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Inorganic Growth in the Organic Food Industry: Examining Barriers to Entry and Economic Rents

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Inorganic Growth in the Organic Food Industry: Examining Barriers to Entry and Economic Rents

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May 2017

Approved to fulfill the requirements of HON 437

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Inorganic Growth in the Organic Food Industry: Examining Barriers to Entry and Economic Rents

Submitted in partial fulfillment of the requirements for the Murray State University Honors Diploma

Jaime Staengel

May 2017
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Dedicated to my mom, Kim Staengel, for her unwavering support in all of my scholastic endeavors and adventures and for encouraging my love of learning from a young age

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Inorganic Growth in the Organic Food Industry: Examining Barriers to Entry and Economic Rents

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Recently in the organic food industry, more lines of organic food are being introduced in stores as demand for organic products continues to grow. The organic food industry has witnessed high price premiums in the past which, according to economic theory, would in a perfectly competitive market attract entry until those price premiums decreased to the point where economic profits were zero. However, the USDA’s National Organic Certification Cost Share Program, or NOCCSP, was introduced in its current form in 2009 and offers reimbursement for farmers who are already certified with certification or recertification costs for their organic farming operation. Since the program only reimburses farmers who have endured the required three year transition period during which a farmer cannot sell their products as organic and receives no price premium and lower yields, a question arises: Is the NOCCSP functioning as an effective barrier to entry and keeping potential farmers out of the market who cannot be first certified to qualify to receive a reimbursement from the NOCCSP? Utilizing state-level data from the United States Department of Agriculture’s (USDA) Census of Agriculture, this paper strives to discover if growth in the organic food industry is inorganic and taking place among farms who are already certified and expanding their organic acreage by utilizing the NOCCSP. If price premiums remain high while the NOCCSP is in place, that may be indicative of the program serving as an effective barrier to entry and helping existing organic farmers maintain economic rents already present in the industry due to differentiation and signaling.
I. Introduction

A casual stroll down one of the grocery aisles at Wal-Mart, Target, or Kroger means there are plenty of foods today labelled “organic,” complete with green packaging and private brand label names resonating a natural feel such as Simply Balanced and Simple Truth Organic. This growth in the organic food industry has been tremendous and in large part due to the ever increasing consumer demand for organic foods. To put this growth into perspective, the “sales of organic products grew 11 percent last year to $43.3 billion, or roughly four times the growth in sales of food products overall” (Strom).

So much of the current popular and research literature on organic food focuses solely on the growth it has seen from the consumer side of the market. Much less research focus is directed on the production side of the organic food market. Despite the growing demand for organic foods in the United States, less than one percent of all farmland is actually certified organic, meaning the supply of certified organics is well out of balance with demand (Kashi). An article from the New York Times mentions how many different large food producers are even starting to underwrite the costs a farm must incur in order to transition from a conventional food producer to an organic one (Strom). The process described in the article where large food processing companies such as General Mills are paying for the transition of their suppliers to organic offers forth a perfect example of vertical integration, or “the merging together of two businesses that are at different stages of production” (The Economist). Many companies are not only paying for the transition to organic, but some private label brands are putting their own organic label on products in the hope to capture lucrative price premiums. Before delving into the economic theory that intimately intertwines itself with the organic food industry, it is first necessary to examine the specific
details of the organic food market to understand why obtaining the right to label a product organic is so difficult to obtain in the first place.

First, it is essential to examine what is precisely meant by the term *organic*. In the United States, the United States Department of Agriculture (USDA) has the power to confer a certified USDA Organic label on a product. The Organic Foods Production Act of 1990 established the official definition of *organic* when they wrote in the law that any agricultural product sold as organic must

have been produced and handled without the use of synthetic chemicals…not to be produced on land to which any prohibited substances, including synthetic chemicals have been applied during the 3 years immediately preceding the harvest of the agricultural products; and be produced and handled in compliance with an organic plan agreed to by the producer and handler of such product and the certifying agent (1990).

This legal definition of what it means for a product to be organic indicates that firms can choose to label their products as *natural*, or even as *organic*, but unless they meet the requirements of the law, they cannot sell their products as *USDA Organic*. Furthermore, according to Guthman (2004), there is a National List in place that is approved by the USDA and serves to delineate which inputs are restricted, completely prohibited, or allowable in the production of organic food.

Twelve years after the passage of the Organic Foods Production Act of 1990, the USDA implemented the National Organic Program and this regulatory program is housed within the USDA’s Agricultural Marketing Service and has the power to accredit organic certifying agents (Agricultural Marketing Service). With this power, the National Organic Program currently has under its purview 80 different certifying agents, meaning a farm wanting to obtain USDA Certified Organic status could through any one of these 80 certifying agents (United States Department of Agriculture). The National Organic Program highlighted one part of the original
1990 act in particular, which was the three-year transition period, as well as a newer component, the Organic System Plan. The Organic System Plan, in which farmers must describe how they plan to maintain organic practices on their land, is required for farms going up for their certification and even after becoming certified, the farm is further required to maintain the Organic System Plan and receive visits on a regular basis for maintenance of their organic certification (Rodale Institute). The costs of going through the labelling process by a USDA certifier are high and as a result, many smaller farms often do not receive the official USDA certification. Currently any farming operations that have more than $5000 in sales must be certified organic by one of the third-party accredited certifiers (Guthman 2004).

However, there is a reimbursement program in place called the National Organic Certification Cost Share Program, or the NOCCSP, which can reimburse up to 75 percent of certification costs or $750, whichever is lower, and which has been in place in its most current form since 2009 (Agricultural Marketing Service). There had been an earlier version of the NOCCSP as part of a 2002 bill, but the allocated funds were trivial as to have no impact on organic farmers, leading to the push for the current NOCCSP structure that became fully implemented in 2009. It is interesting to learn the NOCCSP came into place as a part of the 2008 Farm Bill, and the group that lobbied for this program was the National Organic Coalition (National Organic Coalition). In fact, this group has held a wide and powerful command over the changing standards and regulation of organics since 2003, and further evidence of their influence manifests itself in the appointment of the National Organic Program Director of the USDA and their involvement in how the annual federal budget allocates money to organic farmers (National Organic Coalition). Knowledge of this coalition of interests and how they would be motivated to assist in protecting their current organic community offers a better understanding of why this
program has some of the limitations it does. According to the Rhode Island Department of Environmental Management, Division of Agriculture and Resource Marketing, in order to qualify for the USDA Organic Certification Cost Share Program, a farm must already “possess USDA organic certification at the time of application” and “must have paid fees/expenses related to its initial certification” (State of Rhode Island). These details further illustrate how benefits of this Cost Share program are not directed at a farm in the initial stages of transitioning to organic and facing the three-year transition period where they must incur costs without being able to sell their products under the organic label and earn no price premium during this time. Even though the reimbursement program in place is limited, it makes the costs of maintaining organic certification for those who already have it lower. Additionally, the NOCCSP allows for the 75% of total certification costs or $750 maximum reimbursement to apply to each certification scope. A certification scope for the purposes of the NOCCSP is “any category or process that must be individually inspected for organic certification” and includes four distinct categories of “crops, wild crops, livestock, and handling” (“What is an organic certification”). This detail of the NOCCSP means that operations that have up to all four of these certification scopes are eligible for a maximum of $3000 in reimbursements, or the $750 maximum reimbursement per scope times the four scope types. This provides further incentives for a potential organic operation to first be concerned with becoming certified in one of the four scopes and then expanding operations through increasing organic acreage from there. The higher potential reimbursement amount makes investing in organic agriculture seem more attractive to the marginal farmer.

However, the USDA’s Agricultural Marketing Service oversees another cost share program: the Agricultural Management Assistance Cost Share Program, or the AMA Cost Share Program. According to the USDA’s 2015 Report to Congress on the two Cost Share Programs, the AMA
Cost Share Program functions like the National Organic Certification Cost Share Program except the AMA program is limited to sixteen states which include the following: “Connecticut, Delaware, Hawaii, Maine, Maryland, Massachusetts, Nevada, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Utah, Vermont, West Virginia, and Wyoming” (Report to Congress). The way sixteen states are specified solely for the AMA program stands in contrast to the NOCCSP, which is open to not only all fifty states, but also to Washington, D.C. and even five territories of the US (Report to Congress). One last point worth noting about the AMA program is that it is nearly mutually exclusive with the NOCCSP. The two separate cost share programs are set up in such a way that, “to prevent duplicate assistance payments, producers participating in the AMA OCCSP are not eligible to participate in the producer portion of the National OCCSP” (Report to Congress). There is a loophole in this rule which lies in the word producer, meaning organic operations can be certified in different areas and thus potentially receive funds from both cost share programs if in the NOCCSP they are not certified as a producer of the same crop they are becoming certified in under AMA. The rules governing these programs are intricate and will play a vital role in influencing the research question.

Another key aspect to consider revolves around what the marginal impact of such a reimbursement program is to those farmers who are considering whether to convert to organic. The pivotal word in the program’s name is certification, indicating how the reimbursement of 75% of certification costs or up to $750 maximum applies solely to the certification costs, and not to any of the transitional costs. The costs that are not covered or eligible for reimbursement include greater levels of machinery, management, and complexity costs, and the average level of all these costs comes to an estimate of roughly $117 per acre for an average farm (Farm Transitions). Given that the average farm size in the United States is 434 acres, a fast
computation yields a total of $50,778 on average that are not eligible for this program (The Food Dialogues). The average net certification costs are approximately $1.60 per acre, which would be $694.40 in certification costs for the average 434-acre farm, and 75% of those costs, or $520.80, could potentially be reimbursed to the average farmer (Farm Transitions). Thus, the total cost of transitioning to organic for the average farm is $51,472.40, of which only $520.80 would potentially be reimbursed, meaning the effect of this program is covering only approximately one percent of total costs to transition to organic. Such analysis suggests the reimbursement will function more as a barrier to entry to maintain economic rents in the market, rather than encourage entry as a larger subsidy would be expected to do. The marginal effect of the program appears at this level as if it will not change the decision of a farmer who is on the fence about converting to organic. The structure of initial certification costs consists of an application fee, annual inspection fees that additionally include travel fees for inspectors to come to the farm, and the annual certification fee based on the Gross Organic Production Value, or GOPV, of any given farm (CCOF). The total fee schedule for certification only can range from $340 if the GOPV is at least $10,000 for crop and livestock and $725 for handlers and processors all the way up to $42,525 for farms with a GOPV greater than $150,000,000 (CCOF).

Recently many large food companies are stepping up to offset transition costs in response to the limitations of the Cost Share Program. The willingness of large food companies to offset the costs of transitioning to organic production seems to serve as a signal from the production side of the organic food industry that there is the expectation profits are going to last. Kashi, a cereal producer, has demonstrated the most intensive commitment to helping offset the transition costs of converting land to organic food production by introducing their own label, called Certified Transitional, in partnership with Quality Assurance International, an accredited organic certifier
(Kashi). They have introduced an entire line of cereal called Dark Cocoa Karma that is produced only from grain that has met their new Certified Transitional standard (Kashi). With yet another label introduced into the organic market, complete with its own standards, it may seem overwhelming to fully understand the different labels and certifying programs. However, the latest move by Kashi seems a natural development seven years after the National Organic Certification Cost Share Program arrived on the scene.

The introduction of the National Organic Certification Cost Share Program in 2009 offers a natural experiment of sorts where the costs of maintaining certified organic food production became relatively inexpensive compared to the costs of conventional food production. This leads to the research question: Does the 2009 National Organic Certification Cost Share Program serve as an effective barrier to entry?

II. Literature Review

Economic literature is rife with studies on the higher profit margins earned by organic food producers. A cornerstone of economic theory is that individuals respond to incentives and organic food production is no different. According to an article from Environment and Planning:

As a form of regulation, the organic system is inherently incentive based. The cornerstone of organic regulatory convention is third-party certification, a way to verify that producers grow according to organic standards. In return for compliance…producers expect to receive a price premium from consumers (Guthman 2004).

The same article applies another concept of economic theory to organic food production that explains why some of the extremely high barriers to entry exist in the first place: rents. Guthman (2004) describes how the steps to becoming certified organic are barriers to entry that create rents for organic producers precisely because the certification process imposes an artificial scarcity of certified organic food based on USDA regulations. Since not all farmers can afford to have their land and production methods certified organic, this leads to a shortage of food items
bearing the official USDA Certified Organic seal while demand for these items continues to grow. This artificial scarcity is one component that has allowed the profit margins of organic producers to remain so high for so long, even after accounting for differences in the costs of production between conventional and organic goods. In *The Economics of Food Labeling* published by the USDA’s own Economic Research Service, the author notes the current labeling regime potentially contributes to barriers to entry in the industry when elucidating how “According to USDA’s regulatory impact analysis, even with the small business exemptions, some small organic farms and some small certifiers may exit the industry and small operations may be discouraged from entering the industry” (Greene 28). Acknowledgement from the regulator’s perspective of the potential pitfalls of organic certification with regards to competition underscores the need to examine the issue in detail.

A closer examination of economic rents illustrates how applicable this theory is in the realm of organic food. Kaplinsky (2000), in reference to David Ricardo, clarifies, “economic rent does not arise from the differential fertility of land itself…but from unequal access to this resource.” The extensive regulations of the organic industry and high costs makes access to producing organic food an unequal playing field. Organic food production, though dependent on “traditional” methods of agriculture, represented a new, entrepreneurial idea when it first garnered national attention. In this way, Kaplinsky (2000) and others are likely to cast such a development as an innovation that would reap entrepreneurial surpluses since the prices of organic food affords returns higher than the cost it took to innovate. Such high profits would attract entry as standard economic theory suggests, unless barriers to entry are in place to keep such rents in the hands of incumbent firms or farms in the market.
Another facet through which to apply the theory of rent to organic food production is specifically to the rent accrued by the land itself. Guthman (2004) makes an interesting point when clarifying how once the land is certified organic, any subsequent owner of the land can obtain economic rent from that land but if the individual decides to work on a different piece of land, then the individual must obtain certification for the new land and go through the mandatory three-year transition period once again. The rent connected to already-certified land falls into a further distinction of what Guthman (2004) calls “consumer-based economic rent” since any and all crops that are grown and harvested from certified land will have the ability to earn a price premium.

One study corroborated this and found that those who do produce and sell organic products are able to earn a larger proportion of the total margin for that product than nonorganic producers of the same good, while simultaneously noting this market power is diminishing as supply in the market adjusts to meet demand (Richards et. al 2011). Furthermore, a study of the Washington organic apple market found that the “allocation of rents shifts toward suppliers of organic apples” (Richards et. al 2011). This shifting of rents toward suppliers, in this case the farmers, of organic food has made investing in organic profitable, but the authors warn that over time, margins for organic suppliers will most likely decrease.

Going further back into economic theory, in his seminal work George Stigler elucidated many of these ideas most clearly when he wrote that industries with the ability to influence regulation strive to have “regulatory policy…be so fashioned as to retard the rate of growth of new firms” (Stigler 1971). The heavy regulation of organic food ever since 1990 has followed in line with what economic theory would expect. Stigler wrote not just about industries wanting to wield power over barriers to entry but also about the subsidy of money to a particular industry.
Furthermore, traditional views of economic theory have expounded on licensing, much like the current licensing of organic foods, as a “tacit” mean to obtain all monopoly profits when the licensing and its standards are controlled by the industry itself (Leland 1979). This is similar to the organic food industry, where the National Organic Coalition lobbied for the introduction of the National Organic Program itself. Leland further argued that a quality standard or license, such as the USDA organic label, sets a standard at some level, under which the supply will in fact be below the socially efficient optimum (Leland 1979). The reason supply will be below the socially efficient level is because the standards will be constructed to restrict supply so incumbent farms obtain the highest economic rents possible. One final insight to take away from the work of Leland was about what occurs when licensing is in markets where opportunity costs are decreasing as quality increases. His model found that “if persons of higher quality find it easier…to meet these requirements, we may well find that the opportunity cost of entering a market is decreasing with quality” (Leland 1979). This applies in the production of organic food because if a farm is of higher quality, or has soil that has already been converted to organic, then the opportunity costs of obtaining certification are very low compared to those farms who, only by the legal definition of organic, are of “lower quality” and would have to pay much more for certification.

Empirical literature concerning subsidies have various results to convey. A study focusing on subsidies to research and development (R&D) collaborations between Germany and Finland found that both patent and R&D activities decreased when there was a lack of subsidies and that there was a positive effect in Finnish R&D when subsidies were present (Czarnitzki et al 2007). These results fall in line with expectations from subsidy policy: an increase in supply since the relative cost of the targeted good has decreased.
One area to look for empirical evidence relating to the research question is at other contrasting studies examining organic policies and their impacts in foreign countries. It was noted that in Europe, a subsidy program in place for farms transitioning to organic helped increase the organic market by 300% (Lohr 2000). It is interesting to note that most of these European subsidies lasted “up to three years during conversion,” which is precisely the same length of time conversion from conventional to organic farming in the United States requires (Lohr 2000). The model of cost-sharing that Iowa utilized before the 2009 program went into place mirrored in some ways the structure of the Earned Income Tax Credit where the more you earn, the less you receive: the program paid “$40 per acre for the first two years, which declines to $10 per acre per year to $10 per acre for the fifth year applied to a maximum of 40 acres” (Lohr 2000). The study utilized a utility difference model and an indirect utility function for each farmer to determine whether the Swedish subsidy had any significant impact on a farmer’s decision to convert but did not focus on whether or not the individual farmer actually converted to organic (Lohr 2000). The specifications of the model were that only income and observable attributes could influence the preferences of any given individual and that a given subsidy would be added to the income of a farmer if that subsidy were necessary to prompt conversion to organic farming.

Furthermore, Lohr (2000) found that in Sweden the subsidy was most effective in getting those farmers who were already aware of organic and the price premiums that could be obtained through conversion to convert, and that the same would likely happen in the US, rather than a wave of mass conversions by traditionally conventional farmers. One of the implications of this study was that any subsidy to farmers who have already converted would be redundant. However, the 2009 National Organic Certification Cost Share Program does just that and
rewards already converted farmers by decreasing the costs of maintaining organic certification, rather than solely focusing on those farmers who are at the margin and deciding if the marginal benefits of converting to organic outweigh the marginal costs. Consequently, these findings seem to suggest that such a subsidy would not lead to a large decrease in the prices of organic foods.

Brock and Scheinkman (1985) found that a decrease in welfare occurs when government subsidies to entry are in place. A limitation of this study is its focus on cartels and entry into a collusive setting. Since the organic food industry is not based on collusion in the same manner that cartels such as OPEC are, the finding of Brock and Scheinkman (1985) may not have as strong of an impact in the organic food industry.

The literature additionally suggested another model to use for empirical work in this area and that is a hedonic pricing model. The concept of hedonic pricing is succinctly described as “the implicit prices of attributes and are revealed to economic agents from observed prices of differentiated products” (Rosen 1974). Maguire et al (2004) employed a hedonic pricing model when studying the price premium for organic baby food. The model afforded the authors the opportunity to estimate specifically the price for the organic aspect of the baby food separate from any other typical aspect of baby food. The production side of the market maximizes their profits when the level of production is such that the “per-unit marginal cost of producing a characteristic, \( y_i \), is equal to the marginal price of that component” (Maguire et al. 2004). While hedonic pricing has been used most often in the literature concerning housing prices, the study done by Maguire et al. (2004) indicates the model’s potential in applications concerning the organic food market.

However, the research presented by Fernandez and Rogerson (1995) provides a direct parallel to the research question in this study. Their study focused on subsidies to higher
education and argues that when subsidies to higher education are only partly subsidized, the transfer of resources that occurs is actually from lower-income members of society to higher income members. A key point in their argument is that higher education is only partially subsidized, much like the partial subsidy to farmers offered through the National Organic Certification Cost Share Program once they are certified organic operations, but not while they are transitioning. An important outline of their reasoning is necessary before demonstrating its relevance to the research question:

If credit constraints affect education decisions, then a vote on the extent to which education is subsidized is also implicitly a vote over who receives the subsidy. By choosing to subsidize only partially the cost of an education, higher-income individuals can effectively exclude poorer individuals from receiving this education and simultaneously extract resources from them. This endogenously determined exclusion is the novel feature of our analysis of redistributive schemes (Fernandez and Rogerson 1995).

The same argument substantiates itself in the realm of organic certification. Since the NOCCSP only partially subsidizes costs and they are after a farmer has obtained certification, the program effectively excludes those producers who are like the low-income voters and not yet certified, meaning they will not receive the benefits of this program because of its design. Any farmers in the three-year transitional stage cannot apply for this program and just as in the model presented by Fernandez and Rogerson, they are endogenously excluded. Their model assumed a linear utility function and two periods where in the first one a person can obtain an education but their decision is dependent to an extent on how much education is subsidized (Fernandez and Rogerson 1995). Since their model has the subsidy for education funded through a tax, this means that even though everyone pays the tax, only those who choose to obtain an education receive the subsidy, and these individuals often have more resources available to them in the first place, allowing them to choose to pursue higher education. In a similar manner, those farmers
who choose to convert to organic receive the subsidy, but these farmers are typically the kind of farms with enough resources to overcome the mandatory three-year transition period in the first place.

This paper incorporates the ideas present in the existing literature into the exploration of the effect on whether the 2009 National Organic Certification Cost Share Program serves as a barrier to entry for the organic food industry.

III. Theoretical Framework

After an extensive, thorough review of the literature, it is necessary to clarify the underlying theoretical framework of this study. The microeconomic framework employed here is barriers to entry. Barriers to entry remains vital in examining the efficiency in all sorts of markets. When a market is perfectly competitive, it attracts entry into that market as more and more firms hope to capture some of the profit. This continues until the point where enough firms enter the market so there is no longer any profit available to capture. Incumbent firms in a market thus have an incentive to construct barriers to entry so that fewer firms are able to enter the market and capture the incumbent firms’ profits. The cost of a barrier to entry, such as licensing or labeling, is relatively small for the firm compared to the profits they can maintain once labeled or licensed.

However, barriers to entry is not the sole theoretical framework underpinning this study. The concept of sunk costs and the sunk cost fallacy influence the analysis as well. Sunk costs are costs that, once incurred, are irrecoverable. In theory, when a firm or individual is looking at an economic decision and deciding whether or not to take an action based on costs and potential gains, sunk costs should not factor into the decision because since they are irrecoverable costs, one cannot get them back by simply quitting a project or task that incurred them in the first
place. A common example in textbooks is of an individual who buys a movie ticket, loses the ticket, and then must decide whether to purchase a new ticket or not. The decision of whether to purchase a new ticket should not be influenced by the fact the individual “lost” or “wasted” money on the first ticket because even if they do not go to the movie, they still will not get the money spent on the original ticket back. Rather, they need to evaluate if they are willing to pay for a new ticket compared to the amount of utility, or satisfaction they would derive from viewing the film.

Despite the attractiveness of this perfectly rational theory, in reality many firms or individuals instead fall for what is called the Sunk Cost Fallacy. In this fallacy, the individual is unable to put aside the sunk costs and instead allows the sunk costs incurred to influence their decision to do something, such as further invest in a project. The Sunk Cost Fallacy could be a second component outside of barriers to entry holding potential organic farmers back. For those farmers who are in the midst of the mandatory three-year transition period, they are incurring costs each year to transition to organic, are losing revenues due to lower yields, and as they evaluate their stance in any given year during the transition period they may let these sunk costs influence their decision about whether to continue in the process. If a farmer gives in to the Sunk Cost Fallacy, they may be exiting the market for organic food prematurely when the fact is they could have remained in the market and later earned higher profits. Much empirical work has already been done on endogenous sunk costs, and Sutton in particular is noted for his contributions to this realm. According to “Sunk Costs and regulation in the U.S. pesticide industry,” a study of the number of firms and entry into the pesticide industry found “results are consistent with Sutton’s (1991) view of sunk costs and market structure in that rising endogenous
sunk research costs...negatively affect the number of firms in an industry” (Ollinger and Fernandez-Cornejo).

Other empirical work has substantiated Sutton’s theory of the nature of endogenous sunk costs in contributing to less competitive markets through functioning as a barrier to entry. Another one of these empirical studies comes from Shiman. In his work, he elucidates what exactly Sutton brought to economic theory with the idea of endogenous sunk costs. Prior to Sutton, economic models assumed that as demand for a given product increases, this attracts entry into that market and typically, leads to less concentration in that market (Shiman 2). Sutton had observed that in certain industries this was not holding true and that there was in fact more concentration than theory would predict, “even though in many of these industries demand has grown and output has increased substantially” (Shiman 3). This exact phenomenon is occurring in the organic food industry. As the demand for and popularity of organic food has reached new heights, production has increased in an attempt to satisfy this demand, but there is still relatively high concentration and attractive price premiums for organic producers. The ultimate distinction made by Sutton in this realm was between exogenous sunk costs, or the “fixed costs incurred upon entry that are necessary to participate in the market” versus the endogenous sunk costs, or the “sunk costs of varying size that firms can choose to invest in...to increase their price-cost margin, but whose size does not depend on the level of production” (Shiman 3). In organic food production, the sunk cost of the three-year transition period would be considered endogenous because independent of the level of intended organic food production, a farm wanting to convert land to organic has to incur this cost. An exogenous sunk cost in the organic food market would be recertification costs that are necessary and required for continued participation in the USDA certified organic market. The NOCCSP is thus subsidizing and lessening the exogenous sunk
cost, but not the endogenous one. This paper aims to investigate empirically if the theory holds true for organic food in a statistically significant way.

Consideration of sunk costs and the Sunk Cost Fallacy in the organic food industry plays a more pivotal role when looking at the traditional farmer who is at the margin. For a given farmer who has been considering whether to convert from traditional to organic methods, the introduction of the National Organic Certification Cost Share Program can serve as a marginal change. For those farmers who were considering converting to organic but were hesitant about doing so because they were concerned about the maintenance costs of yearly recertification, the NOCCSP may make the relative costs of such recertification smaller so that the farmer is induced to switch from traditional to organic production. This idea of thinking at the margin motivates the investigation into this program because if the NOCCSP did not alter the incentives enough for the farmer who is at the margin and considering going organic but needs the correct incentive to do so, the policy surrounding organic food production can be changed to obtain that goal.

One more theoretical tool to consider is the discounting of future profits and how much a farmer values current profits over future profits. In literature on public policy and cost-benefit analysis, future streams of costs and maintenance costs must be evaluated using present discounted value (Gruber 209). This concept is vital in the organic farming case because the future maintenance costs are the yearly recertification costs that must be discounted to compare with current costs of transitioning to organic. However, the NOCCSP will affect the recertification costs an organic farmer faces in the future since the program means some of those costs will be partially subsidized. Each farmer’s discount rate should be slightly different because a privately owned farm mirrors private firms, where “if private firms were making an
investment decision, the proper discount rate should represent the opportunity cost of what else the firm could accomplish with those same funds” (Gruber 209). If a farmer values current profits more highly than future profits even after discounting, then the NOCCSP might function as a barrier to entry because the subsidy is not helping a farmer get higher profits today, but rather in the future.

This detailed analysis leads to a few keen research questions. An initial question is whether the number of certified organic operations has increased from pre- to post-NOCCSP implementation. This question would allow us to see if the NOCCSP helped overcome some of the Sunk Cost Fallacy by inducing more farms to enter the market for organic food production. If the post-NOCCSP number of certified organic farms is lower than before the program, this could be indicative of the NOCCSP instead functioning as a barrier to entry. Thus, examining the rate of growth of new entry and whether that rate of growth was increasing or decreasing will assist in answering this question. Another question to look at is whether the number of certified organic acres in production increased or decreased after the implementation of NOCCSP. This question indirectly looks at the effects the program has on those firms who are already certified and not just those farmers who were at the margin because already existing organic farmers may be induced to transition more acres to organic as a result of the program. By examining these two separate measures of organic farming, this study hopes to evaluate to some extent any inframarginal impacts. Much like how in the realm of public policy there is a focus on inframarginal impacts in taxation, or the “tax breaks the government gives to those whose behavior is not changed by new tax policy” (Gruber 209), the question surrounding the NOCCSP is how much of the subsidy is going to those who were already certified and who planned to recertify regardless of whether the cost share program had been in place. A question that
combines the previous two and is important to the inframarginal impact assessment is whether both the number of organic operations and organic acres increased together after introduction of NOCCSP. Rather than solely focusing on these two variables, another question to examine is how the number of transitioning operations and acres changed over time. These questions combined will help to answer the overarching research question: Does the 2009 National Organic Certification Cost Share Program serve as an effective barrier to entry?

IV. Data and Methodology

The data utilized in this study come primarily from the United States Department of Agriculture (USDA) National Agricultural Statistics Service (NASS) Quick Stats Database and the USDA National Organic Certification Cost Share Program Annual Report to Congress. The data from the Quick Stats Database came from a combination of the Ag Census and Certified Organic Survey for the years 2008, 2011, 2014, and 2015. In 2008 the Organic Production Survey collected data from not only already certified organic operations, but also those operations which are exempt, meaning they have less than $5000 in organic sales, and those operations that were in the process of transitioning to organic at that time (“Organic Survey”). In contrast, the 2011 Certified Organic Production Survey gathered data solely on certified organic operations, whereas the 2014 Organic Survey once again included certified, exempt, and transitioning operations but at a more detailed level than the survey in 2008 had done (“Organic Survey”). The 2015 Certified Organic Survey, like its 2011 counterpart, only analyzed certified operations. Due to the distinction between what types of operations were included in certain survey years, every attempt was made in the study to look solely at variables for certified operations. In the few cases where the 2008 or 2014 data on variables for use in this study did not have a “certified” label, the data for that variable with a “certified and exempt” label was
selected instead as this is the most consistent choice. Certified and exempt is simply the sum of certified and exempt organic operations and typically the majority of the sum is from certified operations.

Another aspect of the data to take note of concerns who distributed the survey. The Census of Agriculture officially oversaw the 2008 and 2014 Organic Surveys, while the Risk Management Agency of the USDA conducted the 2011 and 2015 Organic Surveys ("Surveys: Organic Agriculture"). For each of the survey years, an appendix to the survey detailed the methodology. A brief overview of the methodology is provided here and Appendix B has links to the full surveys and their appendices on methodology. For all years of the survey, the means was predominately through the mail with some personal, telephone, and web interviewing conducted with the aid of computers to supplement the mailed-in responses. In order to know which farms to mail the surveys to, the USDA began to build a list of certified, exempt, and transitioning operations from a variety of their other agencies such as the Economic Research Service, the Agricultural Marketing Service, and operations noted as organic in the 2007 Census of Agriculture. Once this base list of organic producers was created for the 2008 Organic Survey, the following years used the operations from 2008 as their baseline of operations to send surveys out to. The survey response rate varied some over the four years of the survey’s implementation and showed a decreasing trend, starting with a response rate of 87% in 2008, followed by 76% in 2011, 63% in 2014, and finally 60% in 2015. One concern for the survey results was non-response bias since not all organic farm operations responded to the surveys. The NASS accounted for the effect of non-respondents, any farms that had been misclassified, and the potential of under-covering all the organic farms in production by adjusting the weights of the answers from respondents. According to the methodology appendix for 2011, “nonrespondents
were accounted for in the final data by increasing the survey weights of the respondents inversely to the proportion of nonrespondents” (“Statistical Methodology”). It is important to be aware of limitations of the dataset such as nonrespondents, but given the extent to which the NASS accounted for such limitations means the data are suitable for econometric analysis here.

A small portion of the data used in this study came from the Organic Trade Association and specifically data they had purchased from Nielsen, the global information company. The Organic Trade Association had bought data on the percentage of households purchasing organic food in 2015 and 2016. The data from Nielsen come from their Homescan data. Nielsen gathers data from various consumer panels where those households in the panel scan their purchases at home in a manner similar to how they are scanned at grocery stores based on their bar codes (“Consumer Panel”). One potential shortcoming of this data is that since it is a Homescan dataset, only those organic goods which have a scan-code on their packaging will be accounted for. This means that fresh, loose organic produce that is not packaged will not be accounted for in the data, and thus the percentage of households buying organic represented in the Nielsen data may underrepresent the actual percentage.

The USDA Annual Report to Congress on the NOCCSP and AMA Cost Share Program began in 2010 reporting on Fiscal Year 2009, the first year implementation of the Cost Share Programs began in their most recent form. For this study, only the data from Fiscal Years 2011, 2014, and 2015 were used from the Annual Report to Congress.

While the NASS Quick Stats Database offered a vast array of data variables, specific ones were picked for the analysis in this study. Of the variables picked, the specifications in the model often drew on the differences in these variables between certain years. Some of these variable
definitions are needed to understand the few models in that appear in Appendix C. The variables picked include the following:

1. **Ag Land—Cropland, Organic—Number of Operations**: measures the number of operations that had certified organic cropland where cropland includes field crops, fruits, vegetables, floriculture, etc. according to the USDA certified organic survey

2. **Ag Land—Cropland, Organic—Number of Acres**: measures the number of acres of certified organic cropland where cropland again includes field crops, fruits, vegetables, etc.

3. **Ag Land—Organic—Number of Operations**: measures total number of operations that are certified organic and includes cropland, pastureland, and rangeland

4. **Ag Land—Organic—Number of Acres**: measures total number of acres that are certified organic and includes cropland, pastureland, and rangeland

5. **Ag Land—Organic, Transitioning—Number of Operations**: measures the number of farms in the transitioning stage where they convert from conventional to organic farming

6. **Ag Land—Organic, Transitioning—Acres**: measures the number of acres undergoing the transition from conventional to organic production. Note that the 2015 survey data were sent exclusively to already certified organic farmers and thus any increase in the number of transitioning acres would be coming from farms that are already noted and counted as certified organic based on the fact that they have at least some other amount of certified organic acres to begin with
7. **Ag Land—Cropland, Organic, Transitioning—Number of Operations**: similar to the measure on transitioning number of operations, only here the measure focuses solely on cropland which mainly includes field crops.

8. **Ag Land—Cropland, Organic, Transitioning—Acres**: similar to the measure on transitioning acres, only here the measure focuses solely on cropland which mainly includes field crops.

9. **Production Plan: 5 Year Plan: Increase Operations, Number of Operations**: the number of certified organic operations who say their 5 Year Plan for organic production includes increasing operations at the state-level; this variable is serving as a proxy for market conditions in the organic food industry: the logic here is that if there are no barriers to entry, a growing market with profits like the organic food market would see more farm operations trying to enter the market and existing farms would plan to increase their operations.

This study combined the NASS data with data from the yearly USDA Annual Report to Congress on the NOCCSP and AMA Cost Share Program. The variables from the Annual Report to Congress data set include the following:

1. **Total Fund Payments**: the actual amount of funds disbursed to the states to be given out as reimbursements to eligible farmers; note that in the regressions in this study this variable will become DisbursedFunds(Year) for a given year.

2. **Number of Operations Assisted**: the number of certified organic operations in a state who received assistance from the NOCCSP or AMA.

The variable from the Nielsen Homescan data set is defined as follows:
1. **HouseholdBuy (Year):** the percentage of U.S households (excluding Alaska and Hawaii) purchasing organic food in a given year; in this study the two years utilized are 2015 and 2016

Before moving on to the econometric model and regression outputs, a preliminary graphical examination of trends in the data is warranted in order to better solidify the hypotheses to be tested. Figure 1 plots certified organic acres against the number of certified organic operations at the national level over a ten-year period from 2006-2016. Observing Figure 1, an intriguing pattern appears. The number of organic operations decreased steadily between 2007 and 2008 and again between 2008 and 2011 after the introduction of the NOCCSP. From 2011 to 2014 the number of organic operations increased slightly to roughly their 2008 levels, before decreasing once more in 2015. The stimulating observation comes from the fact that while the number of organic farms was decreasing after the NOCCSP, the number of organic acres witnessed a mostly increasing trend.

These two trends in the data support the idea that the NOCCSP may be serving as an
effective barrier to entry in the organic food industry. The number of organic farms may have shrunk as new entry was discouraged, slowed, or only those who were able to withstand the three-year transition phase to obtain the reimbursement for recertification were counted as certified organic farmers, leading to the decrease in the number of certified organic operations over time. The increase in the number of organic acres over time further augments the barriers to entry theory because it could indicate that as some farmers left the organic food industry, the ones that did remain in it were able to have larger operations by adding more acres. It is important to recall that as long as some amount of a farm operation is certified organic, the entire operation will be counted as one certified organic operation for data collection purposes. This means a farmer that decided to first certify a small amount of their operation in order to obtain USDA certification and then, after the NOCCSP introduction where they qualified for reimbursements for any recertification costs, decided to expand their organic operations could account for the pattern exhibited by the data.

Figure 2 can be considered as well before conducting econometric analysis. Figure 2 depicts the total funds utilized or disbursed for the NOCCSP plotted against the total number of farm operations assisted or receiving these reimbursements.
Figure 2 seems to suggest that the number of operations receiving assistance is perhaps positively correlated with the total funds utilized. However, it is worth noting there was a decrease in both the number of operations assisted and the total funds utilized in the third full year after NOCCSP introduction. The later data, such as that for 2015, indicate that the number of farms receiving assistance is just starting to reach and slightly exceed the 2010 levels from when the NOCCSP began.

There is one last set of data to consider before moving on to examining econometric models and that is data on price premiums received for certain organic fruits over conventional ones. In a perfectly competitive market with no barriers to entry, any profit in that market attracts new entry until profits decrease to zero. Agricultural markets are not always perfectly competitive even with free entry. This may be due to the fact that there are large economies of scale in agriculture. For example, there is a high fixed cost for a technologically advanced irrigation system. Once that system is in place, the per-unit cost of utilizing such an irrigation system is small and when employed to large scale farming is more efficient. Such scale economies in
farming may mean perfect competition is not a reality. The recent trend of large companies such as Kashi and General Mills to underwrite farmers’ costs of transitioning to organic illustrates how large scale farming may in fact be more similar to oligopoly with a few large players, although collusion is probably unlikely due to the way typical agricultural products are not that differentiated. As an example, wheat from one farmer is similar to wheat from another farmer. Similarly, organic wheat is similar to other organic wheat and price fixing by the largest players in large-scale farming is unlikely. It is important to realize the organic market is most likely not perfectly competitive, even with free entry, due to these and other reasons. The assumption that profits in this market should go to zero if free entry is present may thus seem harsh and should be relaxed.

Additionally, it is important to remember that some of the price premium of organic food over conventional comes from the differing costs of production than conventional farmers have. Since organic farmers cannot use pesticides or fertilizers, they usually have to incur higher costs in order to utilize approved organic practices and maintain profitable yield levels. For organic farmers, a way to gauge their profit is by looking at price premiums for their organically produced version of the crop over the price received for conventional versions. This higher price premium is thought to compensate them in part for higher production costs so that, when the profit is calculated as \((\text{Price} - \text{Costs}) \times (\text{Number of Units})\), there will be a positive number as the outcome. While this is a component contributing to the price premium, it is important to realize there may be different reasons why organic farmers receive a price premium for their goods than costs. Aside from the structure of the farming industry as a whole preventing profits from going to zero even with free entry and higher production costs, there are a few other reasons to anticipate organic products would still see a price premium even with free entry.
The first is that even when free entry is present, price premiums can exist because consumers are willing to pay more for organic products they believe to be better for their health. Marketing campaigns by organic companies often claim better health benefits from the consumption of organic food and even though other studies have proved there is inconclusive evidence as to the health benefits of organic food, many consumers believe such claims. When given the choice between an organic and conventional product, the organic industry has done such an effective job of differentiating their product so that the consumer does not view it as a perfect substitute for its conventional counterpart. The consumer will be more likely to pay a higher price for this product if they think the organic version of the good will bring them health benefits. As long as organic and conventional goods are no longer seen as perfect substitutes for one another due to differentiation, a difference in price between the two types of goods will remain.

Another reason for price premiums in this industry even with free entry could stem from the idea of signaling. A person who purchases or consumes organic food may be doing so in order to signal they are affluent enough to afford organic goods, or that they care about the environment and are attempting to use the buying of organic food as a signal they are a good person. A parallel example can be found in the case of the popular Toms® Shoes. These shoes are marketed as being altruistic so that when a pair is bought, another pair is given to a child in need in a less developed country. A person who wants to signal they care about others and are not purely selfish can buy the shoes, which have a higher price over similar counterparts. This product differentiation and signaling are more likely to lead to a price difference between organic and conventional food even if free entry occurs. Despite the likelihood that price premiums would exist with free entry due to differentiation and signaling, the existence of incredibly high or increasing price premiums over time, and particularly an increase over existing price
premiums after the NOCCSP implementation, could be a sign of increasing barriers to entry from the cost share program and warrant econometric analysis of the issue.

The organic food market has been around for quite some time depending on if one counts its start as 1990 when the Organic Foods Production Act legally defined what organic is or if one instead prefers to count its official beginning in 2002 when the National Organic Program began. Regardless of the starting year chosen, the organic food market is at least fifteen years old and thus a somewhat mature, but still growing market. This means ample time has gone by so that if no barriers to entry existed, profits and the price differences in the market should be lessening, although they would still likely be present due to the reasons discussed above. It would be unusual to see much new growth in already existing price premiums due to differentiation or signaling after the NOCCSP implementation unless the cost-share program serves as an effective barrier to entry.

The USDA offered data on the price premium for organic fruits over conventional ones for the years 2010-2013. These years are after the introduction of the NOCCSP and as such can provide insight as to whether the cost share program led to an increase in price premiums, — suggesting effectiveness at functioning as a barrier to entry—a decrease, or no change. The data provided by the USDA focuses on two terminal markets where produce is sold: Atlanta and San Francisco. I analyzed the price premiums for the same fruits separately for the two markets to account for differences in demand between the two markets or other differences that could lead to differing price premiums between the two. All of the price premiums are in US Dollar units and the premium is for a standard unit of the particular fruit with which it corresponds. All of the standard units for the fruits are included in Appendix A. All of the figures for the remaining fruits are included in Appendix A as well. While these figures reflect trend data over time and
are not econometric models, it is apparent that since the introduction of the NOCCSP in 2009 many organic fruits have seen substantial increases in their price premium over conventional counterparts. For those fruits which may not have seen the same substantial increase, or even a decrease in their price premium, it is still evident that organic fruits continue to receive considerable price premiums over conventional fruit, suggesting at least some barriers to entry in this market—perhaps the NOCCSP in particular—are effectively keeping potential new entrants out, regardless of whether they are increasing barriers into entering this market. One fruit that saw an increase in price premiums at the end of 2013 over its 2010 starting price in both the Atlanta and San Francisco markets was the organic avocado.
Figure 3: Price Premium for Organic Avocados over Conventional-ATL Terminal
Standard unit for Avocados: Cartons 2 layer

Figure 4: Price Premium for Organic Avocados over Conventional-SF Terminal
Standard unit for Avocados: Cartons 2 layer
The price premium data for this crop in these two markets is notable because both markets have substantial price premiums for organic avocados over conventional avocados well after the introduction of the NOCCSP. This implies the program’s effectiveness in at least maintaining barriers to entry in the market or existing price premiums due to differentiation or signaling, providing further reason to investigate this program through the tools of econometric analysis. However, between the two markets there are differences. In Atlanta, price premiums first increased and then decreased but remained above the initial 2010 price premium. In San Francisco, the price premium for organic avocados experienced a greater increase but at a value of $16.71 in 2013, the premium in this market is still lower than the $20.24 price premium in 2013 in Atlanta. Appendix A tracks the trend in organic fruit price premiums for many other fruits. The consistent price premiums over time for these other fruits underscores the idea that barriers to entry or existing characteristics of this market are at the very least maintained after NOCCSP introduction and justifies the application of econometric analysis to this industry.

V. **Econometric Regression Models and Results**

I applied different econometric regression models to this study for four years and the change between those years: 2008, 2011, 2014, and 2015. The year 2011 is only analyzed in models included in Appendix C. I utilized Eviews statistical package to run regressions and test for statistical significance and heteroskedasticity. In this section, I discuss my hypotheses and the results of various models and explain their meaning in relation to the research question and my hypotheses. Unless otherwise indicated, all models were tested for heteroskedasticity and had none present.
The background of the organic food industry and the National Organic Certification Cost Share Program, combined with a review of the literature and economic theory led to the following null and alternative hypotheses:

\[ h_0: \text{DisbursedFunds}(\text{Year}) = 0 \]

\[ h_a: \text{DisbursedFunds}(\text{Year}) \neq 0 \]

The null hypothesis states that the variable DisbursedFunds(Year), which is the disbursed NOCCSP funds in a given year, has no statistically significant effect on the dependent variable, which in my models alternates between the difference in the number of certified organic operations between two years and the difference in the number of certified organic acres between two years. The alternative hypothesis states that the variable DisbursedFunds(Year) does have a statistically significant effect on one of the two dependent variables. Specifically, I anticipate \( \text{DisbursedFunds}(\text{Year}) < 0 \) in the case where the dependent variable is the difference in the number of certified organic operations, since that would suggest the NOCCSP functions as a barrier to entry and any increase in funds from this program leads to a slowing rate of growth of new certified organic farm entry. I anticipate \( \text{DisbursedFunds}(\text{Year}) > 0 \) in the case where the dependent variable is the difference in the number of certified organic acres, since that would suggest NOCCSP funds are influencing those farmers already in the market to increase their existing operations by expanding acres. These hypotheses are tested through the following econometric models. Before describing the models, Table 1 provides a description of all the variables used in the various models.
<table>
<thead>
<tr>
<th><strong>Variable Name</strong></th>
<th><strong>Definition</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>DifferenceinNumberofOrganicOperations0814</td>
<td>difference between the number of certified organic operations between 2008 and 2014</td>
</tr>
<tr>
<td>DisbursedFunds14</td>
<td>amount of NOCCSP funds that were disbursed to the states in Fiscal Year 2014</td>
</tr>
<tr>
<td>Plninc14</td>
<td>number of certified organic farms stating on the 2014 Organic Survey that they plan to increase their organic operations in the next five years</td>
</tr>
<tr>
<td>DisbursedFunds(Year)</td>
<td>the disbursed NOCCSP funds in a given year</td>
</tr>
<tr>
<td>AMASTATE</td>
<td>a dummy variable that takes on a value of one if the state is one of the sixteen states also eligible for cost-share reimbursement funds from the AMA program in addition to the nationwide NOCCSP and a zero otherwise</td>
</tr>
<tr>
<td>HouseholdBuy15</td>
<td>percentage of households purchasing organic products in 2015</td>
</tr>
<tr>
<td>DifferenceinNumberofOrganicAcres0814</td>
<td>difference in the number of certified organic acres between 2008 and 2014</td>
</tr>
<tr>
<td>DisbursedFunds15</td>
<td>amount of NOCCSP funds disbursed to the states in Fiscal Year 2015</td>
</tr>
<tr>
<td>Plninc15</td>
<td>number of certified organic farmers in 2015 who said they plan to increase their organic operations in the next five years</td>
</tr>
<tr>
<td>DifferenceinOrganicAcres1415</td>
<td>difference in the number of certified organic acres between 2014 and 2015</td>
</tr>
<tr>
<td>DifferenceinNumberofOrganicOperations1415</td>
<td>difference between the number of certified organic operations between 2014 and 2015</td>
</tr>
<tr>
<td>DifferenceinNumberofCertifiedOrganicOperations0811</td>
<td>difference between the number of certified organic operations between 2008 and 2011</td>
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<tr>
<td>DifferenceinNumberofTransitioningOperations1214</td>
<td>difference between the number of transitioning operations between 2012 and 2014</td>
</tr>
<tr>
<td>DisbursedFundsDifferenceFY1214</td>
<td>difference between the NOCCSP disbursed funds between Fiscal Years 2012 and 2014</td>
</tr>
<tr>
<td>HouseholdBuy%Chng1516</td>
<td>change in the percentage of households buying organic between 2015 and 2016</td>
</tr>
<tr>
<td>DisFundDiffFY1415</td>
<td>total disbursed funds difference between Fiscal Years 2014 and 2015</td>
</tr>
<tr>
<td>DifferenceinCroplandTransitioningNumberofOperations1415</td>
<td>difference in the number of operations between 2014 and 2015 transitioning their cropland to organic</td>
</tr>
<tr>
<td>Plninc08</td>
<td>number of certified organic farmers in 2008 who said they plan to increase their organic operations in the next five years</td>
</tr>
</tbody>
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*Table 1: Table of Variables*
Equation 1 is the first model developed to test the hypotheses:

\[ \text{Difference in Number of Organic Operations}_{0814} = \beta_0 + \beta_1 \text{Disbursed Funds}_{14} + \beta_2 \text{Plninc}_{14} \]  

(1)

In this model, the variables are defined as follows:

- \(\text{Difference in Number of Organic Operations}_{0814}\) - the difference between the number of certified organic operations between 2008 and 2014
- \(\text{Disbursed Funds}_{2014}\) - the amount of NOCCSP funds that were disbursed to the states in Fiscal Year 2014
- \(\text{Plninc}_{14}\) - the number of certified organic farms stating on the 2014 Organic Survey that they plan to increase their organic operations in the next five years

Table 2 reports the results from this regression below:

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>-28.04812</td>
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<td>Disbursed Funds_{14}</td>
<td>-.000290</td>
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<tr>
<td>Plninc_{14}</td>
<td>0.619946</td>
<td>0.132598</td>
<td>4.675360</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

| R-squared:       | 0.327345    | Mean dependent var: | -4.591837   |
| Adjusted R-squared: | 0.298099  | S. D. dependent var: | 69.08296    |

Table 2: Outputs for Equation 1

To interpret the results, I first look at the Disbursed Funds_{14} variable. The result is highly statistically significant based on its p-value. The coefficient on this variable means that for a one unit, or one dollar, increase in the disbursed funds from the NOCCSP in 2014, there is an...
expected decrease in the total difference in the number of certified organic operations between 2008 and 2014 of .000290. Put another way, as the disbursed funds from the NOCCSP in 2014 increase, the rate of change in the difference in the number of certified organic operations is slowing. When putting this interpretation in a more realistic framework with regard to the amount of funds states typically receive, this means a $10,000 increase in NOCCSP funding a state receives leads to a 2.9, or nearly 3-farm decrease in the total difference in the number of certified organic farms between 2008 and 2014 than would occur without the cost-share program. The finding here supports the hypothesis that the NOCCSP functions as an effective barrier to entry; if increasing the funds from this cost-share subsidy decreases the total difference in the number of organic operations and leads to a slowing rate of change as evidenced by the negative effect of the disbursed funds variable on the difference in certified organic operations in the years before and after NOCCSP implementation, that means the rate of farms entering the market than otherwise would be in the absence of NOCCSP is slowing, leading to the decrease in the total difference in the number of operations between the two years.

Turning to interpret the next variable, Plninc14, it is apparent this result is highly significant as well. The understanding of this variable is that for a one-unit increase in the number of farms stating they plan to increase organic operations in the next five years, there is a .62 increase in the total difference in the number of organic operations between 2008 and 2014. The practical interpretation of this result is harder to grasp. The result suggests that if a farm planned in 2014 to increase operations in the next five years, they did so because they believe the market will still be profitable in the next five years and worth increasing their operations, most likely through an increase in organic acreage. If farmers do have this rational view of the market and that is why they plan to increase operations in the next five years, then it makes sense this could be serving
as a signal the market is still profitable enough to attract new entrants, even in the face of potential barriers to entry. This line of logic would explain why the coefficient has a positive sign on the total difference in the number of certified organic operations between 2008 and 2014, suggesting an increase in the rate of growth in organic operations over time.

This first model lends support to the alternative hypothesis that funding provided by the NOCCSP functions as an effective barrier to entry. In order to strengthen the analysis, I began to test other models as well. The next model was similar to the first and is given by Equation 2:

\[ \text{DifferenceinNumberof\ Organic\ Operations}_{0814} = \beta_0 + \beta_1 \text{DisbursedFunds}_{14} + \beta_2 \text{Plninc}_{14} + \beta_3 \text{AMASTATE} \]  \hspace{1cm} (2)

The DisbursedFunds14 and Plninc14 variables have the same definitions as in Equation 1. AMASTATE is a dummy variable that takes on a value of one if the state is one of the sixteen states also eligible for cost-share reimbursement funds from the AMA program in addition to the nationwide NOCCSP and a zero otherwise. Table 3 delineates the results of Equation 2:

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
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<tbody>
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<td>-2.426414</td>
<td>0.0193</td>
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<tr>
<td>DisbursedFunds14</td>
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<td>8.96E-05</td>
<td>-3.198921</td>
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<td>Plninc14</td>
<td>0.615021</td>
<td>0.152202</td>
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<td>0.0002</td>
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<tr>
<td>AMASTATE</td>
<td>1.460518</td>
<td>21.37428</td>
<td>0.068331</td>
<td>0.9458</td>
</tr>
</tbody>
</table>

R-squared: 0.327415
Mean dependent var: -4.591837
Adjusted R-squared: 0.282576
SD. dependent var: 69.08296

Table 3: Outputs for Equation 2
The sign and the magnitude of the coefficients for DisbursedFunds14 and Plninc14 are nearly the same in both Equation 1 and 2 and both remain statistically significant. The AMASTATE dummy variable is not statistically significant and has not helped in increasing the R-squared by much, or explaining more of the variation in the total difference in the number of certified organic operations between 2008 and 2014.

In the next model, I add a proxy variable for demand based on the Nielsen Homescan data and incorporate that into Equation 3:

\[
\text{Difference in Number of Organic Operations 0814} \\
= \beta_0 + \beta_1 \text{DisbursedFunds14} + \beta_2 \text{Plninc14} + \beta_3 \text{AMASTATE} \\
+ \beta_4 \text{HouseholdBuy15} \quad (3)
\]

The new variable, HouseholdBuy15, is the percentage of households purchasing organic products in 2015. Although the model is measuring the difference in the number of organic farms between the years 2008 and 2014 and not 2015, I chose to include this variable to proxy for demand given the limited data I was able to collect that measured demand for organic goods. The

\[
\begin{array}{|c|c|c|c|c|}
\hline
\text{Variable} & \text{Coefficient} & \text{Std. Error} & \text{t-Statistic} & \text{Prob.} \\
\hline
\text{C} & 276.1020 & 102.4210 & 2.695756 & 0.0101 \\
\text{DisbursedFunds14} & -0.000186 & 8.10E-05 & -2.294655 & 0.0269 \\
\text{Plninc14} & 0.515632 & 0.131594 & 3.918345 & 0.0003 \\
\text{AMASTATE} & 35.64595 & 19.57512 & 1.820982 & 0.0759 \\
\text{HouseholdBuy15} & -4.044578 & 1.349421 & -2.997270 & 0.0046 \\
\hline
\end{array}
\]

\textit{Table 4: Outputs for Equation 3}
results from this model must be taken with caution as HouseholdBuy15 is standing in for lack of a better proxy variable. Table 4 illustrates the results.

Interpreting this model yields both reaffirming insights and new ones. The coefficients on DisbursedFunds14, Plninc14, and AMASTATE all maintain the same signs and approximate magnitudes. In the case of the AMASTATE dummy variable, in this model the variable becomes statistically significant. The new variable in this model, HouseholdBuy15, is statistically significant and has a negative sign on its coefficient. The coefficient states that for a one-unit percentage increase in the number of households purchasing organic food, there is an expected decrease of 4.045 organic farms in the total difference between the number of organic operations between 2008 and 2014. Although HouseholdBuy15 is an imperfect proxy for demand, its significance in this model could potentially further the evidence of barriers to entry in the organic food industry. The logic is that as demand for organic food increases, more households will purchase organic food. This increase in organic demand driven by a change in tastes from consumers will shift the demand curve for organic food to the right and increase the price of organic food at any given quantity level of output, making the industry seem more profitable to potential entrants and encouraging entry. However, incumbent firms would be aware of this in a market with perfect information and, if they act rationally to such information, would construct barriers to entry, such as the NOCCSP, to keep out new entrants trying to capture some of the higher prices and profits in the market. This logic makes the interpretation of the sign of the coefficient on HouseholdBuy15 make sense and potentially support the idea that barriers to entry are present in this industry.

After examining the regressions when the difference in the number of certified organic operations between two years is dependent on variables like the difference in disbursed
NOCCSP, I estimated a simple linear regression with the difference in the number of certified organic acres between 2008 and 2014 as the dependent variable. Equation 4 outlines this model:

\[
\text{Difference in Number of Organic Acres 08-14} = \beta_0 + \beta_1 \text{Disbursed Funds 2014} \quad (4)
\]

The left-hand side, or dependent, variable is the difference in the number of certified organic acres between 2008 and 2014. The independent variable is again the disbursed NOCCSP funding in 2014 over the lack of funding in 2008 prior to the program’s implementation. Table 5 describes the model’s outputs:

<table>
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<tr>
<th>Dependent Variable: DiffinAcres0814</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method: Least squares</td>
</tr>
<tr>
<td>Sample: 50 Included Observations: 49</td>
</tr>
<tr>
<td>Variable</td>
</tr>
<tr>
<td>C</td>
</tr>
<tr>
<td>DisbursedFunds14</td>
</tr>
<tr>
<td>R-squared:</td>
</tr>
<tr>
<td>Adjusted R-squared:</td>
</tr>
</tbody>
</table>

Table 5: Outputs for Equation 4

Although this model is only a simple linear regression and has a low R-squared value, I chose to include it because it demonstrates a statistically significant relationship between the difference in certified organic acres between 2008 and 2014 and the difference in NOCCSP disbursed funds given out in 2014 over the lack of those funds in 2008. The significant and positive coefficient can be interpreted as saying that for a one unit, or one-dollar increase in the amount of disbursed funds given to the states as a result of the NOCCSP, there is an increase of 0.14 acres in the total difference between certified organic acres in 2008 and 2014. When applying this interpretation to dollar levels more closely actualized in the realm of this cost-share program, the result can be viewed as saying that for a $10,000 increase in disbursed NOCCSP
funding, there is an increase of 1,400 certified organic acres in the total difference between 2008 and 2014 than otherwise would have been there in the absence of the NOCCSP. When coupled with the statistically significant negative coefficient the DisbursedFunds2014 variable had on the difference in the number of certified organic operations between 2008 and 2014, there appears to be evidence in favor of rejecting the null that the NOCCSP is not an effective barrier to entry in favor of the alternative hypothesis that the NOCCSP is an effective barrier to entry. The two results support the idea that the NOCCSP is effectively slowing down the growth rate of new entry into the organic food industry as suggested by the negative sign on the funding variable when looking at the difference in certified operations, while at the same time encouraging existing farmers who qualify for the program to expand their operations, as evidenced by the positive sign on the funding variable for the difference in certified acres. After analyzing these foundational models, I examined more models in order to make the analysis more robust.

The next model examined the effect of the NOCCSP reimbursement on the difference in the number of certified organic operations between 2014 and 2015.

\[
\text{Difference in Number of Organic Operations}_{1415} = \beta_0 + \beta_1 \text{DisbursedFunds}_{15} + \beta_2 \text{Plninc}_{15} \quad (5)
\]

The variable DisbursedFunds15 is the amount of NOCCSP funds disbursed to the states in Fiscal Year 2015 and Plninc15 is the number of certified organic farmers in 2015 who said they plan to increase their organic operations in the next five years. Table 6 gives the results:
The coefficient on the DisbursedFunds15 variable is negative and statistically significant. It means that for a one unit or one-dollar increase in the disbursed NOCCSP funds a state receives in 2015, there is a decrease in the difference of certified organic operations by an amount of 0.0000523. Viewed in the realm of dollar amounts more likely to be disbursed to states, a $10,000 increase in the amount of disbursed NOCCSP funds a state receives in Fiscal Year 2015 over not receiving funds leads to a decrease of .523 certified organic farms in the total difference in the number of certified organic operations between 2014 and 2015. This can be considered a sign of increasing barriers to entry from the NOCCSP program as the rate of growth in the number of certified organic operations continues to slow between 2014 and 2015. It is worth noting the coefficient magnitude on this DisbursedFunds(Year) variable is smaller than the coefficient magnitude on this same variable in the model examining the effects of DisbursedFunds14 on the total difference in the number of certified organic operations between 2008 and 2014. The fact that the magnitude of the coefficient on DisbursedFunds15 is smaller in

<table>
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<td>2.98E-05</td>
<td>-1.755120</td>
<td>0.0862</td>
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<tr>
<td>Plnine15</td>
<td>-0.047383</td>
<td>0.067662</td>
<td>-0.700281</td>
<td>0.4874</td>
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</tbody>
</table>

Table 6: Outputs for Equation 5
this model could suggest that the NOCCSP is becoming less effective over time as a barrier to entry. Although the sign on this variable was negative in both models, indicating a slowing growth rate in the number of certified organic operations between two years than otherwise would have occurred without this funding, the smaller magnitude of this negative sign on the difference in the number of certified organic operations between 2014 and 2015 over the same difference between 2008 and 2014 could mean that over time the program is not able to slow the growth rate of new entry as much. Another potential explanation for the difference in magnitude on this variable between the two years is that in the model examining the effect of DisbursedFunds14 on the total difference in the number of certified organic operations between 2008 and 2014, there is a bigger gap of time between the two years, whereas in this model the effect of DisbursedFunds15 on the total difference in the number of certified organic operations between 2014 and 2015, or just a one-year difference. The length of time in each of these differences in the number of certified organic operations could be impacting the magnitude of the independent variable, DisbursedFunds(Year).

The Plninc15 variable is not statistically significant and thus in this model, I cannot draw any concrete conclusions from this variable. This model has an R-squared of .258, which is relatively promising given the fact it incorporates only two independent variables. While this model seems to further support my alternative hypothesis, I decided to try another model that adds more independent variables in an attempt to better explain more of the variation in the dependent variable of the difference in the number of certified organic operations between 2014 and 2015. Equation 6 describes this latest model with two other independent variables.
\[ \text{DifferenceinNumberofOrganicOperations}_{1415} = \beta_0 + \beta_1 \text{DisbursedFunds}_{15} + \beta_2 \text{Plninc}_{15} + \beta_3 \text{HouseholdBuy}_{15} + \beta_4 \text{AMASTATE} \quad (6) \]

In this equation, the new variable AMASTATE is again a dummy variable that takes on a value of one if the state is one of sixteen that gets both NOCCSP and AMA reimbursements and the HouseholdBuy_{15} variable is the percentage of households in the United States purchasing organic food in 2015. Table 7 presents the results:

<table>
<thead>
<tr>
<th>Variable</th>
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<th>t-Statistic</th>
<th>Prob.</th>
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<td>Plninc_{15}</td>
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<tr>
<td>HouseholdBuy_{15}</td>
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<td>0.0032</td>
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<tr>
<td>AMASTATE</td>
<td>17.16199</td>
<td>12.35279</td>
<td>1.389321</td>
<td>0.1724</td>
</tr>
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</table>

Table 7: Outputs for Equation 6

The results displayed here seem to weaken the evidence that the NOCCSP disbursed funds in a given year are an effective barrier to entry. In this model, the coefficient on DisbursedFunds_{15} remains negative, suggesting the barrier to entry exists and slowing growth of new entry is occurring, but it is not statistically significant here. This means that although the negative sign would imply that a one-unit increase in the disbursed NOCCSP funds in 2015 would lead to a decrease of .0000218 in the total difference in certified organic farms between 2014 and 2015, the p-value indicates in this model it is not significant and more likely is occurring by chance.
This mixed result on this pivotal variable could warrant further investigation with other models, some of which are included in Appendix C. However, one explanation for the mixed significance could be that as time goes on from the initial introduction of the NOCCSP, the effectiveness of the program as a barrier to entry could be weakening as other innovations in the marketplace, such as the certified transitional label initiated by large companies such as Kashi, attempt to offset and overcome barriers to entry. This idea was already present when examining Equation 5 and the model there. It is also possible that when the other variables were added to this model, the effect of the disbursed funds in 2015 was no longer a significant one.

In examining the other variables, it is evident that the coefficient on Plninc15 has the same sign as in the previous model, but again the variable remains insignificant. The dummy variable, AMASTATE, is insignificant as well. The only significant result in this model is the coefficient on HouseholdBuy15. This coefficient is highly significant and suggests that for a one-unit increase in the percentage of households buying organic products in 2015, there is a decrease of 2.86 farms in the total difference in the number of certified organic operations between 2014 and 2015.

Although HouseholdBuy15 remains an imperfect proxy for demand, its significance in this model could again further the evidence of barriers to entry in the organic food industry. The logic applied to interpreting the coefficient of this variable in this model is similar to the interpretation used in explaining the results of Equation 3. If incumbent farms are aware of the increase in demand and the potential of such an increase to attract growth, that could motivate them to obstruct barriers to entry to prevent, or at least hinder, potential entry. This logic assumes that certified organic farmers have access to information on the demand for organic food.
One more model to include in the analysis of the question as to whether the NOCCSP functions as an effective barrier to entry in the organic food industry is described by Equation 7:

\[
\text{Difference in Organic Acres}_{14\text{15}} = \beta_0 + \beta_1 \text{Disbursed Funds}_{15} + \beta_2 \text{Plninc}_{15} + \beta_3 \text{Household Buy}_{15} \quad (7)
\]

In this model, the dependent variable is the difference in the number of certified organic acres between 2014 and 2015, while the three independent variables are DisbursedFunds15, Plninc15, and HouseholdBuy15, all of which are defined in the same manner as in previous models.

The initial results for this model were tested for heteroskedasticity with the Breusch-Pagan Test and these results indicated heteroskedasticity was present in the model. In order to correct for heteroskedasticity, the coefficients were estimated with White heteroskedasticity-consistent standard errors and covariance. The results from White’s correction appear in Table 8. The

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<td>Sample (adjusted): 50</td>
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<td>1.982658</td>
<td>0.0541</td>
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<tr>
<td>HouseholdBuy15</td>
<td>-193.8391</td>
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<td>-0.316432</td>
<td>0.7533</td>
</tr>
</tbody>
</table>

R-squared: 0.296548 | Mean dependent var: -5846.778
Adjusted R-squared: 0.245076 | S. D. dependent var: 40350.12

Table 8: Outputs for Equation 7
original model outputs and standard errors with heteroskedasticity present appears in Appendix C.

Only one of the variables in this model is statistically significant, and it is the one this study has been most interested in: DisbursedFunds15, or the disbursed NOCCSP funds in fiscal year 2015. The coefficient on this variable is statistically significant and has a positive sign, which is what the alternative hypothesis that the NOCCSP is functioning as an effective barrier to entry anticipated. The interpretation of this result is that for a one-dollar increase in the disbursed NOCCSP funds there is an increase of .12 acres in the total difference in certified organic acres between 2014 and 2015, implying an increasing rate of growth in certified organic acres. Equivalently, for a $10,000 increase in disbursed NOCCSP funding in 2015, there is an expected increase of 1,182.90 acres in the total difference in certified organic acreage between 2014 and 2015. This interpretation can be viewed as supporting the idea that the NOCCSP is an effective barrier to entry because if disbursed NOCCSP funds are leading to a statistically significant increase in the growth rate of certified organic acreage, while in the model where the difference in the number of organic operations between 2014 and 2015 is the dependent variable the disbursed NOCCSP funds had a statistically significant negative sign, that could mean new entrants are finding it more difficult to enter the industry, evidenced with slowing or decreasing growth rates in certified organic operations, while those who are already in the market are benefitting from the NOCCSP and able to expand their operations by increasing the acreage of their farm, as evidenced by increasing growth rates in certified organic acreage.

VI. Conclusion

After comprehensively examining the organic food industry, reviewing economic literature and economic theory needed to understand the research question, and applying econometric
analysis, this study arrives at some critical conclusions. The first conclusion is that, based on the available data and econometric analysis conducted, the National Organic Certification Cost Share Program functions as an effective barrier to entry in the organic food industry. There was enough evidence in the econometric models to reject the null hypothesis that the NOCCSP disbursed funds had no effect on the total difference in either the number of certified organic operations or the number of certified organic acres in favor of the alternative hypothesis that the effect of this program was to function as a barrier to entry. The support for this comes from the fact that most models with the difference in the total number of certified organic operations as the dependent variable yielded statistically significant and negative coefficients for the independent variable DisbursedFunds(Year) for a given year. This indicated a one-unit increase in dollar funding of disbursed funds for a given year would lead to a decrease in the total difference in the number of certified organic operations between two years, or a slowing growth rate in the number of certified organic operations. At the same time, when this variable was incorporated in a model where the dependent variable was the difference in the number of certified organic acres, the results displayed a typically significant and positive coefficient for the DisbursedFunds(Year) variable. This implied a one-unit increase in dollar funding of disbursed funds for a given year would lead to an increase in the total difference in the number of certified organic acres, or an increase in the growth rate of certified organic acres. Taken together, these results suggest that the NOCCSP is effective at making it more difficult for new farmers to enter the certified organic market while subsidizing recertification costs for incumbent farmers to the extent that they are encouraged to increase operations by expanding their acreage.

While it is encouraging to have obtained results that appear to agree with the alternative hypothesis, it must be reiterated that this study was limited by data availability. Future research
on this topic could incorporate data that will be available in the future. For instance, in October 2017 the 2016 Organic Survey results will be made public. Future studies could work to incorporate this latest data and test the models here with the most recent numbers on certified organic operations and acres by state. Another avenue for future research to explore lies in getting at a better proxy variable for demand of organic food. Demand of organic food was difficult to proxy and the data available on the percentage of households buying organic by state was only from 2015 and 2016. If a future researcher has access to Nielsen scanner data from a longer time period, there is a better potential for the results to be tested for consistency in sign and magnitude over time.

Additionally, other researchers may be able to develop a way to proxy for demand that is less likely to be indirectly affected by equilibrium demand and supply. If a proxy is found that truly isolates demand, I would recommend testing the models in this study again with that proxy.

While this study was cross-sectional, a researcher in the future could try to incorporate the research question into a time-series model and see if the results yielded from such a study corroborate the findings here.

Appendix A in this study has data on price premiums for organic foods in terminal markets over time, but there was a lack of price premium data at the state level. If state-level price premium data can be gathered, a future adjustment to the research models presented here would be to add a variable for overall organic price premiums and see if that has a statistically significant effect on entry or inframarginal growth in the organic food industry.

One other realm related to barriers to entry and labeling worth investigating in the future could be in regards to “Non-GMO” food labels. Like the certified organic label, the “Non-GMO” label is beginning to gain attention as more and more consumers are concerned about eating
foods containing GMOs, or genetically modified organisms, and the labeling and marketing of these products attempts to shift consumers’ tastes. If there is data available in the future, it could be worth trying similar models with regards to GMOs rather than organic foods to determine if the labeling in this industry is helping producers of non-GMO foods gain economic rents.

In the grocery store, it is inevitable that organic foods, both certified and uncertified, will continue to populate store shelves with their claims of better health and environmental impacts. New labels such as Kashi’s Certified Transitional label may gain more popularity and prevalence as it becomes harder to enter this profitable market. Despite its green and natural appearance, and claims of a humble grassroots origin, the results of this study should encourage a healthy dose of skepticism on the part of consumers to not accept the claims by organic producers or labels at face value; consumers need to be aware there may be something inorganic, and indeed very unnatural, about the growth of the organic food industry. With this healthy skepticism as a part of their diet, the consumer can choose to purchase organic products for reasons they truly believe in, rather than the ones being marketed to them. An awareness of the shortfalls, and indeed prohibitive effects of existing programs like the National Organic Certification Cost Share Program can encourage the development of new legislation aimed at farmers in the transitional stage of the organic process that could actually encourage new growth in this industry.
References


Appendix A: Price Premiums for Organic Fruits over time: 2010-2013
The Atlanta Terminal is denoted ATL and the San Francisco terminal is denoted SF.

Figure 1A: Price Premium for Organic Braeburn Apples over Conventional-ATL

Figure 2A: Price Premium for Organic Braeburn Apples over Conventional-SF

Standard Unit size for Braeburn Apples: cartons tray pack 80s,88s

Standard Unit size for Braeburn Apples: cartons tray pack 80s,88s
Figure 3A: Price Premium for Organic Fuji Apples over Conventional-ATL

Figure 4A: Price Premium for Organic Fuji Apples over Conventional-SF

Standard Unit size for Fuji Apples: cartons tray pack 80s,88s

Standard Unit size for Fuji Apples: cartons tray pack 80s,88s
Figure 5A: Price Premium for Organic Raspberries-ATL

Standard Unit size for Raspberries: flats 12 6-oz cups with lids

Figure 6A: Price Premium for Organic Raspberries-SF

Standard Unit size for Raspberries: flats 12 6-oz cups with lids
Figure 7A: Price Premium for Organic Bananas-ATL

Standard Unit size for Bananas: 40 lb cartons

Figure 8A: Price Premium for Organic Bananas-SF

Standard Unit size for Bananas: 40 lb cartons
Figure 9A: Price Premium for Organic Strawberries-ATL

Figure 10A: Price Premium for Organic Strawberries-SF

Standard Unit size for Strawberries: flats 8 1-lb cntrs with lids
Figure 11A: Price Premium for Organic Oranges - ATL terminal

Figure 12A: Price Premium for Organic Oranges - SF Terminal

Standard Unit size for Oranges: 7/10 bushel cartons
Figure 13A: Price Premium for Organic Bartlett Pears-ATL

Standard Unit size for Pears: 4/5 bushel cartons

Figure 14A: Price Premium for Organic Bartlett Pears-SF

Standard Unit size for Pears: 4/5 bushel cartons
The fourteen graphs in Appendix A are demonstrative of the continued price premiums in the organic food industry, especially the organic fruit segment of the industry. In most of the graphs, 2011 is serving as a turning point by either being the lowest or the highest value of the price premium in the four years there is trend data for the particular fruit’s price premium. However, 2011 is not consistently the highest or lowest point and that led to the question as to what might potentially account for the difference across fruits in terms of if 2011 is the highest or lowest price premium. One potential explanation for this is weather. According to the Environmental Protection Agency, there was a La Nina event between September 2010 and May 2011, and this greatly disrupted the growing season of some of these fruits (“Climate Impacts”). A further peak into potential reasons for 2011 and its turning point role comes from the National Oceanic and Atmospheric Administration (NOAA), which listed billion-dollar weather events from 2011 such as severe drought, Hurricane Irene, a blizzard, and flooding (“Billion-Dollar Weather”). These graphs emphasize the trend of organic price premiums to persist and potentially reflect barriers to entry into this industry. The graphs do not serve to show causation and so the question surrounding why 2011 is often a turning point year for many fruits is lightly considered. Further research into this topic could warrant focus solely on price premiums of organic foods and how correlated they are with the weather in a given year. Further research could potentially investigate the relationship between the price premiums of organic fruits and the terminal sales market as well.
Appendix B: Links to Methodology Descriptions for USDA NASS Data and Nielsen Homescan Data

The following links provide detail on the exact statistical methodology followed by the USDA National Agricultural Statistics Service for their data collection in the Organic Surveys.

2008:  

2011:  

2014:  


Please note that for the 2011 and 2015 links, the statistical methodology description begins with Appendix A at the end of the report. Additionally, the link provided here also features in Appendix B the Organic Survey form sent out to farmers.

The following link provides details on Nielsen Homescan Data and its implications when being used in policy analysis. This evaluation of the Nielsen Homescan Data comes from the USDA’s Economic Research Service (ERS):  
Appendix C: Additional Econometric Regression Models

The models displayed in the appendix here are intended to further augment the study. Some models also include the year 2011 when looking at the effect of NOCCSP funding. Many of the models included here, but not all, suggest barriers to entry do exist as a result of the NOCCSP, at least to the extent that it leads to a slowing rate of growth in new entry into the market. Please note that all variables in these models are defined in the same manner as in the models included in the text.

\[
\text{Difference in Number of Certified Organic Operations 0811} = \beta_0 + \beta_1 \text{DisbursedFunds11} + \beta_2 \text{PlnInc08} + \beta_3 \text{AMASTATE} \quad (1C)
\]

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<th>Variable</th>
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<th>Std. Error</th>
<th>t-Statistic</th>
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</tr>
<tr>
<td>Mean dependent var:</td>
<td>-99.44186</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted R-squared:</td>
<td>0.776243</td>
<td></td>
<td></td>
<td>133.5432</td>
</tr>
</tbody>
</table>

Table 1C: Outputs for Equation 1C
### Equation 2C

**Difference in Number of Transitioning Operations 1214**

\[ \text{Dependent Variable: } \text{DiffNumOpsTrans1214} = \beta_0 + \beta_1 \text{DisbursedFundsDifferenceFY1214} \]  
\[ (2C) \]

where **DisbursedFundsDifferenceFY1214** is the difference between the NOCCSP disbursed funds between Fiscal Years 2012 and 2014.

### Table 2C: Outputs for Equation 2C

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>-39.95372</td>
<td>7.543055</td>
<td>-5.296756</td>
<td>0.0000</td>
</tr>
<tr>
<td>DisFundDiffFY1214</td>
<td>-0.000779</td>
<td>0.000127</td>
<td>-6.121166</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

**R-squared:** 0.438391  
**Mean dependent var:** -51.10000

**Adjusted R-squared:** 0.426691  
**S. D. dependent var:** 68.35957

---

### Equation 3C

### Table 3C: Outputs for Equation 3C

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>8966.446</td>
<td>68390.14</td>
<td>0.131107</td>
<td>0.8963</td>
</tr>
<tr>
<td>DisbursedFunds15</td>
<td>0.118291</td>
<td>0.028851</td>
<td>4.10035</td>
<td>0.0002</td>
</tr>
<tr>
<td>Phinc15</td>
<td>-203.4579</td>
<td>64.23009</td>
<td>-3.167642</td>
<td>0.0029</td>
</tr>
<tr>
<td>HouseholdBuy15</td>
<td>-193.8391</td>
<td>886.2245</td>
<td>-0.218725</td>
<td>0.8279</td>
</tr>
</tbody>
</table>

**R-squared:** 0.296548  
**Mean dependent var:** -5846.778

**Adjusted R-squared:** 0.245076  
**S. D. dependent var:** 40350.12
*Equation 3C is the same model as Equation 7 but the results are reported with heteroskedasticity present:* Difference in Certified Organic Acres 1415

\[ = \beta_0 + \beta_1 \text{Disbursed Funds}_15 + \beta_2 \text{Plninc}_15 + \beta_3 \text{HouseholdBuy}_15 \]  

(3C)

Table 4C gives the results of the Breusich Pagan Test for Heteroskedasticity for Equation 3C.

<table>
<thead>
<tr>
<th>Heteroskedasticity Test: Breusch-Pagan-Godfrey</th>
</tr>
</thead>
<tbody>
<tr>
<td>F-statistic: 5.536334</td>
</tr>
<tr>
<td>Obs*R-squared: 12.97376</td>
</tr>
<tr>
<td>Scaled explained SS: 42.18362</td>
</tr>
</tbody>
</table>

*Table 4C: Heteroskedasticity results for Equation 3C*

<table>
<thead>
<tr>
<th>Dependent Variable: Diff in Cropland Transitioning Number of Operations 1415</th>
</tr>
</thead>
<tbody>
<tr>
<td>Method: Least squares</td>
</tr>
<tr>
<td>Sample: 50</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>29.47688</td>
<td>14.43535</td>
<td>2.041993</td>
<td>0.0476</td>
</tr>
<tr>
<td>HouseholdBuy%Chng 1516</td>
<td>-.225857</td>
<td>2.371251</td>
<td>-0.95248</td>
<td>0.3214</td>
</tr>
<tr>
<td>DisFundDiffFY 1415</td>
<td>0.000157</td>
<td>0.000157</td>
<td>1.003810</td>
<td>0.3214</td>
</tr>
<tr>
<td>Plninc 15</td>
<td>-0.314833</td>
<td>0.090418</td>
<td>-3.481990</td>
<td>0.0012</td>
</tr>
<tr>
<td>AMASTATE</td>
<td>5.114236</td>
<td>17.09093</td>
<td>0.299237</td>
<td>0.7663</td>
</tr>
<tr>
<td>R-squared:</td>
<td>0.344342</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted R-squared:</td>
<td>0.280375</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Table 5C: Outputs for Equation 5C*

*Difference in Cropland Transitioning Number of Operations 1415*

\[ = \beta_0 + \beta_1 \text{HouseholdBuy%Chng}_1516 + \beta_2 \text{DisFundDiffFY}_1415 + \beta_3 \text{Plninc}_15 + \beta_4 \text{AMASTATE} \]  

(5C)
In Equation 5C, HouseholdBuy%Chng1516 is the change in the percentage of households buying organic between 2015 and 2016 and DisFundDiffFY1415 is the total disbursed funds difference between Fiscal Years 2014 and 2015.

\[
\text{DiffinNumOrgOps}_{1415} = \beta_0 + \beta_1 \text{HouseholdBuy}_{15} + \beta_2 \text{DisFundDiffFY}_{1415} + \beta_3 \text{Plninc}_{15} + \beta_4 \text{AMASTATE} \quad (6C)
\]

In Equation 6C, DiffinNumOrgOps1415 is the total difference in the number of certified organic operations between 2014 and 2015 and DisFundDiffFY1415 is the total disbursed funds difference between Fiscal Year 2014 and 2015.