) helped to identify the impacts which are inherent when suburbanization encroaches on rural areas which are predominantly used for agriculture. There is a negative relationship between urbanization and farmland conversion. Most impactful is the urban expansion and exurban growth which consumed substantial farmland acreage since the end of World War 2 (Heimlich and Anderson, 2001). This leads to the development of farmland for residential purposes. There is also additional development pressure for the other amenities that the new population patterns demand, such as roads and shopping centers. The direct impact of this transition is the loss of farmland, which is prime for development because it is often flat, well drained and cleared of trees and brush. While it can be easy to develop this farmland for residential and commercial use, it can be assumed that it would be cost prohibitive to convert that land back into farmland, so this farmland loss is typically deemed irreversible. This rural development and urban expansion is estimated to have resulted in the average loss of 1 million acres of farmland every year from 1960 to 1990 (Heimlich and Anderson, 2001).

In addition to the farmland loss caused by suburbanization, there are also indirect impacts which affect farmers. The research of Lopez, Adeleja, and Andrews (1988) and Daniels and Bowers (1997) have identified four impacts of

suburbanization which can be categorized into regulatory, technical, speculative, and market effects.

The regulatory effects often arise when non-farmer residents are confronted with the unpleasant aspects associated with farming life. New residents may demand that farmers negate some of the externalities which are common on agricultural operations. Non-farmer residents may supersede farmers on local land use boards and implement regulations which can hinder farmers' activities. This can create a less favorable regulatory environment for farmers. These regulations can include limiting the spraying of manure or chemical inputs which create disagreeable odors, or restricting the driving of slow moving farm machinery on heavily trafficked roads which could potentially increase commuting times for non-farming residents. "Right to farm" statutes have been implemented to protect farmers' from the burden of overly restrictive regulations (Lopez et al., 1988).

The technical effects of suburbanization can alter the efficiency of agriculture. This may be the case when there is a decline in the number of farms which leads to the loss of localized farm inputs and market infrastructure in a specified area. This loss of businesses means that farmers must travel further for necessary supplies, which pulls them away from their farm work. Also, larger farms may be operating on noncontiguous farmland. Since new roadway infrastructure may not be properly designed to handle the size of farm equipment, such as tractors, it may be additionally time consuming for farmers to move equipment between their tracts of land. In an effort to not disrupt local

residents, farmers may also change the timing of chemical applications or the hours that they drive their slow tractors on the roads so as to not aggravate local residents (Lopez et al., 1988).

The speculative effects of suburbanization refer to the changes in production decisions caused by development pressures. Since developers want to purchase farmland, there is an increased demand for agricultural land, which invariably increases the price of farmland. Increased competition in farmland markets pushes farmland prices above the range which is economically feasible for most farmers. Rising farmland value may create an entrance barrier and prohibit many young and new farmers from being able to enter into the agricultural industry. There is the potential for the increased price of farmland to also limit the opportunities for existing farmers to expand their operations. High farmland prices can also look enticing for farmers when they weigh the benefits of selling their land assets, which have increasing value, against the costs of staying in the agricultural industry (Lopez et al., 1988).

The fourth indirect effect of suburbanization is the market effect, which can be both positive and negative. The increased value of land can be a benefit to current farmland owners who see an increase in the value of their financial asset. But, new and beginning farmers could be priced out of the farmland market by developers, meaning that fewer people will be joining the agricultural industry. On the other hand, suburbanization can reduce the geographic distance between farmers and their markets. This may lead to a reduction in transportation costs. There is also the increased potential for more direct marketing to consumers,

which can lead to higher prices received for farm products (Lopez et al., 1988).

This will be discussed in further detail in section 2.3.

A result of the many pressures from urbanization is that farmers in urban-influenced areas exhibit an “impermanence syndrome”. The impermanence syndrome is defined as the shortening of a farmers’ planning horizon and a hesitancy to make investments in their farm operations. This hesitation can also have the additional impact of reducing the amount of necessary investments, such as purchasing new machinery or making farm improvements, which may be required to maintain profitability (Adelaja et al., 2011).

It is clear that suburbanization causes a conversion of farmland to urban land use, which has reduced the total amount of farmland in the U.S. (Berry, 1978). The greatest proportional losses of farmland and the heaviest urbanization has been occurring in the Northeast. Between 1945 and 1997, nearly half of the farmland in the region was lost and the amount of land area dedicated for urban uses tripled (Vesterby & Krupa, 2001). As a result, Northeast farming in particular faces challenges such as high input costs, a regulatory burden stemming from rural-urban conflicts, and land values which are increasing rapidly due to the growth of the region’s industrial and service sectors (Adelaja, 1995).

## **2.2 Public Interest in Preserving Local Farms**

There is mounting interest from the non-farm public to maintain farmland, particularly farms in their local area. At the same time, consumers are showing a partiality for local agricultural products (Martinez et al., 2010). When farm

products are sold within a close proximity of the farm, the farm output can be marketed as “locally produced”, and often sold at a premium (Yue and Tong, 2009). There is currently no consensus on what constitutes food that is “local” based on distances between production and consumption of agricultural products. Nevertheless, the concept of “local” food marketing, where farmers sell directly to consumers, resonates with segments of the public who are eager to reconnect with local food producers. In addition to the obvious contribution of agricultural products to the local market (e.g., vegetables, meat, and value added products such as canned vegetables or clothing) there are additional economic benefits. The economic activity generated by farmers selling in their local area can be clearly measured and can be important to a local economy.

Marketing agricultural products directly to consumers accounted for \$551 million in sales in 1997 and \$1.2 billion in sales in 2007, amounting to more than a doubling in sales in 10 years (Martinez et al., 2010). The development of a local food system is critical to support small and beginning farmers who generally tend to sell directly to consumers in their local area (Low et al., 2015). As defined by the Sustainable Agriculture Research and Education Program, a local food system is “a collaborative effort to build more locally based, self-reliant food economies---one in which sustainable food production, processing, distribution, and consumption is integrated to enhance the economic, environmental, and social health of a particular place” (Feenstra, 2002). With a growing demand for local food, there is potential for farmers to redirect some of their resources toward supplying their agricultural products in local markets. If farmers are

already participating in direct marketing, there is the potential to expand an operation's sales by fulfilling the desire for local consumers to purchase agricultural products that were grown and produced in their area.

Given the increased demand for local agricultural products, there have been a number of studies conducted to analyze consumers' preferences for locally produced foods and the motivations to purchase local agricultural products. A survey of consumers in two Oregon communities found that over 80% of consumers felt that the purchase of local food to support local agriculture was important to them (Stephensen and Lev, 2004). A national study of diverse consumers found that freshness, support for the local economy and knowing the source of their products were motivating factors for buying local foods at direct markets (Food Marketing Institute, 2009). Additionally, consumers who are willing to pay higher prices for locally produced foods had many motivating factors such as product quality, the environmental effects of agricultural production methods, and supporting local farmers (Martinez et al., 2010).

There is also growing consumer interest in reorganizing our agro-industrial complex, which is inherently large and has created a large disconnect between where our food is produced and where it is consumed. Our conventional food system is predominantly controlled by large agri-business farms and multinational corporations, and as the rising costs of fuel increase the price of shipped food products, consumers are demanding a cheaper and more locally sourced alternative (Feagan, 2007). A partial solution for reducing the total distance that food travels is through the creation of local food systems. Given

that consumers are seeking this alternative, some social scientists are asserting that local food systems have the potential to restructure the prevailing food supply system to shorten the distance between producers and consumers. Anderson and Cook (2000) contend that there would be positive impacts to the economic viability of agricultural regions if our current food systems were restructured and there was more emphasis on developing shorter food supply chains. There are developments in the local food system which are having a positive influence on shortening these supply chains. They come mainly in the form of more direct marketing by local farms, through the development of farmers markets and the establishment of more community supported agriculture farms.

Farms also provide many non-market outputs which are not valued directly by the market but may influence consumers to purchase local farm products. These include contributions such as rural landscapes, habitats for wildlife, a connection to our not so distant agrarian cultural heritage, and recreational opportunities (Hellerstein et al., 2002). These non-market goods are considered positive externalities because farmers receive no direct monetary return from their provision. Although none of these services provides cash flow for farmers, their contributions are nonetheless important to the public. Unfortunately, since there is no monetary payoff for these contributions to a local environment, farmers do not consider these goods when making decisions about the use and management of their land (Lynch and Duke, 2007; Schilling et al., 2012). What results is a classic market failure; these types of socially desirable farmland based goods and services will be undersupplied in private market

settings.

Given that the public is interested in the non-market services that farms provide, state and local governments have enacted farmland preservation policies to help protect farmland from development. A variety of public preferences underlie farmland preservation efforts, from concerns for the environment and maintaining rural and open space, to the maintenance and preservation of family farms and the protection of local food supplies (Hellerstein et al., 2002). This is especially true in areas that are more densely populated, and therefore have less remaining farmland, which is the case in the Northeast. Preserving these rural amenities through a broad range of farmland preservation legislation has been a major action taken in the Northeast since the 1980s. In fact, the most active farmland preservation programs exist in the Northeast, with Maryland, Massachusetts, New Jersey and Pennsylvania accounting for 68 percent of PDR (purchase of development rights) expenditures in 2001 (Heimlich and Anderson, 2001). By 2014, 285,000 acres of farmland had been permanently protected from development in New England alone (AFT, 2015). Based on the idea that public preferences help to guide government policies, farmland preservation programs are consumer driven and help to partially correct for this market failure (Lopez et al., 1988).

### **2.3 Maintaining Farm Viability through Direct Marketing**

Several studies have found that farmers are able to increase their income by utilizing direct marketing to consumers, and this is especially true of small farms. A study of New Jersey farms found that farmers who primarily sell their

products through direct retailing consistently earn higher incomes compared to farmers who do not utilize direct marketing (Govindasamy, 1999). Another study found that the marketing of produce by farmers directly to consumers in their local area generated higher prices for their agricultural products and therefore enhanced the economic viability of small farms (Stephenson and Lev, 2004). A study of farmers in California found that over 50% of farmers reported receiving higher per unit profits from direct marketing sales when compared to conventional marketing channels (Kambara and Shelley, 2002). Kambara and Shelley also found that direct marketing is a more practical approach for small farms to begin their operations because there is a lower threshold volume of sales for a beginning farmers' market participation when compared to conventional marketing methods. Additionally, two similar studies found that small farms were able to generate greater revenue through concentration of marketing activities on direct marketing, rather than diversifying with both retail and wholesale markets (Park and Lohr, 2006; Hardesty and Leff, 2010). As Steven Schnell put it, "CSAs, farmers markets, and other forms of direct marketing have promoted this (local food economies) as a new ideal, one that expands from a sole focus on agricultural inputs to a broader conception of the context in which agriculture takes place, one that encompasses local economies, working conditions, and the creation of personal connections within the food system" (Schnell, 2007).

Schilling, Sullivan and Komar (2012) note that small family farms in the Northeast must also cope with a scarcity of access to wholesale-markets and

also lack scale efficiencies due to an absence of available land. As stated by Schilling, Sullivan, and Marxen (2007), direct marketing allows farmers to recapture a greater portion of the “marketing margin”. This shortening of the distribution chain helps farmers to reduce the costs associated with processing, packaging, retailing, and wholesale distribution. Additionally, direct marketing also provides opportunities for direct customer feedback, which can be helpful for farmers who are attempting to be responsive to local market demand. Lastly, direct marketing capitalizes on growing interest in local foods and it follows recommendations from the USDA’s *Know Your Farmer, Know Your Food* initiative which is designed to better connect consumers with local food producers (Schilling et al., 2007).

The contributions of direct marketing to total farm income are especially relevant in the Northeast. Although the northeastern region of the United States only accounts for less than 5 percent of total national farm revenue, it accounts for more than one-quarter of farm direct marketing sales (Schilling et al., 2012). This shows the relative importance of direct market income for states in the Northeast and justifies the need to understand how farmers in the region can expand their income from direct marketing.

## **Chapter 3**

### **Community Supported Agriculture**

#### **3.1 Background & Definition**

The community supported agriculture model falls under the classification of direct marketing, and has the potential to increase the direct marketing income of farms in the Northeast. The largest number of CSA farms are located in New England and the megalopolis region of the Northeast, around New York City, Philadelphia and Boston (Schnell, 2007). The study found that counties that had at least one CSA were more likely to have populations which were growing and were more urbanized or suburbanized.

Community supported agriculture helps to fulfill the demand for local food, local farms, and environmentally sustainable agriculture. The community supported agriculture (CSA) movement has existed in the United States for nearly 30 years. The movement started in 1986 at two farms, Indian Line Farm in Massachusetts and Temple-Wilton Community Farm in New Hampshire. These farms simultaneously but independently developed innovative subscription-based farm share programs which connected farmers with consumers (McFadden, 2004).

Rochelle Kelvin (1994) defines CSAs at the most basic level; "Community Supported Agriculture is a marketing arrangement where a farmer enters into an agreement with a group of local consumers to provide food directly to their families." In these arrangements, farmers sell "shares" to consumers, or members, before the growing season begins, and that share will entitle the

members to a weekly portion of the farm's harvest for a certain period of time throughout the season. Since most consumers pay for their shares before the growing season begins, the CSA model often provides the farmer with much needed cash before planting has begun, thus helping to cover the costs associated with planting, such as seeds and fertilizer. Additionally, the farmer has the ability to concentrate their efforts on production of farm products more intensely, instead of having to worry about both production and marketing during the growing season (Sanneh et al., 2001). Members generally receive a variety of vegetables and fruits produced at the farm in weekly bundles from May through October, in amounts that can provide for an entire family. Some CSA farms also offer alternative shares, such as winter, meat, egg or cider shares, depending on what is produced at the individual farm (Kelvin, 1994).

According to McFadden (2004), the CSA model emerged as a result of multiple concerns on both sides of the market. For farmers, there was an interest in the benefits of ecological farming, whereby the farmer is conscientious of their impact on their farmland and the surrounding environment while also still maintaining economic sustainability. Consumers interested in CSAs had similar concerns about the impact of individual farms on their surrounding environment. These consumers also wanted to ensure that there would be sustainable farms in their communities which were capable of providing local food whenever it was possible. With those goals in mind, CSA farmers and a group of local consumers enter into an agreement where both the risks and rewards for the season are shared. In other words, since consumers purchase their share before the

harvest has begun, they receive whatever portion of the harvest they are entitled to, regardless of quantity or quality produced, and therefore they will bear some of the risk.

According to Tegtmeier and Duffy (2005), CSAs may “minimize some of the negative effects of more conventional systems of food production and distribution because it involves less chemical use, less soil erosion, less food packaging, fewer food miles and more crop and ecosystem diversity. CSA may revitalize local economies by helping to retain more capital in the community and increasing interaction and understanding between urbanites and rural residents.” (Tegtmeier and Duffy, 2005)

There can be different arrangements for shareholders based on their commitment to the farm throughout the growing season. CSA farms can offer different types of shares to members depending on how much involvement the member would like to have in the operation. There can be a non-working share, in which a shareholder acts as a silent partner. The shareholder makes the initial payment to the farmer for their share, and receives their basket of produce based on the arrangement with the farmer. CSA's can also offer “working” shares, wherein a shareholder agrees to participate in farm related activities, which often include land preparation, weeding, planting, harvesting, and packaging. Working shares allow members to purchase the same amount of produce as non-workers, but at a reduced cost so that it may be more affordable. This is an approach that allows for people who are financially disadvantaged to receive locally grown produce, which they might not be able to purchase otherwise.

### **3.2 Benefits to Consumers**

There are many reported benefits for members of CSA farms. Although surveys of CSA members show that price savings are not an important motivating factor (Kelvin, 1994, Oberholtzer, 2004), CSA shares have been shown to be less expensive when compared to the retail value of equivalent quantities of organic and conventionally grown produce (Cooley & Lass, 1998, Sabih & Baker, 2000). Other studies have pointed to non-economic benefits that members receive from taking part in CSAs. One survey found that social and “club” benefits were important factors for becoming members of a CSA, such as knowing the farmer who grew their vegetables, reestablishing a direct urban-rural channel, and supporting common interests and beliefs (Farnsworth et al., 1996). Other surveys saw changes in consumers’ diets due to their participation in a CSA. Oberholtzer (2004) found that CSA membership resulted in an increase in the variety and amount of produce consumed. Perez et al. (2003) found that CSA members reported changes in their cooking habits and felt that they were eating healthier diets due to membership. Kolodinsky et al. (1999) found that consumers obtain satisfaction from time spent on activities related to CSA farms. In their study, they found that CSA members derived direct satisfaction from their involvement in a CSA, including being at the farm, picking up their produce and even cleaning their share of the produce. CSA members also derived utility from the consumption of meals that are produced at home with the goods they received from the farm (Kolodinsky et al., 1999).

### **3.3 CSA Organizational Factors and Their Effects on Farm Economic**

#### **Viability**

There are two primary management strategies for CSA farms (Sanneh et al., 2001). The first strategy has the farm operator making all management decisions. The second is known as core-group management strategy, which allows a group of shareholders to participate in management decisions related to farm activities such as crop selection and setting the price of a share. In a study of CSA farms in the northeastern United States, Sanneh et al. (2001) found that CSA farms that used the core-group management strategy had higher net income per acre when compared to non-core management CSA farms.

There have been a few studies about the nature of benefits and costs associated with including the CSA model as part of a farm's marketing mix. A case study of small-scale fruit and vegetable producers in Central New York found that among five different marketing channels (CSA, unstaffed farm stand, wholesale, staffed U-pick with farm stand, and farmers' markets) the CSA model performed the best in terms of profit percentage, risk, and marketing labor requirements (LeRoux et al., 2010). This was attributed to the ability of the CSA to produce large sales volume with high profits without requiring much processing and packaging while still maintaining high customer return rates. Another case study of California farms examined the profitability of different marketing channels (including wholesale, farmers' markets and CSA) across different farm sizes (Hardesty and Leff, 2010). Small farms, defined as having revenue less than \$500,000, had the highest revenue from their CSA activity,

with the least expenditure for packing and storage costs. For all farm sizes, the CSA channel had equal or higher net returns per dollar of sales compared to farmers' markets. Also, as the cost of production increased, the CSA had the highest profits of all the marketing channels (Hardesty and Leff, 2010).

Lass et al. (2004) found that Northeast CSA farms appear to exert a small degree of monopoly power within their market. The study showed that CSA farms had the ability to price their CSA shares above their marginal costs. However, for a variety of reasons, one being the altruistic nature of CSA farmers towards their shareholders, they opted to not exert their market power and therefore sold their shares below what the market would have borne. Lizio and Lass (2005) analyzed the factors that contributed to the profitability of CSA farms, finding that the number of shares sold, the years of CSA experience for the primary farmer, the inclusion of an active core group, and marketing through additional direct markets (e.g., farmers' markets or roadside stands) had positive impacts on profitability. From the previous research that has been conducted on the CSA model, there is evidence that incorporating a CSA can be a better option when compared to other farm marketing activities. Also, there are best practices which are recommended when it comes to the proper management of a CSA operation.

### **3.4 CSA National and Regional Surveys**

Two national surveys and three regional surveys have collected a great deal of information on CSA operations in the United States. In 1999, the first comprehensive national survey of 368 CSA farms was conducted and covered

CSA operations in 41 states, concentrated in the northeast, the west coast and the north central regions (Lass et al., 2003a). Farms with CSA as part of their marketing mix tended to be small enterprises. Nearly 70% of the farms operated on less than 50 acres, and half operated on less than 10 acres.

Lass et al. (2003a) found that in terms of land ownership, a majority of farmers owned the land they operated, but 27% owned no land. These farms used alternative land use arrangements, such as rental agreements, long-term leases, and ownership by a non-farmer CSA organization or land trust. Many of the surveyed CSA farms also sold produce through farmers' markets, farm stands, or wholesale channels. However, the majority of farms (58%) used CSA as their primary farm enterprise, meaning that they dedicated at least 50% of their cropland for the CSA operation. In terms of cultural practices, 84% of CSA farms practiced organic agriculture, although only 41% were certified organic (Lass et al., 2003a).

Lass et al. (2003a) also found that CSA farmers tended to be younger than the average U.S. farmer. The average age of primary operators of CSA farms was 43.7 years. In comparison, the average age of all US farm operators was 54 years. Also, a significant percentage (39%) of CSA primary operators were women, which was a striking finding when one considers that only 8.6% of the principal operators of U.S. farms were women. In terms of community building efforts, 81.5% of farms hosted social or educational events at their farms. Due to the categorical nature of the data collected, median farm income could not be calculated precisely, but lied somewhere between \$20,000 and

\$29,000. The gross farm income category with the greatest response was \$40,000 to \$99,000. Sixty percent of surveyed CSA farms reported earning income of \$20,000 or more, compared to 39% of all US farms. The impact of incorporating a core-group management strategy into the CSA had a positive impact on farm income when compared to the non-core group CSAs. On average, core group CSAs had farm income that was \$7,000 higher and were able to charge a higher price per share. Lastly, 61% of primary operators of CSAs earned less than \$10,000 in non-farm income. This finding is important because many U.S. farmers must depend on a higher proportion of farm household income from nonfarm sources (Hallberg et al., 1991). Therefore, there is potential for farmers to rely less on non-farm income if they incorporate a CSA into the marketing mix.

A second national survey of 354 CSA farms, conducted in 2001, replicated portions of the 1999 survey and yielded similar results (Lass et al., 2003b). Surveyed CSA farms were again concentrated in the northeast, the west coast, and the north central regions. CSA farms tended to be small, with over 70% operating on less than 50 acres. More than 20% of CSA operators did not own the land they farmed. More than 50% of farms used one or more additional marketing avenues for their farm products. While over 80% claimed to grow their produce organically, only 42% were certified organic. Farmers tended to be younger than the national average, and had fewer years of farming experience. The percentage of female primary operators was 36%. Similar to the 1999 survey, more than 60% of the CSA farms surveyed in 2001 reported gross farm

income that exceeded \$20,000, compared to the national average of only 38%.

This second national survey (Lass et al., 2003b) included additional questions about farmers' views of their operations. Of those surveyed, 46% said that they were satisfied with their ability to cover operating costs. The majority of farmers (73%) stated that the CSA operation improved their ability to meet operating costs, 54% stated that it improved their compensation and 56% stated that it improved their quality of life. In regard to their overall farming operations, 48% said they were unsatisfied with their own compensation from the farming operation, and over 68% were unsatisfied with their financial security in relation to health insurance and retirement. Although the operation on the whole could be struggling, farmers felt that the CSA operation contributed positively to farm viability and personal satisfaction (Lass et al., 2003b).

Two regional surveys of CSA farms had many results similar to the national surveys. Tegtmeier and Duffy conducted a 2002 survey of 55 CSA farms in the Midwest. Woods, Ernst, Ernst and Wright conducted a 2009 survey of 205 CSA farms in 9 states (Illinois, Indiana, Kentucky, Michigan, Missouri, Ohio, Pennsylvania, Tennessee and West Virginia). Both surveys found that compared to the general US farm population, CSA operators tended to be younger and have less farming experience. A relatively higher percentage of CSA operators were women when compared to the overall farm sector. Both surveys found that most (80%) of CSA farms used at least one additional marketing channel in addition to the CSA operation. Also, the Midwest survey revealed different land tenure arrangements relative to the earlier national

survey. Notably, 73% of CSA operators owned all of the land used for production which was a much higher percentage than was reported in the national CSA surveys. In terms of income generated from the CSA, the Midwest survey found that while the CSA operation accounted for 37% of total farmland used on these operations, it generated 48% of total farm income, showing higher returns on land investment compared to other marketing opportunities.

While CSA as a marketing strategy has only existed for thirty years, many farms have adopted CSA either as an entrance strategy for establishing a farm or as a way of diversifying the market mix of an existing farm. Previous research has documented the many benefits to consumers that CSAs provide.

Additionally, there is evidence that incorporating a CSA as part of a farm's marketing mix can help farmers maintain economic viability.

## **Chapter 4**

### **Research Design and Data Description**

#### **4.1 Research Design**

The objectives of this research were fulfilled by analyzing respondent (i.e., farm) level data obtained from the 2007 Census of Agriculture. The census collects a wide range of agriculture data from all farms within the nation every five years. These data include information on farm size and composition, types and quantities of crops and livestock produced, sales and expense data, cultural practices used, and operator characteristics.

This thesis research comprises multiple tiers of analysis. The first level of analysis provides a broad contextual understanding of direct marketing in the study area through descriptive analysis of direct marketing farms (DM farms) and the larger subset of farms which do not sell directly to consumers (non-DM farms). A second level of descriptive analysis focuses on the structural, economic, and demographic characteristics of the subset of DM farms that reported having a CSA. The third level of analysis encompasses econometric modeling to isolate the profit impacts of CSA incorporation among DM farms. A final stage of analysis employs econometric modeling to determine whether profit impacts associated with CSA development vary across different subsets of DM farms stratified according to size (in sales terms) and operator characteristics.

The geographic scope of this research encompasses the greater Northeast region of the United States (hereafter, the “Northeast”). The U.S. Census Bureau defines the Northeast to include Connecticut, Delaware, Maine,

Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont. For the purposes of this study, Delaware and Maryland, which are generally classified in the Mid-Atlantic region, are included because of similarities in the scale and nature of agricultural production when compared to the other 9 states in the Northeast<sup>1</sup>.

#### **4.2 Data**

The respondent-level data utilized for this study are not published. These data were accessed through an agreement to access unpublished data through the USDA National Agricultural Statistics Service (NASS). NASS compiled the requested data and made it available for analysis at the NASS Northeastern Regional Field Office located in Harrisburg, Pennsylvania.

Section 32 of the US Census of Agriculture form collects sales data on whether farms “produce, raise or grow any crops, livestock, poultry, or agricultural products that (are) sold directly to individual consumers for human consumption”. For the purpose of this study, any agricultural product sales that were reported in this section will be defined as “direct market sales”, and any farm that reported sales within this category will be defined as a direct marketing (DM) farm. This definition includes sales from roadside stands, farmers markets, pick your own operations and door to door sales. These data do not consider craft items, non-edible products, and processed products.

The 2007 Census of Agriculture data illustrate that farms in the Northeast

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<sup>1</sup> These 11 states which I have designated as the “Northeast” also constitute the service area of the USDA’s National Agricultural Statistics Service Northeastern Regional Field Office located in Harrisburg, Pennsylvania. It was at this office that all research and processing of this data related to this thesis occurred.

rely heavily on direct marketing as part of their marketing mix. As noted previously, the region accounts for less than 5 percent of total national farm revenue, but accounts for more than one-quarter of farm direct marketing sales (Schilling et al., 2012). The importance of direct marketing in the Northeast is further revealed by the fact that most of the states within the region derive a disproportionately larger percentage of total farm sales from DM (Table 4.1). In fact, 8 of the 11 states of the Northeast rank in the top ten states in terms of the percentage of farm income derived from direct marketing.

**Table 4.1-Direct Marketing Revenue and Relative Reliance on Direct Marketing in the Northeast: Ranks Among States**

| State         | Total Farm Sales (USD 1000) | National Rank | Income from Direct Marketing of Farm Products (USD1000) | National Rank | Percent of Sales from Direct Marketing | National Rank |
|---------------|-----------------------------|---------------|---------------------------------------------------------|---------------|----------------------------------------|---------------|
| Connecticut   | 550,620                     | 46            | 30,439                                                  | 15            | 5.5%                                   | 4             |
| Delaware      | 1,274,014                   | 39            | 4,302                                                   | 45            | 0.3%                                   | 25            |
| Maine         | 763,062                     | 44            | 24,793                                                  | 21            | 3.3%                                   | 8             |
| Maryland      | 2,271,397                   | 36            | 28,038                                                  | 16            | 1.2%                                   | 12            |
| Massachusetts | 429,211                     | 47            | 47,909                                                  | 5             | 9.7%                                   | 3             |
| New Hampshire | 190,907                     | 48            | 20,321                                                  | 22            | 10.6%                                  | 1             |
| New Jersey    | 1,006,936                   | 40            | 33,308                                                  | 12            | 3.3%                                   | 7             |
| New York      | 5,415,125                   | 26            | 100,646                                                 | 2             | 1.9%                                   | 10            |
| Pennsylvania  | 7,400,781                   | 22            | 86,030                                                  | 3             | 1.2%                                   | 13            |
| Rhode Island  | 59,652                      | 49            | 6,253                                                   | 43            | 10.5%                                  | 2             |
| Vermont       | 776,105                     | 42            | 27,430                                                  | 18            | 3.5%                                   | 6             |

Sources: USDA-NASS, 2012 Census of Agriculture; Schilling et al., 2012.

### 4.3 Descriptive Analysis of Direct Marketers vs. Non-Direct Marketers

In 2007, there were 81,698 farms operating in the Northeast (USDA-NASS, 2014). Of these, 15,784 farms (19%) engaged in some form of direct to consumer marketing. The characteristics of DM farms are compared to those of non-DM farms in Table 4.2. DM farms were generally smaller in size than non-

DM farms (average farm sizes were 121 acres and 189 acres, respectively). Average net cash income (NCI) was also lower for DM farms as compared to non-DM farms (\$18,877 versus \$39,999). DM farms had a median NCI of \$278, while non-DM farms had a NCI of -\$290. Potentially, DM farms had, on average, half the NCI of non-DM farms because they managed smaller operations. DM farmers were slightly younger and also had fewer years of operating at their current location. While having less experience can be a detriment, it is encouraging to see younger farmers managing DM operations. This is particularly heartening since the average age of U.S. farm operators reported in the 2012 census increased to 58 years old.

**Table 4.2 – Comparison of Financial and Operator Characteristics for Direct Market and Non-Direct Market Farmers in the Northeast**

|                            | Direct Marketers<br>(n=15,784) |          | Non-Direct Marketers<br>(n=65,914) |          |
|----------------------------|--------------------------------|----------|------------------------------------|----------|
|                            | Mean                           | Median   | Mean                               | Median   |
| Sales Per Farm             | \$78,794                       | \$11,500 | \$147,825                          | \$8,984  |
| Net Cash Income            | \$18,877                       | \$278    | \$39,999                           | \$(-290) |
| Acres Per Farm             | 121.18                         | 56       | 189.67                             | 83       |
| Net Cash Income Per Acre   | \$310                          | \$4      | \$211                              | \$(-4)   |
| Farm Expenses Per Acre     | \$1,389                        | \$335    | \$4,502                            | \$280    |
| Principal Operator Age     | 54.8                           | 54       | 56.3                               | 56       |
| Years in Operation         | 20                             | 17       | 23                                 | 20       |
| Retired Principal Operator | 22.7%                          |          | 24.6%                              |          |

Source: USDA-NASS, 2007 Census of Agriculture

#### 4.4 Direct Marketers with and without CSAs

This section examines the differences between DM farms classified as having a CSA and those that are classified as non-CSA farms. Of the 15,784 farms that participate in direct marketing, only 801<sup>2</sup> farms incorporated a CSA as part of their marketing mix.

Table 4.3 shows the summary statistics for CSA and non-CSA farms. CSA farms reported higher sales, on average, than non-CSA farms; however, the difference was not significant. CSA farms did, on average, have slightly lower NCI per acre than non-CSA farm (\$153 versus \$155, respectively). Average expenses per acre were moderately higher for CSA farms, relative to non-CSA farms (\$662 versus \$600). Expenses differences may reflect the fact that CSA farms were more likely to have hired workers. Nearly 46% of CSA farms hired at least one laborer for less than 150 days of the year (versus 27.0% of non-CSA farms). As for longer term employment, 31.5% of CSA farms had at least one worker employed for more than 150 days of the year (versus only 16.3% of non-CSA farms). Differences in the average cost structure across CSA and non-CSA farms may also be scale-related. CSA farms were, on average, nearly 10 acres smaller than non-CSA farms (112.2 acres versus 121.9 acres, respectively). Also, CSA farms were far more likely to market organic produce, with 43.2% of CSA farms growing organically compared to only 9.2% of non-CSA farms.

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<sup>2</sup> Although 1155 farms reported including a CSA, 354 of those farms had \$0 in income from direct sales to consumers. Those farms were not included in the analysis.

**Table 4.3 – Comparison of Financial and Demographic Characteristics for Direct Market Farmers with and without CSA in the Northeast**

|                                                     | <b>CSA Farms<br/>(n=801)</b>                                                         | <b>Non-CSA Farms<br/>(n=14,983)</b>                                                | <b>Mean<br/>Difference</b> |
|-----------------------------------------------------|--------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|----------------------------|
| Average Sales Per Farm                              | \$84,803                                                                             | \$78,997                                                                           | \$5,806                    |
| Net Cash Income Per Farm                            | \$17,156                                                                             | \$18,904                                                                           | -\$1,748                   |
| Average Acres Per Farm                              | 112.2                                                                                | 121.9                                                                              | -9.7                       |
| Net Cash Income Per Acre                            | \$153                                                                                | \$155                                                                              | -\$2***                    |
| Average Expenses Per Farm                           | \$74,326                                                                             | \$73,063                                                                           | \$1,263                    |
| Expenses Per Acre                                   | \$662                                                                                | \$600                                                                              | \$62*                      |
| Principal Operator – Age                            | 50.0                                                                                 | 55.0                                                                               | -5***                      |
| Principal Operator – Retired                        | 13.2%                                                                                | 23.1%                                                                              | -9.9%***                   |
| Principal Operator – Female                         | 28.3%                                                                                | 15.7%                                                                              | 12.6***                    |
| Years in Operation                                  | 14.0                                                                                 | 20.0                                                                               | -6***                      |
| Operator Worked More Than 200 Days off Farm in 2007 | 30.2%                                                                                | 38.5%                                                                              | -8.3%***                   |
| Percent of Income from Operation                    | 38.7%                                                                                | 25.9%                                                                              | 12.8%***                   |
| Organic Producers (not certified)                   | 43.2%                                                                                | 7.5%                                                                               | 35.7%***                   |
| Type of Organization                                | Family.....73.0%<br>Partnership.....11.4%<br>Corporation.....10.9%<br>Other.....4.7% | Family.....87.0%<br>Partnership.....7.2%<br>Corporation.....5.1%<br>Other.....0.8% |                            |
| Hired at Least 1 Worker Less Than 150 Days          | 45.6%                                                                                | 27.0%                                                                              | 18.6%**                    |
| Hired at Least 1 Worker More Than 150 Days          | 31.5%                                                                                | 16.3%                                                                              | 15.2%***                   |

Source: USDA-NASS, 2007 Census of Agriculture

Note: Statistically significant means are displayed as follows: \*\*\* $p \leq .01$ , \*\* $p \leq .05$ , \* $p \leq .10$

In terms of farm operator characteristics, all of the means difference tests were statistically significant. CSA principal operators were younger than non-CSA principal operators by five years on average, and they also tended to have six years less experience on their current operations. CSA operators were almost twice as likely to be females (28.3% versus 15.7% for non-CSA farms), which is consistent with previous research on CSA farms. This number is in stark contrast to the state of U.S. agriculture in general, since only 13.9% of

principal operators were female in 2007. Principal operators of CSA farms also tended to be less likely to be retired, with only 13.2% being retired compared to 23.1% for non-CSA farms. In terms of organizational structure, CSAs tended to be involved in more partnerships, corporations and other types of organizations such as estates, trusts, grazing associations, etc.

#### 4.5 CSA Farms

There were 801 CSA farms that were included in this study after answering “yes” to the question, “At any time during 2007, did this operation market products through a community supported agriculture (CSA) arrangement?” Table 4.4 shows the distribution of Northeast CSA farms by state. The following sections will explore Northeast CSA farm and farmer characteristics in further detail.

**Table 4.4 – Distribution of Northeast CSA Farms by State**

| State             | CT | DE | ME | MD | MA | NH | NJ | NY  | PA  | RI | VT | Total<br>Northeast |
|-------------------|----|----|----|----|----|----|----|-----|-----|----|----|--------------------|
| Number<br>of CSAs | 42 | 8  | 76 | 77 | 96 | 38 | 44 | 167 | 172 | 17 | 64 | 801                |

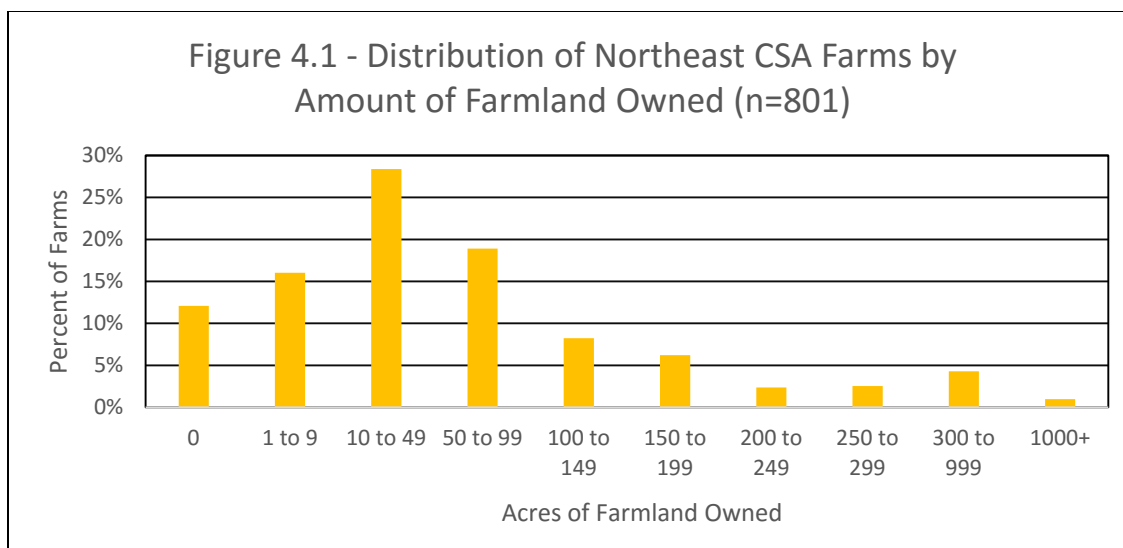
Source: Author’s analysis of respondent level 2007 Census of Agriculture data

##### 4.5.1 Land<sup>3</sup>

Figure 4.1 illustrates the distribution of land owned by CSA farmers. On average, CSA farms owned 94.8 acres of land, although this statistic does not clearly represent the nature of land ownership among CSA farms. The median amount of land owned was 35 acres. More than one-quarter (28.1%) of CSA farms owned less than 10 acres. In fact, 138 (17.2%) of the farms owned no land at all.

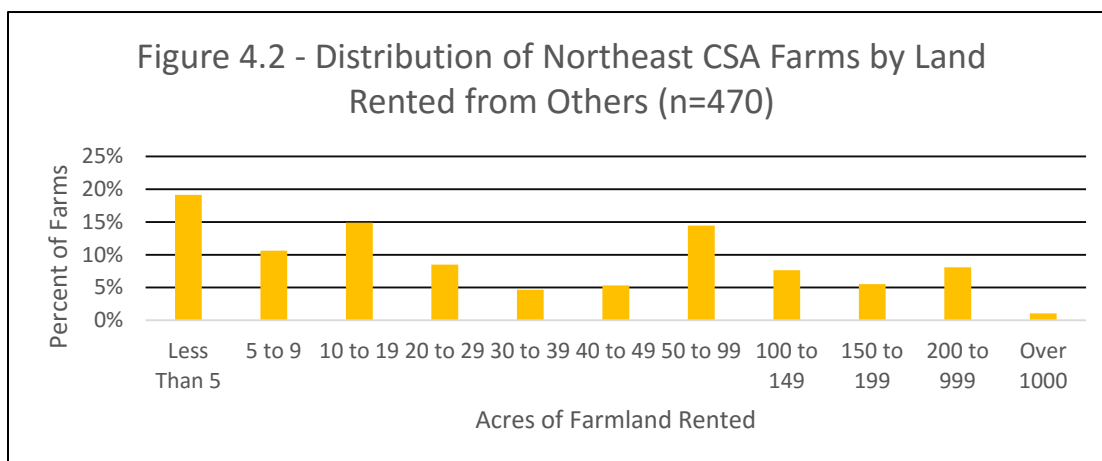
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<sup>3</sup>The Census of Agriculture does not collect data on the acreage used specifically to support CSA activity. Reported data reflect total farm size.



Source: Author's analysis of respondent level 2007 Census of Agriculture data

Figure 4.2 shows the distribution of land rented from others by CSA farmers. Out of the 801 CSA farms, 470 (58.7%) rented land from others. On average, CSA farms rented 82.7 acres, although several farmers rented over 1000 acres, which skews the mean. The median land rented is 25 acres. It is clear that many CSA farms depend on rented land to either run or expand their operations.



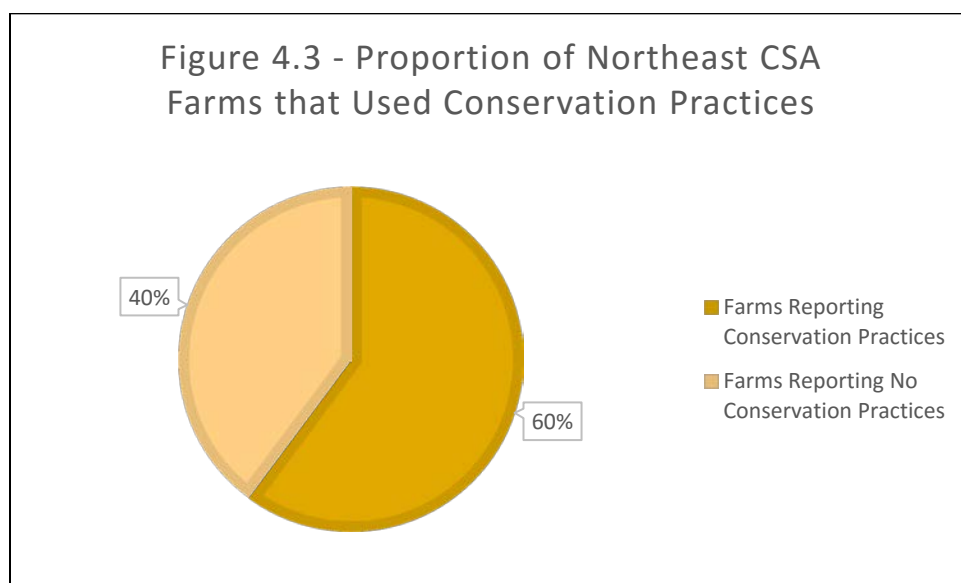
Source: Author's analysis of respondent level 2007 Census of Agriculture data

#### 4.5.2 Cultural Practices

Farming is an inherently risky business influenced by many factors outside

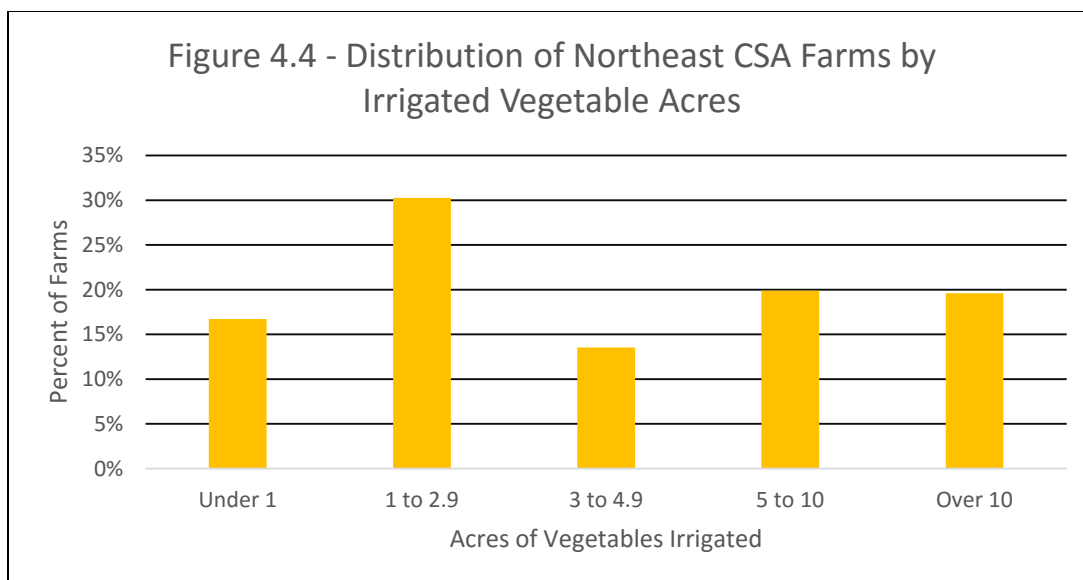
of the farmers' control. It is therefore important for farmers to implement practices which attempt to minimize loss in areas which they can control. The use of sustainable cultural practices have effects on both environmental and economic sustainability and therefore have an influence on farm viability.

The use of conservation methods, as defined by the USDA, include but are not limited to practices such as no-till or limited tilling, filtering runoff to remove chemicals, and fencing animals from streams. Sixty percent of CSA farms used some form of conservation methods (Figure 4.3). In comparison, 22.9% of all U.S. farms reported employing such methods (USDA-NASS, 2009).



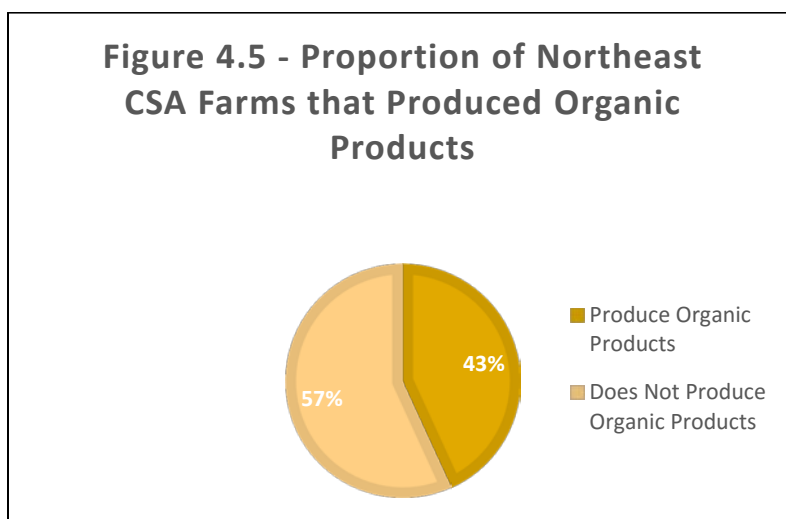
Source: Author's analysis of respondent level 2007 Census of Agriculture data

Water management can alleviate losses due to unpredictable rainfall and can help improve yields. While 30% of CSA farms used irrigation in their vegetable production, about 60% irrigated less than five acres of their vegetables (Figure 4.4). In comparison, 13.7% of all U.S. farms reported employing such methods (USDA-NASS, 2009).

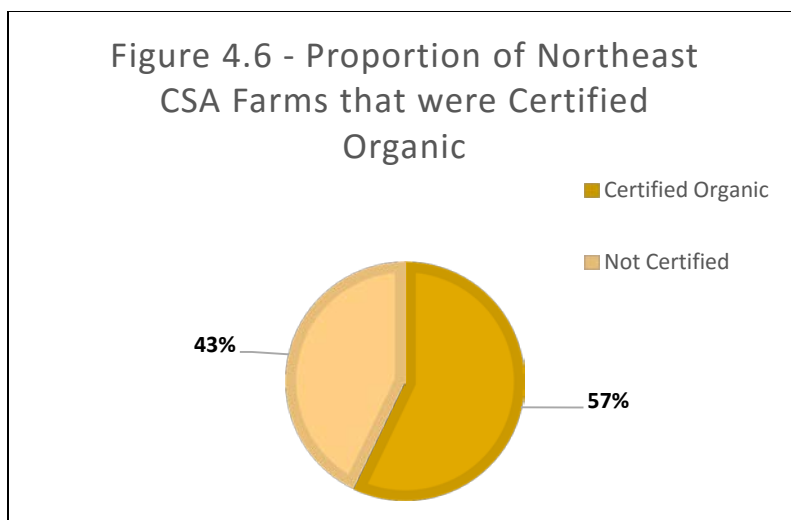


Source: Author's analysis of respondent level 2007 Census of Agriculture data

Of the 801 CSA farms, nearly half, or 346, reported producing organic products according to the National Organic Standards while 455 farms did not produce anything organically (Figure 4.5). Of those 346 farms who produce products organically, 57% had their operation certified as organic, while 43% did not have their operations certified (Figure 4.6). This is consistent with previous research on organic production at CSA farms.

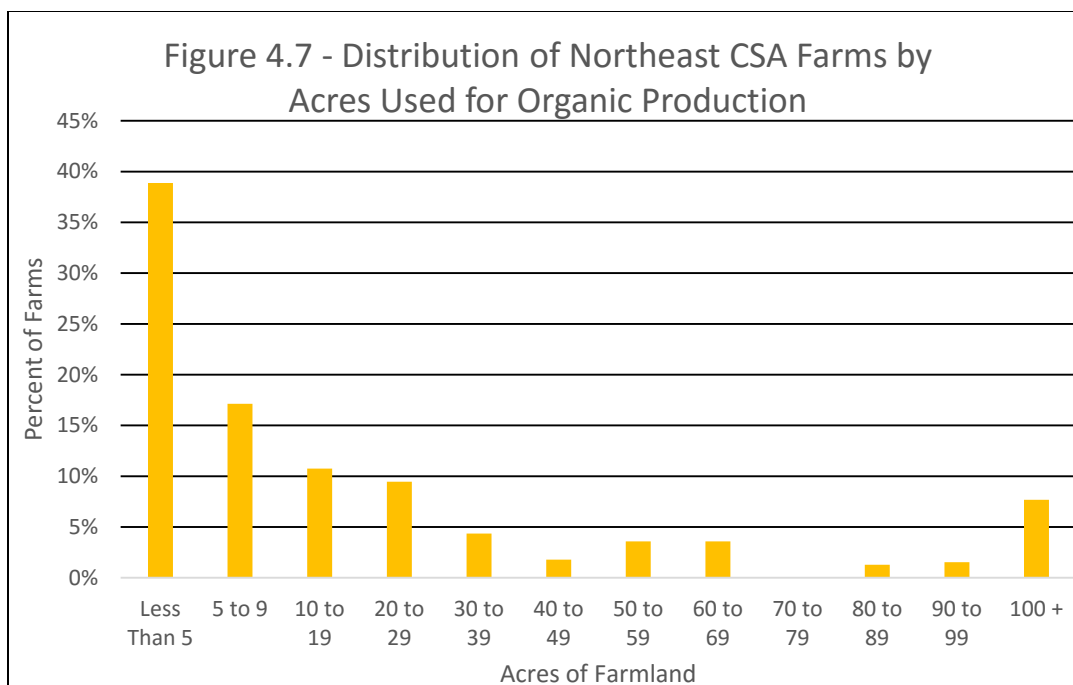


Source: Author's analysis of respondent level 2007 Census of Agriculture data

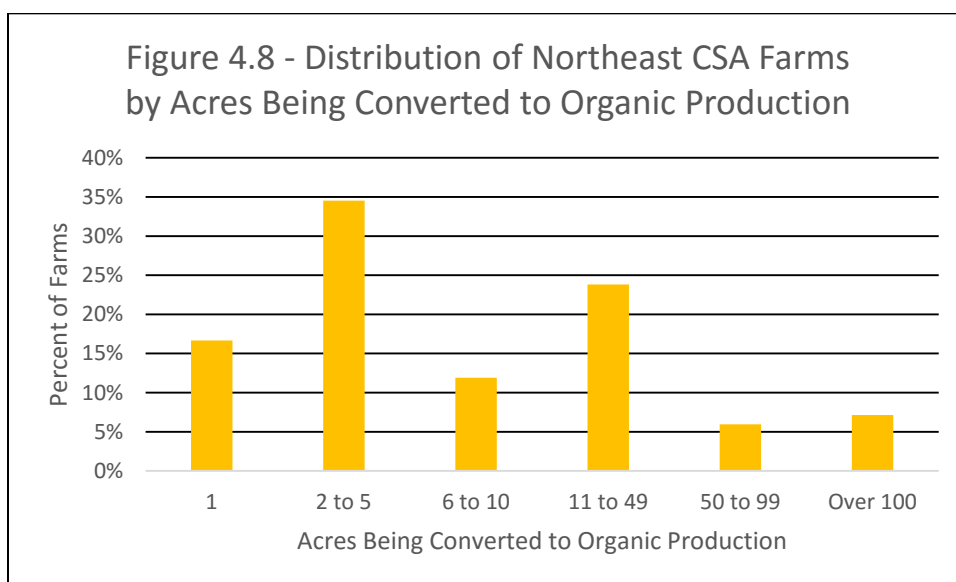


Source: Author's analysis of respondent level 2007 Census of Agriculture data

Figure 4.7 illustrates the distribution of acres used for organic production on CSA farms. In terms of organic acreage, the average CSA farm used 27.9 acres of land for organic production. Again, the number appears to be inflated due to the fact that the ten largest farms farmed more than 200 acres organically. The median acreage under organic production is 5 acres and is a better representation of the group. Due to the growing interest in organic agriculture, coupled with the higher premiums that farmers can get for organic produce, over half of CSA farms are in the process of converting their existing farmland over to certified organic, with the average farm converting 2.6 acres (Figure 4.8).

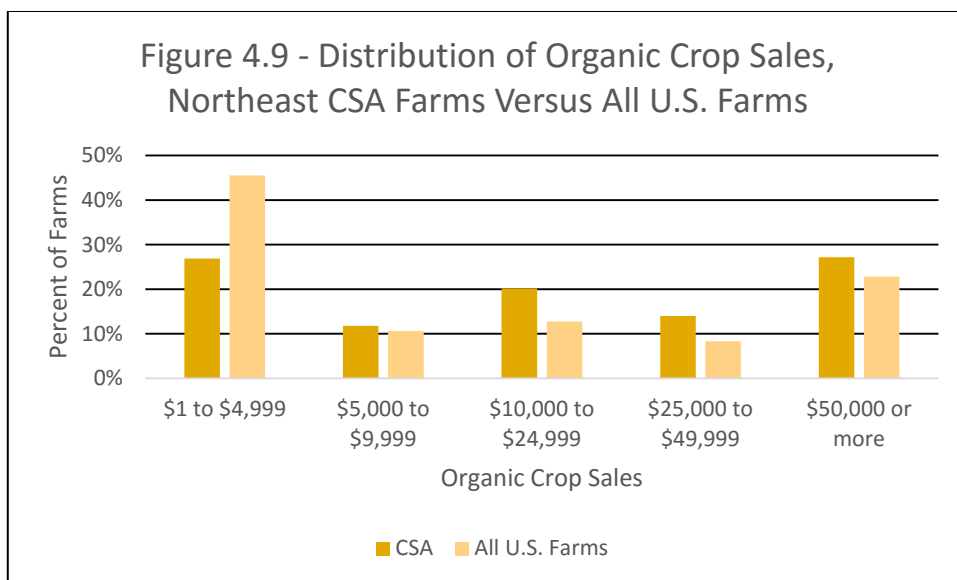


Source: Author's analysis of respondent level 2007 Census of Agriculture data



Source: Author's analysis of respondent level 2007 Census of Agriculture data

In comparing CSA farms who sell organic crops to all U.S. farms who sell organic crops, the CSA farms typically had higher organic sales. While only 31% of U.S. farms which had organic sales over \$24,999, 41% of CSA farms had organic sales over that threshold. Figure 4.9 shows the distribution of CSA farm sales of organic crops compared to all U.S. farm sales of organic crops.

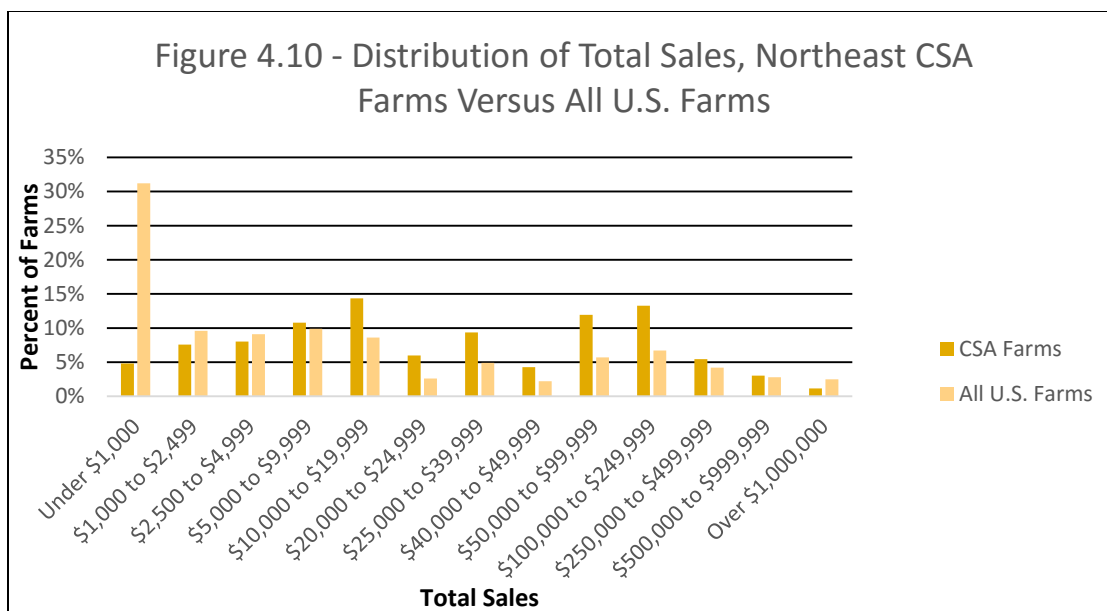


Source: Author's analysis of respondent level 2007 Census of Agriculture data

#### 4.5.3 Farm Sales

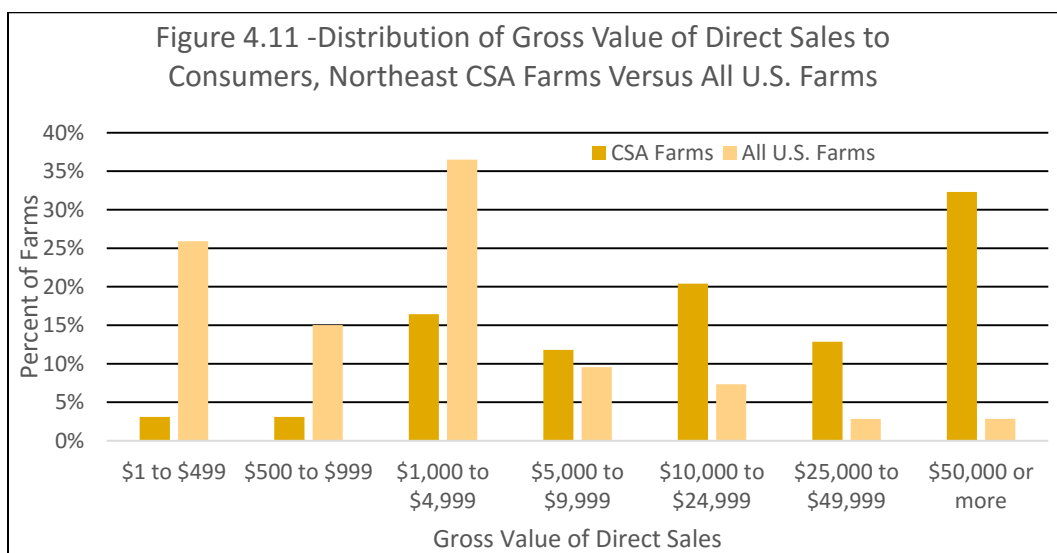
The 2007 Census of Agriculture survey does not disaggregate CSA sales from total farm sales. Therefore, this study is unable to attribute any specific percentage of total farm sales to the CSA portion of the business.

Figure 4.10 show the distribution of U.S. farms by total sales. The average total sales for CSA farms was slightly over \$100,000. However, a dozen CSA farms had sales that were in excess of \$1,000,000, skewing the average upward. Removing outliers in the distribution of CSA farm sales lowers this average to \$82,123. Nevertheless, the chart in Figure 4.10 shows that CSA farms generally produce higher sales volumes when compared to all U.S. farms. For example, 34% of CSA farms generated sales in excess of \$50,000 in 2007. As comparison, only 23% of all U.S. farms reached this sales level. At the other end of the distribution, half of U.S. farms earned \$5,000 or less in sales. Only 21% of CSA farms had sales below that threshold.



Source: Author's analysis of respondent level 2007 Census of Agriculture data

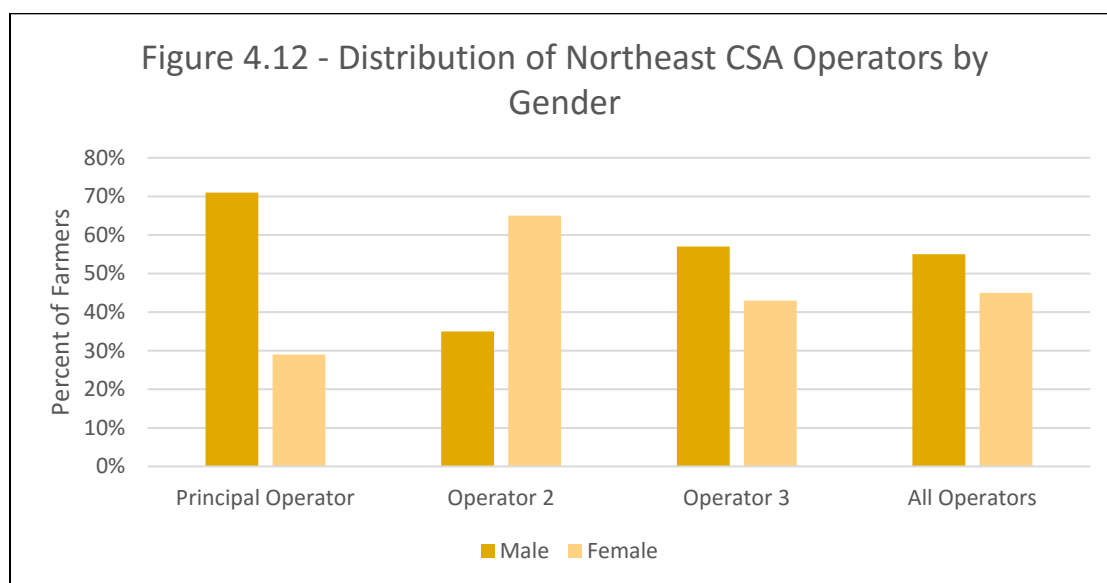
Figure 4.11 shows the distribution of direct sales for U.S. farms and Northeast CSA farms. In 2007, just over 45% of CSA farms had direct sales of \$25,000 or more, yet only 6% of all U.S. farms fell into that category. Only 22% of CSA farms had direct sales below \$5,000, while 78% of U.S. farms had direct sales that were that low.



Source: Author's analysis of respondent level 2007 Census of Agriculture data

#### 4.5.4. Operator Characteristics

Figure 4.12 shows the distribution of farms by gender, comparing Northeast CSA farms with all U.S. farms. The large majority (86.1%) of U.S. principal operators are male<sup>4</sup>. Only 13.9% are female. In marked contrast, 28% of Northeast CSA farms had a female principal operator. The 2007 Census of Agriculture also allowed farms to report up to two additional operators, in addition to the principal operator. Women accounted for 46.3% of all reported CSA operators. This finding comports with previous research on CSA farm operators (Lass et al., 2003a, Lass et al., 2003b, Tegtmeier and Duffy, 2005).



Source: Author's analysis of respondent level 2007 Census of Agriculture data

A recent expert panel was convened by the USDA's National Agricultural Statistics Service to better document the extent and nature of women's participation in agriculture. Panel deliberations specifically recognized that (1)

<sup>4</sup> The USDA defines the principal operator as the person primarily responsible for the day-to-day operation of the farm.

the roles of women as principal farm operators is often under-reported and (2) women often play lead roles in farm product marketing (Schilling, 2016).

Table 4.5 presents additional information about CSA farmer characteristics. The average age of the principal operator of CSA farms was 50 years old in 2007. The average length of time spent by principal operators working on their current farms was 14 years. The average age of the second farm operator was slightly lower and they also had less experience on their current farm compared to the principal operator. The third operator had the youngest average age, at 37 years old, and they generally had spent half the amount of time on their current operation when compared to the principal operator.

**Table 4.5 - CSA Farmer Characteristics**

|                                       | Mean  | Median |
|---------------------------------------|-------|--------|
| <b>Principal Operator</b>             |       |        |
| Age (Years)                           | 50.0  | 50     |
| Average Years on Current Farm         | 14.0  | 10     |
| Percent of Income from Farm Operation | 38.7% | 25%    |
| <b>Operator 2</b>                     |       |        |
| Age (Years)                           | 47.4  | 48     |
| Years on current farm                 | 11.3  | 8      |
| <b>Operator 3</b>                     |       |        |
| Age (Years)                           | 37.2  | 34     |
| Years on current farm                 | 7.6   | 6      |

Source: Author's analysis of respondent level 2007 Census of Agriculture data

In terms of ethnicity of CSA farmers, there was little diversity among operators. More than 97% of CSA farmers listed their ethnicity as “white”. No other race represented even 1% of the make-up of CSA farmers. While there may be more diversity in terms of gender for CSA farmers, there is still a great deal of homogeneity in terms of race.

Nearly 70% of CSA principal operators identified farming as their primary occupation. This stands in sharp contrast to the 45% of U.S. farmers who claimed their primary occupation to be farming. Most CSA principal operators worked very few days off of the farm operation. In fact, 39% of the principal operators of CSA farms indicated that they did not work off-farm in 2007. More than 50% of CSA operators worked fewer than 50 days off of the farm. But, the second most frequent response (30%) was for working over 200 days off of their farm. So while many farmers dedicated all of their time to the operation, there was still a large group that presumably was required to have another form of income from a second job.

## **Chapter 5**

### **Empirical Model**

#### **5.1 Introduction**

Although it may be the case that farms that adopt the CSA model are attempting to achieve certain goals other than economic profitability, profitability must still be an important underlying factor when considering the survival and maintenance of a farm. For that reason, it is important to assess whether the incorporation of a CSA into a farm's marketing mix will contribute positively to a farm's net cash income. While previous studies of CSA farms have looked at pricing and management factors (Sanneh et al., 2001, Lizio and Lass, 2005) that contributed to profitability, no study has looked at a range of financial and socio-demographic variables that contribute to increased profitability. The intent of this study is to develop a model to test the hypothesis that the incorporation of a CSA into a Northeastern farm's marketing mix will positively impact farm profitability.

#### **5.2 Methodology for Explaining Farm Viability**

The goal of this viability model is to identify the determinants of farm profitability and their relative effects on a farm's viability. For this study, viability is defined as the ability of a farm to cover their financial obligations which arise from the farming operation. Studying the relationship between viability and farm/farmer characteristics can provide useful information for existing and prospective farmers about operational decisions that will have a positive impact on their continued existence.

Many studies have examined the financial performance of farms to

determine the contributing factors which can be beneficial or detrimental to a farm's economic success. The financial performance of a farm is a subjective term based on the time frame which is being considered (short or long term viability), as well as the farm business and/or farm household goals (Mishra and Morehart, 2001). Due to this fact, different financial performance indicators have been used to analyze factors contributing to farm profitability. For example, Mishra and Morehart (2001) used operators' labor and management income (OLMI) to analyze the factors that contributed to U.S. dairy farm profitability. Mishra et al. (2009) used return on assets (ROA) to analyze factors affecting new and beginning farmers' financial performance. Bhuyan (2012) used net farm income to analyze factors that impact dairy farm profitability.

The conceptualization of my viability model draws from previous research on farm viability conducted by Bhuyan (2012), Mishra and Morehart (2001), and Mishra et al. (1999). The model assumes a profit-maximizing farm operator who selects the combinations of inputs and outputs that will maximize profits subject to the following production constraint (Equation 1),

$$\text{Max } \pi = [\sum P_i Q_i(k, P_i, y)] - [\sum C_i(Q_i, w_i, \eta, \theta)],$$

(1)

where  $\pi$  is net profits operationalized in this study as net cash income,  $P_i$  is a vector of output prices,  $Q_i$  is a vector of output produced,  $k$  is a vector of farm operator characteristics and  $y$  is a vector of various farm characteristics. For the cost side,  $C_i$  represents the cost of production which depends on  $Q_i$ , the quantity produced,  $w_i$ , a vector of output prices,  $\eta$ , a vector of farmer characteristics, and

$\theta$ , a vector of farm characteristics.

Based on Equation 1, the following model can be estimated:

$$NCI = \alpha_0 + \sum \alpha_{ij} X_{ij} + \varepsilon, \quad (2)$$

where NCI is net cash income,  $\alpha_{ij}$  is a vector of parameters to be estimated,  $X_{ij}$  is a vector of farm, operator and financial characteristics, and  $\varepsilon$  is the unexplained random component.

### 5.3 Econometric Model

An econometric model was developed to explain the impact of incorporating a CSA on the profitability of DM farms in the Northeast. Drawing from research on factors that affect farm viability, the model incorporates farm structural and cultural characteristics, along with farm operator characteristics, to explain the factors which affect farm income. Since the goal of the analysis is to determine the impact of including a CSA as part of a farm's marketing mix, a binary CSA variable is included as an explanatory variable. My hypothesis is that the inclusion of a CSA as part of a farm's marketing mix will have a positive impact on a farm's net cash income and will therefore increase farm viability for farmers in the Northeast.

#### 5.3.1 Dependent Variable

Net cash income (NCI) is used as a proxy for farm viability because it relates directly to the profitability of a farm. Net cash income, as defined in the Census of Agriculture, is derived by subtracting total farm expenses from total sales, government payments, and other farm-related income. Previous researchers have noted that there are limitations to using NCI as the sole

performance measure of farm financial performance. For example, due to the fact that it is an accounting measure, NCI does not take opportunity costs into account. Therefore, it may not accurately reflect the resource base (Mishra and Morehart, 2001). Nevertheless, NCI is used as a proxy for measuring profitability because it is the best measure available from the 2007 Census of Agriculture.

The dependent variable is defined as net cash income per acre. The purpose of using normalizing NCI on a per-acre basis is to control for the effects of farm scale. This is especially important because of the range of farm sizes and NCI.

Table 5.1 shows the distribution of NCI among all 15,784 DM farms in the Northeast region. Approximately 49% of DM farms report having negative net cash income, while another 32% have an income range of only \$1-\$25,000.

**Table 5.1 – Distribution of Net Cash Income Among Direct Market Farms in the Northeast**

| <b>Net Income</b>      | <b>Frequency<br/>(n=15,784)</b> | <b>Percent</b> | <b>Cumulative<br/>Percent</b> |
|------------------------|---------------------------------|----------------|-------------------------------|
| -3,000,000 to -400,000 | 16                              | 0.10%          | 0.10%                         |
| -399,999 to -300,000   | 10                              | 0.06%          | 0.16%                         |
| -299,999 to -200,000   | 31                              | 0.20%          | 0.36%                         |
| -199,999 to -100,000   | 115                             | 0.73%          | 1.09%                         |
| -99,999 to -50,000     | 257                             | 1.63%          | 2.72%                         |
| -49,999 to 0           | 7259                            | 45.99%         | 48.71%                        |
| 1 to 25,000            | 5047                            | 31.98%         | 80.68%                        |
| 25,001 to 50,000       | 1123                            | 7.11%          | 87.80%                        |
| 50,001 to 100,000      | 947                             | 6.00%          | 93.80%                        |
| 100,001 to 150,000     | 381                             | 2.41%          | 96.21%                        |
| 150,001 to 200,000     | 185                             | 1.17%          | 97.38%                        |
| 200,001 to 300,000     | 191                             | 1.21%          | 98.59%                        |
| 300,001 to 500,000     | 137                             | 0.87%          | 99.46%                        |
| Greater than 500,001   | 85                              | 0.54%          | 100.00%                       |

(Source: USDA-NASS, 2007 Census of Agriculture)

### **5.3.2 Independent Variables**

A list of independent variables and their descriptions is presented in table

5.2.

**Table 5.2 – Farm and Farm Operator Variables included in Econometric Model**

| Variable            | Description                                                                                                                                                            | Expected Sign |
|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| CSA                 | Marketed products through a community supported agriculture (CSA) arrangement. 1=Yes 0=No                                                                              | +             |
| salesperacre        | Gross value of agricultural products sold per acre (in \$)                                                                                                             | +             |
| Totalexpenditures   | Total production expenses for the operation (in \$)                                                                                                                    | –             |
| depreciationexpense | Depreciation expense for all capital assets for the operation (in \$)                                                                                                  | –             |
| operatorage         | Primary operator age (in years)                                                                                                                                        | ?             |
| Numberoperators     | Number of operators working the operation                                                                                                                              | +             |
| Occupationfarming   | Occupation that the primary operator spent the majority of their worktime<br>1 = 50% or more time at farm<br>0= less than 50% time at farm                             | +             |
| Totalacres          | Total acres of the operation (includes owned, rented and leased acres) (in acres)                                                                                      | +             |
| Ownedland           | Did the operator own any of the farmland<br>1=Yes 0=No                                                                                                                 | +             |
| Organic             | Did the operation produce and sell organic products according to the National Organic Standards<br>1=Yes 0=No                                                          | +             |
| Conserve            | Did the operation use conservation methods such as no-till or limited tilling, filtering run-off to remove chemicals, fencing animals from streams, etc.<br>1=Yes 0=No | ?             |
| Hiredworkers        | Did the operation have any hired labor, including paid family members and office workers<br>1=Yes 0=No                                                                 | ?             |
| reg1                | Maine, Vermont and New Hampshire (binary: 1=Yes 0=No)                                                                                                                  | ?             |
| reg2                | Massachusetts, Connecticut and Rhode Island (binary: 1=Yes 0=No)                                                                                                       | ?             |
| reg3                | New York, New Jersey, and Pennsylvania (binary: 1=Yes 0=No)                                                                                                            | ?             |

The key independent variable for this study is the CSA variable. A significant and positive coefficient will indicate that the inclusion of a CSA in a farm's marketing mix is beneficial to a farm's economic viability. CSA is a binary variable, where 0 means that the farm did not market any products through a CSA arrangement and 1 means that the farm did market through a CSA.

Previous studies of direct market farms have included CSA marketing as part of their analyses of contributions from different marketing techniques. According to Uematsu and Mishra (2011), the use of CSA as a direct marketing strategy had a negative effect on gross cash farm income, but it was not statistically significant. Cheng, Bills and Uva (2011) found that inclusion of a CSA for direct marketers in the Northeast had a large positive effect on direct food sales.

Several financial-related variables were included in the model. SALESPERACRE is a production indicator which divides total farm sales by farm size (in acres). The variable is used as a measure of production intensity based on the assumption that a farm which utilizes land more efficiently will operate more profitably. This was done because of the fact that most of the CSA farms operate on less than 100 acres, while farms without CSAs operate on nearly twice as much land. Adelaja and Sullivan (1998) found that gross farm income per acre had a positive impact on NCI for New Jersey farms operating on the urban fringe.

TOTALEXPENSES is included to account for the amount of money spent

by the operation and is expected to decrease NCI per acre. Total expenses accounts for all farm expenses except for depreciation expenses. Additionally, DEPRECIATIONEXPENSE is included in the model as a measure of capital expenditures, because it allows the expensing of capital purchases over multiple years. It is the only expense that is not included in the calculation of total expenses and therefore, it is also not included in the calculation of net cash income.

Previous literature on agricultural viability included socio-demographic characteristics such as operator age, experience, and number of decision makers working on the farm. Mishra et al. (2009) found that there was an inverted U-shaped relationship between farm operator age and financial performance. Young farmers were more likely to exhibit lower financial performance, partly based on their lack of experience and their lack of farm assets. Older farmers, in contrast, had a greater likelihood of positive financial performance, possibly due to their experience and their ability to allocate resources more efficiently, but that as farmers reached the end of their careers, financial performance declined. Adelaja and Sullivan (1998) found that operator age had a negative impact on NCI, which indicated that older farmers operated less viable farms, which they attributed to older farmers having less vigor and being less innovative.

OCCUPATIONFARMING is a binary variable where 0 indicates that a principal operator spent more than 50% of their worktime off of the farm and 1 indicates that they spent more than 50% of their time on the farming operation.

Mishra et al. (2009) and Mishra and Morehart (2001) found that farm operators who held off farm jobs had lower financial performance. This is attributed to the fact that an off-farm job will detract from farm management effort.

The variable NUMBEROPERATORS captures the number of people who worked on the farm who had decision making and managerial responsibility. The 2007 Census of Agriculture enumerates up to three farm operators, so the number of operators could potentially be higher than what is reported. Mishra et al. (2009) found that the management strategy of increasing the number of decision makers can have a positive effect on financial performance. They attribute the increase in financial performance to the potential of various people contributing different expertise in various aspects of farm management.

TOTALACRES measures the effects of farm size on farm viability. Adelaja and Sullivan (1998) found that smaller farms operating at the urban fringe are less economically viable than farms with more acreage. Park et al. (2014) found that total acres had a significant positive impact on farm earnings. It is expected that the total farm acreage will be positively correlated with net cash income per acre.

The CONSERVE and ORGANIC variables to account for the cultural practices that farmers may implement which could have an effect on NCI. The organic production indicator is important because the majority of CSA farms grow produce organically. Omission of this variable could therefore obfuscate effects of incorporating a CSA on viability. Detre et al. (2011) found that direct market farms with organic production had higher gross sales when compared to farms

that did not have organic production.

Lastly, HIREDWORKERS is included as a partial measure of farm size and efficiency, because larger farms will most likely need more hired workers to help maintain the farmland and market the produce, while smaller farms have the potential to operate without the aid of hired workers because they have less land to manage. El-Osta and Johnson (1998) found that hired labor on dairy farms could have either a positive or a negative effect on net returns for commercial dairies. For that reason, no assumptions were made about the effects of having hired workers.

Regional dummy variables were included to divide the Northeast into smaller regions. It is hypothesized that farms in different regions operate differently based on variability in the price and availability of land, access to markets, and variations in season length. REG1 includes Maine, Vermont, and New Hampshire. REG2 includes Massachusetts, Connecticut, and Rhode Island. REG3 included New York, New Jersey, and Pennsylvania. The base region includes Maryland and Delaware.

The empirical model developed to explain the impact of incorporating a CSA on the economic performance of DM farms is as follows:

$$\begin{aligned} \text{NCI} = & b_0 + b_1\text{CSA} + b_2\text{SALESPERACRE} + b_3\text{TOTALACRES} + \\ & b_4\text{OWNEDLAND} + b_5\text{TOTALEXPENSES} + b_6\text{DEPRECIATIONEXPENSE} \\ & + b_7\text{OCCUPATIONFARMING} + b_8\text{OPERATORAGE} + \\ & b_9\text{NUMBEROPERATORS} + b_{10}\text{HIREDWORKERS} + b_{11}\text{ORGANIC} + \\ & b_{12}\text{CONSERVE} + b_{13}\text{REG1} + b_{14}\text{REG2} + b_{15}\text{REG3} + U. \quad (3) \end{aligned}$$

In Equation 3,  $U$  is an error term assumed to be independently and normally distributed with a mean of zero and a constant variance.

## **5.5 Model Classifications**

Not all farms operate at the same scale or with the same goals. It was therefore deemed useful to refine the econometric modeling by estimating the empirical model in Equation 3 using the full sample of Northeast direct market farms and a series of subsets constructed in accordance with the USDA Economic Research Service (ERS) farm typology (Hoppe and MacDonald, 2013). The ERS typology classifies farms into more homogenous cohorts based on scale and operator characteristics. A similar modeling approach was used in recent assessments of the impacts on farm profitability associated with participation in a state farmland preservation program (Schilling et al., 2014a) and the development of agritourism (Schilling et al., 2014b)

### **5.5.1 Model 1**

Model 1 includes all Northeast farms that reported direct marketing sales to consumers. This sample included 15,784 farms, of which 801 included CSAs as part of their marketing mix.

### **5.5.2 Models 2-8**

The ERS typology<sup>5</sup> separates farms into small family farms with sales less than \$250,000, and large-scale family farms with sales greater than \$250,000. Small family farms are further divided into 5 subgroups. The first

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<sup>5</sup> The ERS farm typology that was used for this study was the original typology that was being used at the time of the 2007 U.S.D.A. Census of Agriculture. It has since been revised, with changes to the farm size measurements and with the limited resource farmer group removed.

classification is *retirement farms*, which have gross farm sales less than \$250,000 and a primary operator who is retired (Model 2). The second classification is *residential/lifestyle farms*, which have gross sales less than \$250,000 and a primary operator who spent less than fifty percent of their work time on the farm (Model 3). The third classification is *limited resource farms*, who have gross sales less than \$100,000 and total household income of less than \$20,000 (Model 4). The fourth classification is *farm occupation with low-sales*, which includes farms where the primary operator spent more than fifty percent of their work time on the farm and the farm had gross sales less than \$100,000 (Model 5). The fifth classification is *farm occupation with medium-sales*, which includes farms where the primary operator spent more than fifty percent of their work time on the farm and the farm had gross sales between \$100,000 and \$250,000 (Model 6). The sixth classification is *large family farms*, which includes farms with sales between \$250,000 and \$500,000 (Model 7). The seventh classification is *very large family farms*, which includes farms with sales greater than \$500,000 (Model 9). Table 5.3 includes statistics for each farm classification, based on the population of DM farms in the Northeast.

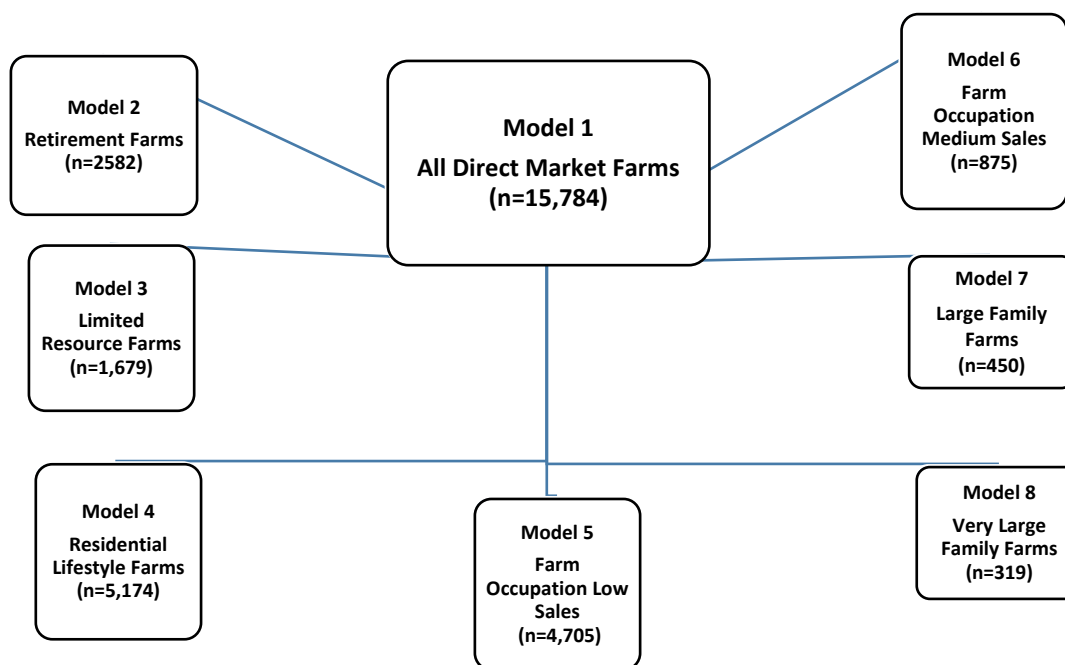
**Table 5.3 – Distribution of Direct Market Farms in the Northeast by ERS Farm Type**

|                              | Number of Farms | Average Total Sales | Acres Per Farm | Average Net Cash Income | No. that Included CSA |
|------------------------------|-----------------|---------------------|----------------|-------------------------|-----------------------|
| Retirement Farms             | 2,582           | \$ 17,825           | 89.1           | \$ 2,363                | 80                    |
| Residential/Lifestyle Farms  | 5,174           | \$ 13,381           | 75.7           | \$ (-892)               | 188                   |
| Limited Resource Farms       | 1,679           | \$ 14,777           | 82.0           | \$ (-1,762)             | 101                   |
| Farm Occupation/Low Sales    | 4,705           | \$ 23,576           | 103.5          | \$ 4,458                | 309                   |
| Farm Occupation/Medium Sales | 875             | \$ 163,344          | 202.4          | \$ 53,416               | 64                    |
| Large Family Farms           | 450             | \$ 347,513          | 337.0          | \$ 109,487              | 37                    |
| Very Large Family Farms      | 319             | \$ 1,343,251        | 592.9          | \$ 330,643              | 20                    |
| All Northeast DM Farms       | 15,784          | \$ 78,794           | 121.2          | \$ 18,877               | 801                   |

(Source: USDA-NASS, 2007 Census of Agriculture)

Figure 5.1 summarizes the farm groups corresponding to each model.

**Figure 5.1: Farm Selection Tree for Model Specifications**



## Chapter 6

### Results

#### 6.1 Empirical Results

SAS 9.3 was used to estimate all models. Initial modeling employed ordinary least squares (OLS) regression (Gujarati, 2003). Examination of the models' residuals plotted against fitted values, however, revealed non-constant variance (see Appendix 1 for a plot graph derived from model 1) indicating that the models are not linear. Because the residuals had a skewed distribution, it was therefore necessary to examine different functional forms.

Due to the fact that the model was non-linear, transformation through the use of natural logs was implemented for all non-negative, continuous variables<sup>6</sup>. Taking the natural logs of non-negative, continuous variables was advisable because the residuals had a skewed distribution (Greene, 2011) and taking the natural log can help mitigate the effects of outliers in the data and result in a more normal distribution (Keene, 1995). After considering the results from each of the new models, it was determined that a partial linear-log model had the best fit, and was therefore implemented as the model used for the analysis. The model results display a smaller number of observations for each model due to missing values for some of the variables, but the dropped observations did not negatively impact the results.

The parameter estimates for all eight models are provided in Tables 6.1-6.4. Model 1 had an F statistic of .99 with an adjusted R-squared value of .056,

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<sup>6</sup> The following variables had the natural log taken in all of the models: Total acres, sales per acre, total expenses, operator age, and number of operators.

meaning that model is a good fit but does not have strong explanatory power. The CSA variable had a positive value but the variable is not statistically significant. Therefore it cannot be stated that DM farms in the Northeast that incorporate a CSA as part of their marketing mix have a higher NCI per acre than their counterparts without CSAs. Sales per acre, which was used as a measure of production intensity, was positive and statistically significant. Total acres, hired workers and occupation farming all had positive values and were statistically significant. Total expenses, which included all expenses except for depreciation expenses, was statistically significant and had a negative value. Operator age was statistically significant and had a negative value. The number of operators was statistically significant and had a negative value, meaning that increasing the number of operators is correlated with a decrease in NCI per acre.

In models 2 through 6, the F statistics were all .99, and the adjusted R-squared values were all below 0.25. For models 2, 5, and 6, the CSA variable had negative values, but lacked statistical significance. In models 3 and 4, the CSA variable had positive values, but again lacked statistical significance. In models 2 through 6, sales per acre and total acres had positive values and were statistically significant. Total expenses had negative values for all models and was statistically significant.

**Table 6.1: Econometric Models 1 & 2: Results**

|                   | <b>Model 1</b>                     |               | <b>Model 2</b>                        |               |
|-------------------|------------------------------------|---------------|---------------------------------------|---------------|
| <b>Variable</b>   | <b>All DM Farms<br/>(n=12,736)</b> |               | <b>Retirement Farms<br/>(n=3,005)</b> |               |
|                   | Coefficient                        | p-value       | Coefficient                           | p-value       |
| INTERCEPT         | 1214.728**                         | 0.0198        | (-784.734)                            | 0.5355        |
| lnSALESPERACRE    | 534.606***                         | <.0001        | 554.966***                            | <.0001        |
| lnTOTALACRES      | 490.304***                         | 0.0001        | 405.838***                            | <.0001        |
| OWNEDLAND         | (-123.686)                         | 0.2393        | (-500.713)**                          | 0.0242        |
| lnTOTALEXPENSE    | (-518.987)***                      | <.0001        | (-410.595)***                         | <.0001        |
| DEXPENSE          | 0.000089                           | 0.9677        | 0.00319                               | 0.4623        |
| OCCUPATIONFARMING | 222.087***                         | <.0001        | 7.229                                 | 0.9296        |
| lnOPERAGE         | (-230.834)*                        | 0.0377        | 195.000                               | 0.4888        |
| lnNUMBEROPERS     | (-196.136)***                      | 0.0018        | (-147.802)*                           | 0.0959        |
| HIREDWORKERS      | 19.082***                          | 0.0044        | (-80.434)***                          | <.0001        |
| ORGANIC           | 4.947                              | 0.9575        | 179.793                               | 0.2229        |
| CONSERVE          | -9.939                             | 0.8601        | (-28.519)                             | 0.7414        |
| <b>CSA</b>        | <b>106.295</b>                     | <b>0.4002</b> | <b>(-223.19876)</b>                   | <b>0.2810</b> |
| REG1              | 44.560                             | 0.7106        | 143.471                               | 0.3744        |
| REG2              | 151.351                            | 0.2276        | 120.716                               | 0.4737        |
| REG3              | 69.140                             | 0.5172        | 65.375                                | 0.6432        |
|                   |                                    |               |                                       |               |
| R-Squared         | 0.0568                             |               | 0.1238                                |               |
| Adj. R-Squared    | 0.0557                             |               | 0.1194                                |               |

A single asterisk (\*) indicates that the coefficient is significant at the  $\alpha=.10$  level

A double asterisk (\*\*) indicates that the coefficient is significant at the  $\alpha=.05$  level

A triple asterisk (\*\*\*) indicates that the coefficient is significant at the  $\alpha=.01$  level

**Table 6.2: Econometric Models 3 & 4: Results**

| Variable          | Model 3                             |               | Model 4                                  |               |
|-------------------|-------------------------------------|---------------|------------------------------------------|---------------|
|                   | Limited Resource Farms<br>(n=1,894) |               | Residential/Lifestyle Farms<br>(n=5,959) |               |
|                   | Coefficient                         | p-value       | Coefficient                              | p-value       |
| INTERCEPT         | 684.093                             | 0.4164        | 3751.219***                              | 0.0012        |
| lnSALESPERACRE    | 475.022***                          | <.0001        | 466.978***                               | <.0001        |
| lnTOTALACRES      | 543.965***                          | <.0001        | 721.786***                               | <.0001        |
| OWNEDLAND         | (-220.298)                          | 0.1899        | 702.106***                               | 0.0033        |
| lnTOTALEXPENSE    | (-611.835)***                       | <.0001        | (-844.068)***                            | <.0001        |
| DEPEXPENSE        | 0.00687                             | 0.3195        | (-0.00673)                               | 0.1649        |
| OCCUPATIONFARMING | 240.395**                           | 0.0133        | N/A                                      | N/A           |
| lnOPERAGE         | 122.984                             | 0.4942        | (-428.840)*                              | 0.0854        |
| lnNUMBEROPERS     | 175.143                             | 0.1060        | (-378.855)***                            | 0.0043        |
| lnHIREDWORKERS    | (-95.766)***                        | <.0001        | 36.287                                   | 0.1583        |
| ORGANIC           | 121.148                             | 0.3968        | (-30.659)                                | 0.8843        |
| CONSERVE          | 37.029                              | 0.7156        | 198.619                                  | 0.1088        |
| <b>CSA</b>        | <b>30.050</b>                       | <b>0.8774</b> | <b>215.216</b>                           | <b>0.4618</b> |
| REG1              | (-47.323)                           | 0.8142        | 10.327                                   | 0.9666        |
| REG2              | (-124.520)                          | 0.5614        | 80.425                                   | 0.7554        |
| REG3              | (-19.238)                           | 0.9179        | 34.366                                   | 0.8750        |
|                   |                                     |               |                                          |               |
| R-Squared         | 0.1301                              |               | 0.0440                                   |               |
| Adj. R-Squared    | 0.1232                              |               | 0.0417                                   |               |

A single asterisk (\*) indicates that the coefficient is significant at the  $\alpha=.10$  level

A double asterisk (\*\*) indicates that the coefficient is significant at the  $\alpha=.05$  level

A triple asterisk (\*\*\*) indicates that the coefficient is significant at the  $\alpha=.01$  level

**Table 6.3: Econometric Models 5 & 6:Results**

| Variable          | Model 5                                        |               | Model 6                                         |               |
|-------------------|------------------------------------------------|---------------|-------------------------------------------------|---------------|
|                   | Farming Occupation<br>Lower Sales<br>(n=5,428) |               | Farming Occupation<br>Medium Sales<br>(n=1,022) |               |
|                   | Coefficient                                    | p-value       | Coefficient                                     | p-value       |
| INTERCEPT         | (-1217.919)                                    | 0.2120        | (-5364.872)                                     | 0.1398        |
| lnSALESPERACRE    | 619.109***                                     | <.0001        | 1898.678***                                     | <.0001        |
| lnTOTALACRES      | 290.582***                                     | <.0001        | 971.585***                                      | 0.0018        |
| OWNEDLAND         | (-939.622)***                                  | <.0001        | (-214.899)                                      | 0.3291        |
| lnTOTALEXPENSE    | (-206.689)***                                  | <.0001        | (-1141.911)***                                  | <.0001        |
| DEXPENSE          | (-0.00273)                                     | 0.4647        | 0.00135                                         | 0.5290        |
| OCCUPATIONFARMING | N/A                                            | N/A           | N/A                                             | N/A           |
| lnOPERAGE         | 73.077                                         | 0.7103        | 331.392                                         | 0.2635        |
| lnNUMBEROPERS     | (-84.821)                                      | 0.4625        | 133.787                                         | 0.4197        |
| lnHIREDWORKERS    | (-80.891)***                                   | <.0001        | (-5.318)                                        | 0.5969        |
| ORGANIC           | 167.428                                        | 0.2823        | 48.533                                          | 0.8530        |
| CONSERVE          | (-122.128)                                     | 0.2300        | 103.633                                         | 0.5005        |
| <b>CSA</b>        | <b>(-231.633)</b>                              | <b>0.2445</b> | <b>(-483.903)</b>                               | <b>0.1019</b> |
| REG1              | (-208.316)                                     | 0.3203        | (-33.470)                                       | 0.9296        |
| REG2              | (-241.439)                                     | 0.2695        | (-168.142)                                      | 0.6547        |
| REG3              | (-363.053)*                                    | 0.0513        | (-33.960)                                       | 0.9152        |
|                   |                                                |               |                                                 |               |
| R-Squared         | 0.0654                                         |               | 0.2298                                          |               |
| Adj. R-Squared    | 0.0630                                         |               | 0.2191                                          |               |

A single asterisk (\*) indicates that the coefficient is significant at the  $\alpha=.10$  level

A double asterisk (\*\*) indicates that the coefficient is significant at the  $\alpha=.05$  level

A triple asterisk (\*\*\*) indicates that the coefficient is significant at the  $\alpha=.01$  level

For model 7, the F statistic was .99 and the adjusted R-squared value was 0.26. The CSA variable had a positive value and was statistically significant at the 5% level. The value of the variable was 4476.87, meaning that large family farms that incorporated a CSA as part of their marketing mix had NCI per acre that was \$4,476.87 higher than farms that did not incorporate a CSA. Sales per acre, total acres and operator age all had positive values and were statistically significant. Total expenses was statistically significant and had a negative value.

For model 8, the CSA variable had a negative value but was not statistically significant. Sales per acre was statistically significant and had a positive value. Total expenses and the organic production indicator were both statistically significant and had negative values.

**Table 6.4: Econometric Models 7 & 8: Results**

| Variable          | Model 7                       |               | Model 8                            |               |
|-------------------|-------------------------------|---------------|------------------------------------|---------------|
|                   | Large Family Farms<br>(n=545) |               | Very Large Family Farms<br>(n=385) |               |
|                   | Coefficient                   | p-value       | Coefficient                        | p-value       |
| INTERCEPT         | (-10007.000)                  | 0.7755        | (-9872.697)                        | 0.6395        |
| lnSALESPERACRE    | 11179.000***                  | 0.0002        | 8363.962***                        | <.0001        |
| lnTOTALACRES      | 7764.758***                   | 0.0093        | 2850.365                           | 0.1475        |
| OWNEDLAND         | (-1264.235)                   | 0.4997        | (-2738.440)                        | 0.2924        |
| lnTOTALEXPENSE    | (-9896.249)***                | <.0001        | (-5397.456)***                     | 0.0002        |
| DEXPENSE          | (-0.00323)                    | 0.6636        | (-0.00079)                         | 0.8051        |
| OCCUPATIONFARMING | (-1951.430)                   | 0.3946        | (-249.706)                         | 0.9153        |
| lnOPERAGE         | 3890.700*                     | 0.0829        | 1174.644                           | 0.7154        |
| lnNUMBEROPERS     | (-573.083)                    | 0.6182        | 1722.545                           | 0.1824        |
| lnHIREDWORKERS    | (-40.640)                     | 0.4731        | (-0.976)                           | 0.9213        |
| ORGANIC           | 927.259                       | 0.6248        | (-5291.117)*                       | 0.0605        |
| CONSERVE          | 1312.456                      | 0.2785        | 616.788                            | 0.6717        |
| <b>CSA</b>        | <b>4476.873**</b>             | <b>0.0364</b> | <b>(-75.816)</b>                   | <b>0.9808</b> |
| REG1              | (-2912.096)                   | 0.2151        | (-338.274)                         | 0.9163        |
| REG2              | (-452.150)                    | 0.8544        | (-2562.619)                        | 0.4232        |
| REG3              | (-2703.199)                   | 0.1593        | (-991.316)                         | 0.7228        |
|                   |                               |               |                                    |               |
| R-Squared         | 0.2784                        |               | 0.2592                             |               |
| Adj. R-Squared    | 0.2580                        |               | 0.2291                             |               |

A single asterisk (\*) indicates that the coefficient is significant at the  $\alpha=.10$  level

A double asterisk (\*\*) indicates that the coefficient is significant at the  $\alpha=.05$  level

A triple asterisk (\*\*\*) indicates that the coefficient is significant at the  $\alpha=.01$  level

## **Chapter 7**

### **Summary and Conclusions**

#### **7.1 Summary and Conclusions**

The number of farms in the United States has been in a sharp decline over the past century. This is especially true in the Northeast region of the U.S., where urbanization has created additional pressures on farm viability. The Northeast in particular faces challenges such as high input costs, a regulatory burden stemming from rural-urban conflicts and land values which are increasing rapidly due to competition for farmland from developers (Adelaja, 1995). These factors have led many Northeast farmers to consider utilizing direct marketing to consumers as a way of increasing revenue (Govindasamy et al., 1999). While there have been studies which analyzed the effectiveness of different forms of direct marketing, such as pick-your-own, farmers' markets, and roadside stands, there is a knowledge gap in regards to the efficacy of the CSA model as a tool for promoting farm viability.

Using respondent level Census of Agriculture data, I examined the structural, economic and demographic characteristics of CSA farms in the Northeastern U.S. I performed econometric modeling to study whether meaningful differences in financial performance existed between farm direct marketers that have incorporated the CSA model into their farm enterprise and those that have not. Finally, I evaluated whether the profit impacts associated with CSA farms varied across more homogenous subsets of farms using the USDA's Economic Research Service's farm typology.

In the Northeast, CSA farms, in comparison to direct market (DM) farms that did not incorporate a CSA, had a slightly lower net cash income (NCI) per acre. On average, CSA farms had higher expenses per acre, which could be one possible explanation of why they had slightly lower NCI per acre. CSA principal operators tended to be younger and fewer of them were retired when compared to non-CSA principal operators. This is an important finding considering that the average age of U.S. farmers is increasing. It suggests that the CSA model could be a potential entrance strategy for young and beginning farmers. Fewer CSA operators worked more than 200 days off the farm operation and CSA operators derived a greater percent of their total income from the farm operation.

CSA farms in the Northeast tended to be small, with most farms operating on less than 50 acres, with a quarter of these farms renting at least half of their land from others. In terms of cultural practices, 60% of CSA farms reported the use of conservation practices such as no-till or filtering run-off. Only 30% of CSA farms implemented any water management techniques, such as irrigation. In terms of organic production, 43% (346) of CSA farms produced farm products organically. Of those 346 organic producers, 57% of them were certified organic. This corroborates previous research that CSA farms tend to be organic producers with a higher rate of certification compared to non-CSA farms.

CSA farms had average sales of \$84,803. While 34% of CSA farms had total sales in excess of \$50,000, only 23% of U.S. farms had sales in that same category. In terms of direct sales to consumers, 45% of CSA farms had DM

sales in excess of \$25,000, while less than 6% of all U.S. farms fell into that category. This shows that CSA farms depend more heavily on direct to consumer sales when compared to most U.S. farms.

CSA principal operators were primarily male. Only 28% of operations had a female primary operator. Yet, this stands in marked contrast when compared to all U.S. farms, where the percentage of female principal operators is only 14%. Nearly 70% of CSA principal operators identified farming as their primary occupation. In fact, 39% of CSA principal operators indicated that they did not work any days off their farm operation.

It appears that this is the first research using respondent (i.e. farm) level data to analyze the effects on profitability of incorporating a CSA into a farm's direct marketing mix. This study employed eight models to estimate whether there were meaningful profit differentials between DM farms in the Northeast that incorporate a CSA into their marketing mix and those that do not. The inclusion of a CSA was not found to have any statistically significant effect on NCI per acre in seven of the eight models. For those farms that were classified as large family farms (sales between \$250,000 and \$500,000), the incorporation of a CSA into their marketing had a statistically significant and positive effect on NCI per acre. This finding provides some evidence that large family farms can benefit from the inclusion of a CSA into their marketing mix.

Although the results of all of the models do not definitively prove that a CSA will impact profitability either positively or negatively, there are still beneficial qualities that CSAs provide to farmers. Since farmers generally sell CSA shares

during the winter and early spring months, this income could be extremely helpful for farmers in the region because it comes at a time when there are many expenditures for seasonal inputs such as seed and fertilizer while there is little cash flow. Additionally, the fact that farmers are able to secure a market for their produce before the growing season has even begun can help to partially distribute risk because they already know that there is a market for a portion of their produce. This extra risk management can alleviate some stress during the growing season. This is especially true since the CSA model allows farmers to share the risks and rewards of the season by only being required to distribute a share of the produce coming from the farm, meaning that if a crop fails, then the farmer shares that failure with the CSA members.

## **7.2 Study Limitations and Future Research**

This study has a few limitations which are noteworthy and should be taken into consideration if further studies are going to be conducted on this topic. Most notably, while USDA Census of Agriculture data are thorough in regards to financial and structural information, the CSA data are extremely limited. While the questionnaire asks whether the farm operation markets produce through a CSA arrangement, there is no information about the sales volume derived through CSA arrangements. Because of this, there is no way to disaggregate CSA sales from the rest of the direct sales to consumers and ascertain the relative importance of CSAs to farm income. Additionally, 2007 was the first year that the Census gathered information about CSAs. It may be the case that new Census variables take a while to become established and that the data may

improve as CSA is better understood as a marketing technique.

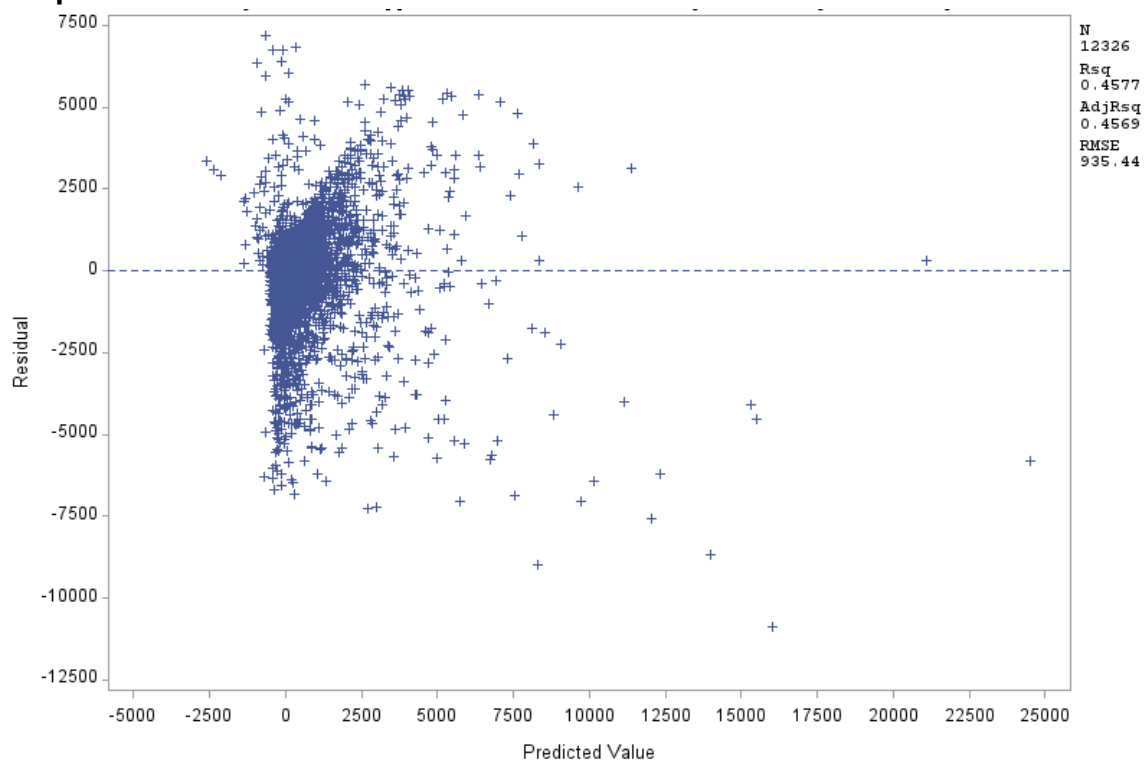
Second, the Census of Agriculture does not collect information about the length of time CSAs have been in operation. Therefore, there is no way to tell if CSA operations realize benefits differentially in the short run or the long run, which could be an important consideration for any farm if they were deciding to incorporate a CSA into their marketing mix. Based on the assumption that experience with a particular marketing technique could potentially increase a farmer's ability to become more efficient, it would be beneficial to know how long a farmer had been marketing through their CSA so that this assumption could be tested.

Third, there is the issue of self-selection bias which was not directly addressed during modeling. It is important to consider the motivating factors that lead to a farm's decision to incorporate a CSA into a farms' marketing mix. If, for example, only the best farmers decide to expand their enterprises to include a CSA, does that reality have an effect on farm profitability which may confound the model results? Nevertheless, future research should take this into consideration while constructing econometric models. Perhaps the use of instrumental variables, matching techniques, or different econometric models could address the problems associated with endogeneity (Butsic et al. 2011).

Lastly, since this work was completed, NASS has compiled the data from the 2012 Census of Agriculture. The same analysis used in this study could be replicated using the more recent data. This analysis could be relevant considering the continued growth in the use of CSA as a marketing technique.

## Appendix 1

**Graph of Predicted Values vs. Residuals for Initial Model**



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