TO CERTIFY OR NOT TO CERTIFY? DECOMPOSING THE ORGANIC PRODUCTION AND CERTIFICATION DECISIONS.

Michael D. Veldstra, Corinne E. Alexander and Maria I. Marshall

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Abstract

Consumer demand for organic food has risen quickly over the past decade, triggered in part by the development and success of USDA's organic regulatory program and label (Greene et al. 2009). This rise in demand has led to a shortage of organic products and strained organic supply chains. There is a need to increase the number of certified organic acres to meet this demand. The objective of this research is to decompose the decision to certify organic, by first identifying the factors that influence the decision to use organic practices then identifying the factors that influence organic producer's decision to certify.

A total of 1559 responses were collected from 4312 surveys sent out to fruit and vegetable growers participating in University of Illinois MarketMaker in 16 different states. Two Probit regressions were performed. The first regression was performed on a total of 1040 usable respondents to examine the significant factors in determining a producer's decision to use organic practices. A second regression was performed with using the respondents who use organic practices to determine the significant factors in determining the producer's decision to certify. The results from the first regression show that a producer's philosophical beliefs and risk of losses due to disease, weeds, and insects has the largest impact on the decision to use organic practices. The results of the second regression show that the size of the producer is positively correlated with the decision to certify, and the process of certification is a barrier to certification. They also show that producers who indicated that direct market channels are their most economically important channels are less likely to certify.

The US organic industry has been growing rapidly and the National Organic Program (NOP) established uniform organic production standards to ensure consumer protection for all products labeled organic in the marketplace (Treadwell 2010). Over the past 10 years the growth in consumer demand for organic food products has increased 20% every year compared to a 5% yearly growth in total food sales (OTA 2010). This growth in organic sales is driven by the sales of fresh produce which accounts for 38% of all organic food sales (OTA 2010; USDA). Organic was once considered a niche market; organic products are now sold in mainstream supermarkets and a majority of consumers by at least some organic products (Hartman 2009). The adoption of and conversion to organic practices has not kept up with this increased demand (Constance and Choi 2009). Much of this demand is being met by imports, and as a result the 2008 Farm Act included several new provisions to increase organic adoption rates (Greene et al. 2009).

In order to understand what drives adoption of certified organic production, the objective of this research is to decompose the decision to certify organic from the decision to use organic practices and to identify the factors that influence these two decisions. We will identify the production, economic and marketing constraints to the adoption of organic practices and organic certification. One reason to separate the production and certification decision is anecdotal evidence that some producers who use organic practices are deciding not to certify. The decision to use organic practices but forgo certification is interesting because certification is seen as a way to convince consumers to pay more for a product (Getz and Shreck 2006).

Literature Review

There is a substantial literature on certified organic production and we base our testable hypotheses on this literature. There are some demographic patterns among certified organic producers. On average, organic farmers are younger and have six to ten years less experience

than their conventional counterparts (D' Souza et al. 1993; Burton et al. 1999). The literature also finds that there are a larger proportion of females among organic producers than among conventional producers (Burton et al. 1999; Padel 2001; Walz 2004). The literature is at odds with respect to the importance of education in the adoption of organic practices. D' Souza et al. (1993) claim that more education is positively and significant related to the adoption of organic practices while Burton et al. (1999) find education is not significant.

Many studies have found that organic farmers are concerned about the environment and sustainability of the food system (Burton et al. 1999; Klonsky 2000; Sierra 2008; Walz 2004). Conversion to organic farming reflects both the relative profitability of organic and conventional systems and the philosophical beliefs of producers (Burton et al. 1999). Darnhofer et al. (2005) explicitly recognize both profit and philosophical motivations underlying the production system choice, and develop a scale of farmer types to capture these motivations ranging from "commited conventional" to "commited organic".

Sierra et al. (2008) also highlight the importance of philosophical motivations. In a survey of California organic producers, they found that 40% used organic practices for philosophical reasons, 17% used organic practices for pragmatic reasons, and 43% had a balance of both. The motivations behind using organic practices depend on the size of the farm. Of producers who farmed 50 acres or less, 49% were philosophical, 43% balanced, and 8% pragmatic. In contrast none of the producers who farmed more than 50 acres were categorized as philosophical.

In addition to the demographic and philosophical reasons for adopting organic practices, there are other factors to consider as well. Gardebroek (2006) found that organic farmers tend to be less risk averse compared to conventional farmers. Not all organic producers face the same

risks nor do they manage their risks in the same way (Hanson et al. 2004; Gardebroek 2006). The amount of risk involved with organic production depends on the organic product being grown. If the organic product is produced in a similar manner as conventional product then the risks tend to be similar to conventional risks but managed slightly differently (Hanson et al. 2004).

Organic producers' production risks from weather and climate are similar to conventional producers but organic farmers must rely on longer crop rotations and more crops diversity to mitigate the risk of disease, insects and weeds as well for soil fertility (Hanson et al. 2004; Oberholtzer et al. 2005). However, an organic producer is vulnerable to the possible migration of pest problems that develop on neighboring farms. The organic producer has few options for dealing with these pests once they have migrated (Hanson et al. 2004). This leads to **H_1: Fertility, disease, insect, and weed losses impact the decision to use organic practices.**

The NOP requires certified organic producers to have longer rotations and more diverse crops. As a result, producers may need to include crops in the rotation that receive little or no premium, while other crops in the rotation gain a large premium (Klonsky 2000; Oberholtzer et al. 2005). Because of the financial risks due to variation in premiums Wolf (2006) suggests that for a producer to succeed at producing organically, he/she must be financially strong with low debt and preferably own the land.

Another deterrent to converting to organic practices is the three year transition period required for organic certification and to gain access to certified organic price premiums. During this transition period the land must be managed according organic practices, but producers cannot obtain certified organic price premiums. However, the producer may be able charge a higher price for being "transitional" (Oberholtzer et al. 2005). The risk of transition may be mitigated by converting gradually.

Other risks associated with organic farming are high managerial costs and the risk of shifting to a new way of farming, limited awareness of organic systems, lack of marketing and infrastructure and inability to capture marketing economies, as obstacles to adoption (USDA). Hanson et al. (2004) also discuss the regulation risks that organic producer's face which include inconsistent interpretation of rules, uneven enforcement, and gray areas associated with the certification rules in the National Organic Program. These regulatory risks could lead to some farmers losing certification unintentionally.

Wolf (2006) mentions that a way of lowering the risk of converting to organic is to do so gradually; this way the producer will develop the skills and knowledge gradually. This slow conversion approach may be common practice among farmers as Sierra et al. (2008) found that 80% of farms with less than 50 acres farmed more than half of their land organically where farms over 50 acres farmed only 29% of their farms organically.

One might believe that if a farmer is using organic practices that he/she would certify, but there is evidence that this is not always the case. Organic producers who are not certified are not simply in the process of getting certified (Burton et al. 1999). One reason organic producers choose to not certify is the financial and time cost of certification and record-keeping are prohibitive relative to farm sales. Another reason may be that the producer prefers to be free of certification requirements (Burton et al 1999). Other reasons include marketing strategies that do not involve certification, lack of access to organic markets or handlers, and a belief that the benefits of certifying do not outweigh the costs. Sierra et al. (2008) examined reasons behind a 20% deregistration ("decertification") of organic producers in California. They found that most cited reasons for discontinuing certification were paperwork, record keeping, and certification costs. This leads to **H_3: Certification costs are barriers to a producer's certification. H_{3a}:**

The three year transition period is a barrier to certification. H_{3b}: Record keeping is a barrier to certification H_{3c}: Loss of "freedom" on farm is a barrier to certification H_{3d}: Cost of Certification is a barrier to certification

Several long-term studies (5-10 years) compared conventionally grown field crop systems with organic field crop systems or low-input systems (Smith et al. 2004; Mahoney et al. 2004; Diebel et al. 1995; Chavas et al. 2009). These studies suggest that some organic systems can be as profitable as conventional systems, but with some caveats. Mahoney et al. (2004) finds that some organic systems' net returns are equal to the conventional systems even without the price premiums and significantly higher with the price premiums. In contrast, Smith et al. suggest that organic systems were profitable but only with price premiums. Chavas et al. (2009) find that only some of the organic systems are more profitable than conventional systems. All three studies find that organic systems returns increase significantly with price premiums. They also all suggest that organic systems are only profitable if the producer is able to maintain lower production costs that help compensate for the income losses from lower yields. This leads to **H_2: High disease and weed control costs impacts the decision to use organic practices.**

Organic producers may face a shortage of organic seed, pesticides and other inputs (Hanson et al. 2004). Green et al. (2009) has also suggested that the fast paced growth of the organic industry has led to shortages of organic inputs. These input shortages have caused prices to increase. Organic producers also have high costs because of relatively intense use of labor, specialized equipment and other substitutes for synthetic chemicals (Oberholtzer et al. 2005). Organic producers may have limited access to capital because banks are unfamiliar with organic systems (Hanson et al. 2004). This leads to **H_4: Difficulty in obtaining organic inputs negatively impacts the decision to use organic practices.**

Larger farms are more equipped to deal with high production costs because they can take advantage of economies of scale. The entry of larger, more mainstream producers and retailers in the organic industry has been accelerated by the introduction of the NOP and has the potential to push out smaller organic producers (Klonsky 2000). According to Klonsky (2000) there is a vested interest among organic farmers, processers, and retailers to limit the organic industry's growth, and therefore hold on to higher price premiums. Dobbs et al. (2000) suggests that if the priority of the organic industry is to foster relatively small and moderate sized farms then a slower and more deliberate growth plan is best. Dobbs et al. (2000) also suggests that if the growth is not slowed there will be a tendency of the organic sector to become much like the conventional "industrial" system. Hanson et al. (2004) suggests that the organic market is experiencing "growing pains" where small organic producers are facing increasing competition from larger organic producers as well as imported organic products from places like China and South America. Sierra et al. (2008) showed that almost half of the deregistered farmers reported less than $5,000 in total farm revenues. Also, 27% of deregistered farmers earned all of their household income from farming. This suggests that large farms tend to certify while small farms do not (Klonsky and Tourte, 1998). This leads to **H_5: An increase in gross sales increases the likelihood of organic certification.**

Small farms also tend to use different marketing techniques than larger farms. According Dimitri and Greene (2002), 60 percent of farms with fewer than 10 acres use direct marketing compared to only 12 percent with more than 10 acres. Because the farmer is marketing directly he/she can earn a higher share of the consumers dollar by selling directly and not through a broker (Dimitri and Greene 2002). This direct contact with consumers may reduce the need for certification because a farmer can just "invite the consumer to the farm to observe his practice"

and many times the consumer is more willing to pay for customer service than the label (Kremen and Greene 2004). Park and Lohr (2006) found that some farmers may choose to only direct market because of problems with organic buyers. With direct marketing the farmer can gain price premiums and consumer trust for his/her produce without the paperwork and cost of certifying his/her land to gain price premiums. However Park and Lohr (2006) found that farmers who use more marketing channels earn more than those who only use one marketing channel. Park and Lohr (2006) and Park(2009) also found the larger farms are more likely to use multiple marketing channels than family farms and sole proprieters.

Some farmers that rely on direct marketing may chose not to certify organic because in the market where these farmers sell there may be negative perceptions of organic products and/or organic product pricing. These markets tend to be in rural areas or in early stages of organic awareness (Kremen and Greene 2004). However, farmers who rely on direct marketing may choose to certify depending on their location. There is evidence of strong consumer demand for certified organic at farmers markets in New Mexico and Washingtion(Kremen and Green 2004). This leads to **H_6: The use of direct marketing reduces the likelihood of organic certification.**

Data

The population for this survey was obtained from a list of fruit and vegetable producers from MarketMaker, a national partnership of land grant institutions and State Departments of Agriculture designed to aid in the development of a comprehensive data base of food industry marketing and business data (MarketMaker). The list obtained from MarketMaker contained 4,312 addresses, of which 3,015 also had an email address. The list came from 16 of the 19 MarketMaker participating states (Table 1).

The survey was implemented using a mixed-mode design, with a mail invitation to an online survey. The mixed-mode design has been shown to increase response rates over a purely internet survey (Dillman 2009). The sample was sent an invitation letter by mail containing an incentive of a two dollar bill on Wednesday, January 4, 2012. According to Dillman (2009) a cash incentive at the time of the survey request can significantly increase the response rate. The two dollar bill was chosen not only for its monetary value, but also its "novelty factor". The letter contained the link **http://www.agecon.purdue.edu/vegsurvey/** and a password "veggie". This link directed the respondents to a web-page where they could access the direct link to the survey. Once they entered the direct link they were prompted for the password.

Email reminders were sent three times on Tuesday, January 10, Wednesday, January 18, and Wednesday, February 1. Dillman (2009) suggests that one to two weeks between reminders is optimum but also states that the optimal reminder dates are dependent on the population sampled. We chose to only send reminders to those with email addresses due to cost constraints.

The survey was designed and implemented using the web-based survey software, Qualtrics. The survey contained two distinct sections. The first section consisted of 36 questions relating to the products, farming practices used, marketing channels, perceived barriers to entry in organic market, perceptions of different farming practices, and demographics. Those who did not grow any fruit or vegetables were thanked for their time and exited out of the survey. The second section of the survey was only for those who grow tomatoes.

A total of 1559 producers responded to the survey. The response rate was calculated using the accepted formula of the American Association for Public Opinion Research (AAPOR). The overall response rate was 36.15%, and Table 1 presents the response rate for each state.

Table1. Response rate of each state sampled from MarketMaker.

State	Respondents	Total in Sample	Response Rate
AL	5	8	62.5%
AR	16	28	57.1%
FL	63	127	49.2%
GA	88	364	24.2%
IA	130	268	48.5%
IL	180	679	26.5%
IN	99	199	49.8%
KY	96	319	30.1%
LA	29	88	32.9%
MI	83	239	34.7%
MS	53	123	43.1%
NE	72	344	20.9%
NY	223	810	27.5%
OH	122	330	36.9%
PA	54	107	50.5%
SC	72	269	26.8%
Survey	1559	4312	36.15%

Once the survey was closed, the survey data were cleaned and the open-ended responses were coded. Based on responses to other vegetable and other fruit, we added an additional 10 crops to the original list of 45. In order to better describe respondents' operations, we created several variables. The variable *numcrop* reports the total number of crops produced. The dummy variable of *vegmelonly* was created by giving the value of 1 if the respondent only grew vegetables and/or melons, and 0 if they grew more than just vegetables and/or melons or did not grow vegetables and/or melons. The variable *perennialonly* was created if the respondent only grew perennial crops such as blueberries, tree fruits/nuts, and grapes.

The respondents were asked to identify what percentage of their production was conventional, certified organic, transition to certified organic, or under organic practices but not certified. The respondents were the asked to identify which of the following eight marketing channels were used for each of these practices: "At the farm", "At farmers' markets", "Through

CSA", "Via Internet-Mail-Order", "Through wholesale markets", "To processor", "Through Coop or Assoc.", and "Other". Responses to the "Other" category were recoded into existing categories and we created another market channel variable for retail and restaurant channels. Respondents were also asked to rank their most economically profitable marketing channel from 1 to 3 where 1 was the most profitable. The dummy variable *econdirect* was created from this question where the value "1" was assigned if the respondent ranked a direct marketing channel (at the farm, at a farmers market, through a CSA, or through the Internet or Mail-order) as their number one most economically important channel, else "0".

The respondents were asked to indicate how many years they had been farming. This was recoded to 80 if it was greater than 80. If the years' farming was greater than their indicated age then it was recoded to missing. The female variable was created as a dummy variable where it was 1 if they checked they were female and 0 if they were male. Similarly a variable for the respondents' ethnicity was created where it was 1 if the respondent was not white and 0 if the respondent was white. The education of the respondents was created into a continuous variable by assigning a value to the level of education indicated by the respondent, e.g. if the respondent indicated their high level of education was grade school they were given the value of 8, if they indicated some high school they were give the value 10, this continued all the way up to graduate degree where they were given the value of 20. A variable for the percent of acres owned was created by dividing the total number of acres owned by the sum of the acres owned and rented.

Respondents were asked to indicate how many family and non-family members worked on the farm. The variable *peoplework* was created by taking the sum of these two variables to indicate the total number of workers on the farm.

Respondents were asked to identify the business structure of their farm and they were given 6 choices: sole proprietorship, limited liability company (LLC), sub-chapter (S) corporation, corporation, partnership, and cooperative. There were only 10 respondents who chose cooperative so these respondents were coded with corporation, based on the similar amount of paperwork required for these business structures.

The respondents were grouped into 4 different geographical regions, South, Delta, Northeast, and Midwest. The South region consisted of Florida, Georgia and South Carolina. The Delta region consisted of Alabama, Arkansas, Mississippi, and Louisiana. The Northeast region consisted of New York and Pennsylvania. The Midwest region consisted of Iowa, Illinois, Indiana, Michigan, Nebraska, Ohio, and Kentucky.

The respondents were grouped into 4 groups based on their gross sales. These were *exempt* (<$5,000), *small* ($5,000-$49,999), *medium* ($50,000-$249,999) and *large* (>$250,000). These are based on the 2008 ARMS with the exception of the exempt category, this category was added because those farms with less than $5,000 in gross sales are not required to certify with the NOP in order to label their products as organic.

The respondents were asked a series of attitudinal questions; they were asked to indicate on a 5-point Likert scale the extent they agree or disagree with a list of 21 statements. There were many missing responses to these attitudinal questions mostly due to the selection of not applicable which was recoded to missing. The inclusion of these attitudinal variables in the regressions greatly reduced the number of usable observations. To reduce the number of missing variables, we created several index variables. These index variables were created by summing multiple Likert scale questions and dividing by the number of questions that respondent

answered. After creating the index variables there were 1040 usable observations from the 1559 responses, compared to only 756 usable observations before creating the index variables.

The first index variable *philosophyave* combined five questions that indicated the respondent's philosophical view on organic production. The second index variable *lossesave* combined the respondents' view that losses related to disease, weeds, insects, fertility, and weather were a barrier to entering organic markets. The third index variable *highinputcostave* combined the respondents' view that high equipment, fertilizer, and seed costs were a barrier to organic markets. The final index variable *lackofave* combined the respondents' view that lack of equipment, organic processing facilities, and reliable labor were barriers to organic certification. Table 2 presents the questions used to create each of these index variables, as well as their means and frequencies. Although the frequencies for most of these variables are less than 1040, each of the 1040 respondents answered at least one of the questions included in each index variable.

Table 2 Frequencies and means of variables used in index variables.

Index Variables		**N**	**Means**	**St. Dev.**
Philosophyave				
Q17_4_c	I support the philosophy of organic farming	1035	3.86	1.28
Q17_13_c	Using organic practices is healthier for me and my family	1018	3.93	1.24
Q17_9_c	My family supports organic production	970	3.62	1.23
Q17_7_c	Organic practices are more sustainable than conventional	1023	3.38	1.43
Q17_2_c	Organic farming is viable for me	1013	2.90	1.46
lossesave				
Q15_3	Disease-related losses	1034	2.13	.72
Q15_2	Insect-related losses	1040	2.18	.71
Q15_4	Weed-related losses	1037	2.07	.77
Q15_1	Weather-related losses	1035	2.02	.70
Q15_5	Fertility-related losses	1028	1.63	.69
highinputcostsave				
Q15_9	High equipment costs	1035	1.82	.74
Q15_8	High fertilizer costs	1038	1.87	.75

Q15_7 lackofave	High seed costs	1035	1.70	.69
Q15_13	Lack of availability of equipment	1037	1.53	.66
Q15_15	Lack of availability of organic processing facilities	1031	1.84	.82
Q15_12	Lack of reliable labor	1039	1.95	.78

The philosophyave questions were on a scale of 1-5 where 1=Strongly Disagree and 5=Strongly Agree. The lossesave, highinputcostsave, and lackofave were on a scale of 1-3 where 1=Not a Barrier and 3=Severe Barrier.

Methods

We use a discrete choice model to describe the producer's decision to use organic practices and/or organic certification. Since the probability that a given producer has chosen to use organic practices or certify is bound by zero and one, we use a probit model. A producers' decision to use organic practices or certification was a discrete choice (yes or no).

Probit models (Greene 2007) are used for explaining a dichotomous dependent variable with the empirical specification formulated in terms of a latent response variable, say y*, where

$$y_i^* = \beta_0 + \boldsymbol{x}_i'\beta + \varepsilon_i \quad (1)$$

Let *i* denote the respondent and:

$\boldsymbol{x}_i'$= $[x_{1i},x_{2i},\ldots,x_{ki}]$ where *k* is the number of independent variables that explain the phenomenon for respondent *i.*
β : Vector of parameters that indicates the effect of $\boldsymbol{x}_i'$ on y_i*
β_0 : intercept that indicates the expected value of y* when all $\boldsymbol{x}_i'$ equal to zero
ε_i: stochastic error term for the respondent *i.*

The latent variable y_i* is continuous, unobserved and ranges from -∞ to +∞. Variable y_i* generates the observed binary variable y_i where

$$y_i = \begin{cases} 1 \text{ if } y_i^* > 0, \\ 0 \text{ otherwise.} \end{cases} \quad (2)$$

To deal with the decision to use organic practices and the decision to certify, two independent models are estimated. First, let y_i* denote the propensity to use organic practices as compared to the use of only conventional practices, with the variable defined as $y_i^* \equiv y_{1i}^*$.

Second, the decision to certify organic in the future is defined as $y_i^* \equiv y_{2i}^*$. Under these assumptions, equation (2) is defined for each of the probit models as

$$y_{1i} = \begin{cases} 1 \text{ if use organic practices.} \\ 0 \text{ if use only conventional practices.} \end{cases} \quad (3)$$

and

$$y_{2i} = \begin{cases} 1 \text{ if certifies with the NOP.} \\ 0 \text{ if use organic practices, but does not certify.} \end{cases} \quad (4)$$

Because we are using a probit model, we must calculate the marginal effects or the effect of x_k on the probability of success prob($y_i = 1 \mid \boldsymbol{x}_i'$). The latent variable y_i^* does not have a well-defined unit of measurement. Thus, the magnitudes of each β_k are not, by themselves, especially useful (in contrast to the linear probability model). We use calculate the marginal effects following Wooldridge (2002). A measure suggesting the goodness to fit of the probit models is the percentage of observations that correctly predicted by the model (Greene, 2007). As a goodness of fit, we will use the "likelihood ratio index" (McFadden 1973).

Data Used in the Models

The first regression is to understand the decision to use organic practices. For this regression there are a total of 1040 observations, 585 use organic practices and 455 use only conventional practices. The second regression is only on those who use organic practices to understand the decision to certify. There are a total of 585 observations of which 158 are certified or in transition and 427 use only organic practices but are not certified. Table 3 gives the full list of variables and their descriptions. The variables for demographic and farm characteristics are used in both regressions. The set of variables in the Organic Practices section are only used in the regression on use of organic practices. The set of variables in the Organic

Certification section are only used in the regression on the decision to certify. Table 4 presents descriptive statistics for each variable and producer type pertaining to these regressions.

Table 3 Variable Descriptions

Variable	Description
female	Producer is female, 1 if yes
exempt	Producer has gross sales <5000, 1 if yes
small	Producer has gross sales between 5000-49,999, 1 if yes
medium	Producer has gross sales between 50000-249,999, 1 if yes
large	Producer has gross sales larger than 250,000, 1 if yes
percentown	Percent of land owned. Total Acres owned/Total Acres
yearsfarming	Number of Years farming
llc	Business Structure is LLC, 1 if yes
subchaps	Business Structure is Sub-Chapter (S), 1 if yes
partner	Business Structure is a Partnership, 1 if yes
corp	Business Structure is a Corporation, 1 if yes
Soleprop	Business Structure is a Sole Proprietorship, 1 if yes
nonwhite	Producer is not white, 1 if yes
education	Continuous variable 8 for grade school through 20 for Graduate school
seasonext	Producer uses season extension, 1 if yes
peoplework	Number of people working on farm. Family members + Non-Family Members
hoursonfarm	Number of hours working on farm business each week
south	If business is in South region, 1 if yes
delta	If business is in delta region, 1 if yes
northeast	If business is in northeast region, 1 if yes
midwest	If business is in the Midwest region, 1 if yes
avedistance	Average distance to markets
numcrop	Number of crops produced
nummarket	Number of markets used
vegmelonly	Grow only vegetables and/or melons, 1 if yes
perenialonly	Grow only perennial crops, 1 if yes
econdirect	Most economically important marketing channel is direct marketing, 1 if yes
timerecordkeep	Percent of time spend recordkeeping
	Organic Practices Model
philosophyave	Index of 5 questions: "I support the philosophy of organic farming"; "Using organic practices is healthier for me and my family"; "My family supports organic production"; "Organic practices are more sustainable than conventional"; "Organic farming is viable for me". These were then summed and divided by the count of number of questions answered.

lossesave	Index of 5 questions: "Disease-related losses"; "Insect-related losses"; "Weed-related losses"; "Fertility-related losses"; "Weather-related losses". These were then summed and divided by the count of number of questions answered.
highinputcostsave	Index of 3 questions: "High equipment costs"; "High fertilizer costs"; "High seed costs". These were then summed and divided by the count of number of questions answered.
satisfied	I am satisfied with my present farming system
lackofave	Index of 3 questions: "Lack of available equipment"; "Lack of available organic processing facilities"; "Lack of reliable labor". These were then summed and divided by the count of number of questions answered.
diseaseweedcontrol	High disease and weed control costs
orginput	Lack of available organic inputs
	Organic Certification Model
q17_3_c	I believe organic markets are reliable
q17_15_c	The process of organic certification is confusing
q14_1	Finding reliable buyers/market for my organic products
q14_2	Difficulty obtaining organic price information
q14_3	Uncertainty in obtaining organic price premiums
q14_4	Distance to available organic markets
q16_1	Loss of freedom of what I can and cannot do
q16_2	Paperwork
q16_3	Cost of certification
q16_4	Interaction with certifier
q16_5	Lack of information about certification
q16_6	3-year transition period
_cons	

Table 4 Variable Means and (Standard Deviation).

	All	**Conventional**	**Organic**	**Non-Certified**	**Certified**
female*	0.31	0.2	0.4	0.41	0.39
exempt*	0.18	0.15	0.2	0.25	0.07
small*	0.41	0.36	0.45	0.47	0.37
medium*	0.27	0.27	0.27	0.22	0.39
large*	0.14	0.22	0.08	0.06	0.17
percentown	0.8	0.76	0.82	0.83	0.8
	(0.35)	(0.36)	(0.34)		(0.35)
yearsfarming	20.18	23.37	17.7	16.71	20.39
	(14.39)	(14.75)	(13.61)	(13.87)	(12.53)
LLC*	0.2	0.18	0.22	0.2	0.25
SubChapS*	0.06	0.07	0.05	0.04	0.08
Partner*	0.06	0.06	0.06	0.05	0.07

Corp*	0.08	0.08	0.07	0.06	0.12
SoleProp	0.6	0.6	0.6	0.65	0.48
Nonwhite*	0.04	0.02	0.04	0.05	0.02
education	15.95	15.86	16.02	15.82	16.56
	(2.56)	(2.58)	(2.54)	(2.52)	(2.52)
seasonext*	0.53	0.35	0.68	0.67	0.7
peoplework	7.02	9.11	5.39	4.74	7.15
	(13.52)	(17.73)	(8.65)	(7.74)	(10.58)
hoursonfarm	39.97	40.41	39.62	38.09	43.77
	(23.17)	(23.84)	(22.65)	(22.59)	(22.37)
south*	0.17	0.15	0.18	0.19	0.15
delta*	0.08	0.09	0.07	0.07	0.09
northeast*	0.21	0.17	0.23	0.18	0.38
midwest*	0.54	0.59	0.52	0.56	0.38
avedistance	27.92	30.86	25.62	21.1	37.86
	(67.12)	(92.52)	(36.71)	(26.11)	(54.39)
numcrop	17.53	10.92	22.66	22.12	24.12
	(12.63)	(9.75)	(12.23)	(11.9)	(13.01)
nummarket	2.46	2.16	2.69	2.56	3.02
	(1.17)	(1.03)	(1.21)	(1.18)	(1.25)
vegmelonly*	0.28	0.31	0.25	0.27	0.18
perenialonly*	0.1	0.16	0.06	0.05	0.08
econDirect*	0.79	0.76	0.82	0.85	0.73
timerecordkeep	11.05	10.95	11.13	10.69	12.3
	(10.96)	(10.55)	(11.28)	(11.04)	(11.84)
Number of Observations	1040	455	585	427	158

*** Indicates a dummy, where the mean is the percentage of respondents with that attribute.**

Researchers have shown that gender effects the decision to use organic practices (Burton et al. 1999; Padel 2001; Walz 2004). Overall, 31.4% of the respondents are female which is consistent with US farmers in general (USDA Census). However, those using organic practices are more likely to be female than those using only conventional practices. When looking at breakdown of conventional and organic producers in our data, only 20% of the conventional producers are female and 40.3% of the organic producers are female. The ethnicity of certified and non-certified producers is significantly different in that only 1.9% of certified producers are not white and 5.4% of non-certified producers are not white.

The average years farming for all producers was 20.2 years, with conventional producers farming an average of 23.4 years and organic producers 17.7 years; this is consistent with the findings of Constance and Choi (2010). The number of people working on the farm may influence the decision to use organic practices because organic practices tend to be more labor intensive. However we find that the average number of people working on the farm for all producers is 7.02 people; conventional producers have an average of 9.11 and organic producers have an average of 5.39 people. This finding may be contrary to our expectations because it is confounded with farm size.

Sierra et al. (2008) suggests that gross sales are a factor in the decision to use organic practices. Conventional producers are more likely to be large than organic producers, with 22% of conventional producers in the large category compared to 8% of organic producers. Certified producers are more likely to be medium or large (39.2% and 16.5%) than compared to non-certified producers (22% and 6.1%). Larger farms are able to take advantage of economies of scale and the cost of certification has less impact on their business. Larger farms are also more likely to use wholesale markets, where certification can give them a price premium.

Overall the respondents are well educated and 60.2% of the respondents had a 4-year college degree or more (Table 5). The respondents have significantly more education than the average US rural resident. Only 17.5% of those living in a rural area have a college degree or higher (USDA ERS). While the levels of education are similar for conventional and organic producers, education levels are significantly different between certified and non-certified producers. Certified producers are significantly more likely to have a graduate degree at 27.9% compared to 18.5% of non-certified producers.

Table 5 Education levels of producers.

Education Level	**All**	**Conventional**	**Organic**	**Certified**	**Non-**

					Certified
Grade School	0.48%	0.44%	0.51%	0%	0.70%
Some High School	0.38%	.22%	0.51%	1.27%	0.23%
High School Diploma	8.75%	12.09%	6.15%	1.27%	7.96%
Some College	29.42%	25.49%	32.48%	29.75%	33.49%
4-year College Degree	33.75%	35.82%	32.14%	31.65%	32.32%
Some Post Graduate	7.02%	6.81%	7.18%	8.23%	6.79%
Graduate Degree	20.19%	19.12%	21.03%	27.85%	18.5%
Number of Observations	1040	455	585	427	158

Consistent with Wolfe (2006), conventional producers owned on average 76.4% of the land they operate while 82% of organic farmers owned their land. Organic producers are more likely to use season extension at 67.5% compared to only 35.4% of conventional producers. Strochlic and Sierra (2007) suggest that producers of perennial crops may choose not to use organic practices because of the higher risks and high investments associated with transitioning perennial crops to organic practices. A total of 10.4% of the respondents grow only perennial crops (*perennialonly*), where 16.3% of conventional producers grow only perennial crops and 5.8% of organic producers grow perennial crops. Certified producers are more likely to grow perennial crops at 8.2% compared to 4.9% of non-certified; this difference may be explained by gross sales or the managerial skills needed for perennial crops may be similar to those needed for certification.

Certified producers are more likely to be a Sub-Chapter(S) or Corporation compared to non-certified producers and this is likely related to the fact that certified farms are larger than non-certified farms, and these business structures offer tax advantages for larger producers. The average percent time spent record keeping for certified producers is 12.3% compared to 10.7% for non-certified producers which is consistent with the additional paperwork for certification.

Tables 6 and 7 present the descriptive statistics for all the Likert and indexed Likert questions. Table 6 presents the questions where producers were asked to rank the severity of the

barrier to organic, from “Not a barrier” to “Severe Barrier”. Table 7 presents the descriptive statistics to the questions related to the level of agreement with certain statements.

Conventional producers are more likely to view high disease and weed control costs (*diseaseweedcontrol*) as a severe barrier at 58.5% and compared to 24.8% of organic producers. The *lossesave* index shows that 31.9% of conventional producers indicated yield losses as a severe barrier, while only 7.5% of organic producers indicated it is a severe barrier. The *orginput* index shows that 22% of conventional producers see difficulty obtaining organic inputs as a barrier compared to 12.3% of organic producers. The *highinputcostave* index shows that 15.4% of conventional producers see high input costs as a severe barrier compared to 11.1% of organic producers. The *lackofave* index shows that 12.3% of conventional producers see the lack of equipment, organic processing facilities and reliable labor as a severe barrier to organic markets compared to 8.7% of organic producers.

Questions Q14_1 through Q14_4 were included in the certification regression because these questions related to the marketing barriers to certification. Only Q14_3 and Q14_4 show significant difference in the number of certified and non-certified producers who indicated a severe barrier to entry of organic markets.

Questions Q16_1 through Q16_6 address the barriers related to certification. For all of these questions, non-certified producers were significantly more likely to perceive a severe barrier than certified producers (Table 6). This is expected since the certified producers are already certified they will perceive these as less of a barrier. Certified organic producers are significantly more likely to agree with the statement “I believe organic markets are reliable” at 41% compared to 20% for noncertified producers (Table 7). Certified organic producers are

significantly less likely to agree with the statement “The process of organic certification is confusing” at 5% compared to 26% of non-certified producers.

As suggested by previous research, we also look the personal philosophy of the producer and how it effects the decision to use organic practices (Padel 2001; Sierra et al. 2009; Burton et al. 1999; Darnhofer et al. 2005). The results show that only 0.9% of conventional producers strongly agree with the philosophy of organic production and 48.4% of organic producers strongly agree with the philosophy of organic production.

Conventional producers are more likely to strongly agree that they are satisfied with their present farming system at 58.9% compared to 41.4% of organic producers. The lower level of satisfaction among organic producers may indicate that they endure criticism for using organic practices (Wolfe 2006). There was also indication that some of the conventional producers may have thought the survey is biased toward organic production and wanted to indicate that they are happy with their conventional practices.

Table 6 Perceived Production Barrier frequencies and (percent).

		Not A Barrier	**Moderate Barrier**	**Severe Barrier**
	Organic Practices Model			
LossesAve* **	All	15%	67%	18%
	Conventional	9%	59%	32%
	Organic	19%	73%	8%
Highinputcostsave* **	All	34%	53%	13%
	Conventional	30%	55%	15%
	Organic	37%	52%	11%
Lackofave*	All	34%	56%	10%
	Conventional	31%	56%	12%
	Organic	36%	56%	9%
Diseaseweedcontrol***	All	20%	40%	40%
	Conventional	11%	31%	58%
	Organic	28%	47%	25%
Orginput***	All	40%	43%	17%
	Conventional	32%	46%	22%
	Organic	47%	41%	12%

Organic Certification Model				
Q14_1-Finding reliable buyers/market for my organic products	All Organic	49%	39%	12%
	Non-Certified	48%	39%	13%
	Certified	53%	37%	11%
Q14_2- Difficulty obtaining organic price information	All Organic	47%	39%	12%
	Non-Certified	47%	42%	11%
	Certified	49%	38%	13%
Q14_3*- Uncertainty in obtaining organic price premiums	All Organic	32%	39%	12%
	Non-Certified	30%	44%	26%
	Certified	37%	47%	15%
Q14_4- Distance to available organic markets	All Organic	49%	39%	12%
	Non-Certified	55%	33%	12%
	Certified	31%	41%	28%
Q16_1***-Loss of Freedom	All Organic	38%	39%	12%
	Non-Certified	30%	43%	26%
	Certified	58%	35%	8%
Q16_2***-Paperwork	All Organic	15%	39%	12%
	Non-Certified	11%	36%	53%
	Certified	27%	49%	25%
Q16_3***-Cost of Certification	All Organic	16%	39%	12%
	Non-Certified	11%	31%	59%
	Certified	31%	47%	22%
Q16_4***-Interaction with Certifier	All Organic	51%	39%	12%
	Non-Certified	42%	39%	18%
	Certified	73%	22%	4%
Q16_5***-Lack of Inputs	All Organic	53%	39%	12%
	Non-Certified	45%	39%	16%
	Certified	76%	18%	6%
Q16_6***-3-year Transition Period	All Organic	48%	39%	12%
	Non-Certified	40%	33%	26%
	Certified	68%	22%	10%

Respondents were asked to indicate the level of barrier to organic markets each of these presents. Frequency (% of Respondents) : P values report significant levels for chi-square test of producers' characteristics. *p<0.05; **p<0.01; ***p<0.001.

Table 7 Likert Scale variables frequencies and (percent).

		Disagree	**Somewhat Disagree**	**Neither**	**Somewhat Agree**	**Agree**
Organic Practice Model						
Philosophyave***	All	5%	15%	27%	26%	28%
	Conventional	11%	30%	42%	17%	1%
	Organic	0%	4%	15%	33%	48%
Satisfied	All	1%	9%	5%	35%	49%

	Conventional	2%	8%	5%	27%	59%
	Organic	1%	10%	5%	42%	41%
Organic Certification Model						
Q17_3_c* **	All Organic	6%	18%	21%	30%	26%
I believe organic	Non-Certified	7%	20%	24%	29%	20%
markets are reliable	Certified	4%	12%	13%	30%	41%
Q17_15_c* **	All Organic	8%	13%	23%	36%	20%
The process of	Non-Certified	4%	7%	28%	34%	26%
organic certification is confusing	Certified	17%	27%	11%	40%	5%

Respondents were asked to indicate the level of agreements with each of these presents. Frequency (% of Respondents): P values report significant levels for chi-square test of producers' characteristics. *p<0.05; **p<0.01; ***p<0.001.

Results

Parameter estimates of the decision to use organic practices model are presented in table 8 as well as the marginal effects. A variable with a positive coefficient indicates that an increase in that variable leads to an increase in the probability the producer uses organic practices, the opposite is also true. The marginal effects reported are interpreted differently depending on whether the variable is a dummy variable, continuous variable, or Likert-scale variable. The log likelihood ratio for the model was highly statistically significant which indicates that we can reject the hypothesis that all of the coefficients for the explanatory variables are zero.

Table 8. Probit Regression Results on Decision to Use Organic Practices.

	Coefficient		**Marginal Effects**	
female	0.132	(0.132)	0.048	(0.048)
exempt	0.173	(0.277)	0.062	(0.098)
small	0.141	(0.231)	0.052	(0.084)
medium	0.194	(0.22)	0.07	(0.078)
percentown	0.076	(0.179)	0.028	(0.066)
yearsfarming	-0.001	(0.005)	0	(0.002)
llc	0.293*	(0.163)	0.104*	(0.055)
subchaps	0.399	(-0.271)	0.135*	(0.082)
partner	0.078	(0.252)	0.029	(0.091)
corp	-0.064	(0.266)	-0.024	(0.1)
nonwhite	0.353	(0.326)	0.121	(0.1)

education	-0.01	(0.023)	-0.004	(0.009)
seasonext	0.232*	(0.129)	0.086*	(0.048)
peoplework	-0.003	(0.005)	-0.001	(0.002)
hoursonfarm	-0.004	(0.003)	-0.001	(0.001)
south	0.064	(0.165)	0.023	(0.06)
delta	0.113	(0.205)	0.041	(0.073)
northeast	0.345**	(0.164)	0.122**	(0.054)
avedistance	-0.001	(0.001)	0	(0)
numcrop	0.047***	(0.007)	0.018***	(0.002)
nummarket	0.243***	(0.058)	0.09***	(0.021)
vegmelonly	0.048	(0.142)	0.018	(0.052)
perenialonly	0.216	(0.211)	0.077	(0.072)
econdirect	0.086	(0.147)	0.032	(0.056)
timerecordkeep	0.001	(0.006)	0	(0.002)
philosophyave	1.041***	(0.075)	0.385***	(0.027)
lossesave	-0.412***	(0.158)	-0.152***	(0.059)
highinputcostsave	0.187	(0.127)	0.069	(0.047)
satisfied	-0.054	(0.057)	-0.02	(0.021)
lackofave	-0.088	(0.126)	-0.033	(0.047)
diseaseweedcontrol	-0.195*	(0.106)	-0.072*	(0.039)
orginput	-0.214**	(0.092)	-0.079**	(0.034)
_cons	-3.322***	(0.713)		

Total N = 1040 observations.
Notes: *p < 0.10 **p<0.05 ***p<0.01

The business structure of an LLC is associated with a positive significant coefficient, implying that respondents with an LLC are 10.4% more likely to use organic practices than a producer with sole proprietorship. While the business structure of a Sub-Chapter (S) is not significant in the original model (p=.141), the marginal effect is significantly positive indicating that Sub-Chapter (S) corporations are 13.5% more likely to use organic practices.

Season extension is associated with a positive significant coefficient, indicating the producers who use season extension are 8.6% more likely to use organic practices. This finding is consistent with Furman et al. (2009) who state that organic farmers use season extension as a way to manage risk and maintain their adaptive capacity.

Producers in the Northeast geographical region are associated with a positive significant coefficient, implying that respondents who were located in the Northeast are 12.2% more likely to use organic practices than producers in the Midwest. This is most likely attributable to the proximity to major urban centers, where organic produce is in higher demand.

The number of crops produced is positive and highly significant. This result is expected because of the longer crop rotations and diversification necessary for effective organic production to maintain soil fertility and to control pests and diseases. The variable related to the number of markets used is positive and highly significant. This is consistent with the literature in that those who organic practices use more market channels (Park 2009).

The coefficient on the index variable of *philosophyave* is positive and highly significant. Normally for Likert scale variables one must assume that the data is ordinal, meaning that ordering and ranking of the responses is possible but no measure of distance is possible (Allen and Seaman, 2007). However, since this variable is an index of 5 different Likert scale questions it is possible to say the distance between 1 and 2 is meaningful (Allen and Seaman, 2007). So for this variable we can say that for each .1 increase in the level of agreement means a 3.85% increase in the probability of the use of organic practices. This finding is consistent with the literature that the philosophy of the producer heavily influences the decision to use organic practices (Burton et al. 1999; Darnhofer et al. 2005; Sierra et al. 2008).

Hypotheses 1, 2 and 4 offered explanations for a producer's decisions to use organic practices. Hypothesis 1 states the perceived loss because of fertility, disease, insects, and weeds affects the decision to use organic production practices. The coefficient on the index variable of *lossesave* is highly significant and negative. Since it is an index variable we can say that for every .1 increase in the level of severity of the barrier to entry in organic markets because of

perceived losses due to disease, insects, weeds, fertility, and weather decreases the likelihood of using organic practices by 1.52%. Consistent with the literature, these results suggest that those who perceived these losses as a barrier to entry where less likely to use organic practices (Hanson et al. 2004; Oberholtzer et al. 2005; Wolfe 2006).

Hypothesis 2 states the costs associated with disease and weed control impact the decision to use organic practices. The coefficient on *diseaseweedcontrol* is significant and negative which is consistent with the literature (Hanson et al. 2004; Oberholtzer et al. 2005; Wolfe 2006). Hypothesis 4 states that the difficulty obtaining organic inputs negatively effects the decision to use organic practices. The coefficient on *orginput* is significant and negative, which is consistent with the literature (Greene et al. 2009).

Organic Certification Decision

Next, for the 585 producers who use organic practices, we examine their decision to certify. Table 9 presents the parameter estimates of the decision to certify model as well as the marginal effects. The log likelihood ratio for the model is highly statistically significant which indicates that we can reject the hypothesis that all of the coefficients for the explanatory variables are zero.

Table 9. Probit Regression Results for Decision to Certify Organic

	Coefficient		**Marginal Effects**	
female	0.096	(0.147)	0.026	(0.04)
exempt	-0.982***	(0.353)	-0.199***	(0.05)
small	-0.556**	(0.283)	-0.146**	(0.072)
medium	-0.083	(0.258)	-0.022	(0.067)
percentown	-0.041	(0.211)	-0.011	(0.057)
yearsfarming	0.011**	(0.005)	0.003**	(0.001)
llc	0	(0.177)	0	(0.048)
subchaps	0.095	(0.285)	0.027	(0.083)
partner	-0.001	(0.309)	0	(0.083)
corp	0.468*	(0.261)	0.147	(0.092)
nonwhite	-0.725*	(0.386)	-0.14***	(0.048)

education	0.064**	(0.028)	0.017**	(0.008)
seasonext	0.061	(0.169)	0.016	(0.045)
peoplework	0.005	(0.009)	0.001	(0.002)
hoursonfarm	-0.006	(0.004)	-0.002	(0.001)
south	0.29	(0.202)	0.085	(0.063)
delta	0.685***	(0.257)	0.227**	(0.096)
northeast	0.425**	(0.166)	0.126**	(0.053)
avedistance	0.007***	(0.002)	0.002***	(0.001)
numcrop	0.006	(0.007)	0.002	(0.002)
nummarket	0.102	(0.062)	0.028	(0.017)
vegmelonly	-0.205	(0.179)	-0.053	(0.044)
perenialonly	0.271	(0.33)	0.081	(0.107)
econdirect	-0.419**	(0.178)	-0.126**	(0.058)
timerecordkeep	0.002	(0.006)	0.001	(0.002)
q17_3_c	0.12*	(0.065)	0.032*	(0.018)
q17_15_c	-0.198***	(0.07)	-0.054***	(0.019)
q14_1	-0.125	(0.12)	-0.034	(0.033)
q14_2	0.224*	(0.128)	0.061*	(0.035)
q14_3	-0.064	(0.129)	-0.017	(0.035)
q14_4	0.201*	(0.116)	0.054*	(0.031)
q16_1	-0.12	(0.118)	-0.032	(0.032)
q16_2	-0.155	(0.116)	-0.042	(0.032)
q16_3	-0.221*	(0.117)	-0.06*	(0.032)
q16_4	-0.313**	(0.134)	-0.085**	(0.036)
q16_5	-0.074	(0.139)	-0.02	(0.038)
q16_6	0.017	(0.115)	0.004	(0.031)
_cons	-0.306	(0.848)		

Total N = 585 observations.
Notes: *p < 0.10 **p<0.05 ***p<0.01

Number of years farming is significant and positively related to being certified organic. The marginal effect implies that every year increase in experience increases the probability of being certified by 0.3%. This consistent with Lohr and Park (2002) who showed that experience positively affects the number of management practices, one of which is certification.

The coefficient on corporation is significant and positive; however the marginal effect is not significant so we cannot relate the fact that the firm is a corporation to the probability of being certified. Consistent with Park (2009) the significant coefficient on corporation can be

related to gross sales because certified producers tend to be larger than non-certified producers.

The coefficient on education is positive and significant; each additional year of education increases the probability of certification by 1.7%. This suggests that education offers producers the skills necessary to sift through all the rules and regulations associated with certification. The coefficient on non-white is significant and negative, indicating that producers who are not white are 14% less likely to be certified. Producers in the Northeast and Delta regions are associated with a positive significant coefficient, implying that respondents in the Northeast and Delta are 22.7% and 12.6% more likely to use organic practices than those in the Midwest. The coefficient on average distance to market is significant and positive.

Producers who agree that "organic markets are reliable" are significantly more likely to be certified. Producers who agree that "the process of organic certification is confusing" are significantly less likely to be certified. Producers who agree that obtaining organic price information and distance to available organic markets are barriers to entry for organic markets are significantly more likely to be certified.

Hypothesis 5 states that an increase in gross sales increases the likelihood of certification. The coefficient on exempt and small is significant and negative, these results support hypothesis 5. Hypothesis 6 states that the use of direct marketing reduces the likelihood of certification. A large number of the respondents used both direct and indirect marketing channels and we believe that the crucial distinction is whether the direct market channel is economically important to the operation, not if they use a direct market channel. The coefficient on *econdirec*t is significant and negative, supporting hypothesis 6.

Hypothesis 3 states that the costs of certification influence the decision to certify organic. This hypothesis was broken into 4 sub-hypotheses. Only one of these sub-hypotheses was

supported by the model on the decision to certify. Hypothesis 3_d states the cost of certification is a barrier to certification. The variable associated with this was significant and negative suggesting that those who perceived the costs of certification as a barrier are less likely to certify organic. The fact that paperwork is not significant is interesting given that 53% of non-certified producers indicated this is a severe barrier compared to 25% certified producers. However, interaction with the certifier is a significant barrier to certification. Digging into the relationship between paperwork and interaction with certifier, we find that 15% of respondents indicated that the interaction with the certifier is a severe barrier, and 87% of these respondents indicated that paperwork is a severe barrier. The fact that paperwork is not significant can also be attributed to the large number of respondents who indicated that the process of certification is confusing. Comparing responses to organic certification is confusing and paperwork, we find that 72.3% of producers, who indicated that paperwork is a severe barrier, also indicated they agree or strongly agree that the process of certification is confusing.

Conclusion

This study decomposes the decision to certify organic into two stages. The first decision is whether or not to use organic practices and the second is whether or not to certify. The objective of this research is to identify the factors that influence producers' decisions at each stage. By separating the decision to certify into two separate decisions of whether or not to use organic practices and whether or not to certify we are better able to determine the differences between these two decisions. The first decision we analyzed is the decision to use organic practices. We look at three specific hypotheses relating to the production methods of using organic practices. These hypothesis state that fertility, disease, insect and weed losses, as well as difficulty

obtaining organic inputs, and high disease and weed control costs impact the decision to use organic practices. All of these hypotheses are supported by the model.

Some interesting results of this model were that a producer's attitude toward organic practices is the largest indicator of whether or not a producer will use organic practices. This is consistent with the literature that states that the largest indicator for a producer to use organic practices is his philosophy (Burton et al. 1999, Darnhofer et al. 2005, Sierra et al 2008). The model also found that farmers who use season extension are more likely to use organic practices than those who do not. One explanation is that organic farmers use season extension as a way to manage risk and maintain their adaptive capacity (Furman et al. 2009).

The second decision analyzed is, for producers who use organic practices, the decision to certify organic. We confirmed the hypotheses related to gross sales and direct marketing. The model results showed that producers with larger gross sales are more likely to certify. Producers who rely on direct marketing are less likely to certify which demonstrates that a direct relationship with the consumer reduces the value of organic certification.

We tested four hypotheses related to the costs of certification as a barrier to certification. The only hypothesis confirmed by the model was that the financial cost of certification is a barrier to certification. By contrast, the three year transition period, loss of "freedom" and recordkeeping are not significant in the decision to certify. We believe that the three-year transition and loss of "freedom" were not significant because we only considered the certification decision for producers who currently use organic practices. These producers would be able to transition to certified organic production without a three-year transition period. In addition, these producers may not perceive a loss of freedom because they are already using organic practices. Lastly, the barrier of paperwork is not significant. However, "the process of

organic certification is confusing" is a significant barrier to certifying and 72.3% of producers who indicated paperwork is a severe barrier also indicated that the process is confusing as a severe barrier. These same producers indicated that the interaction with the certifier is a severe barrier, indicating that the burden of paperwork and confusion of about the certification process could be exacerbated by the certifier. Further, 50 percent of producers who use organic practices but choose not to certify agreed that the process of organic certification is confusing. This has implications for policy makers, in that there may be a need to simplify the certification process, offer more education to producers on the process of certification, or train certifiers on how to make the certification process less confusing.

We find that producers located in the Delta region and Northeast region are more likely to certify than those located in the Midwest or South regions. One explanation for this could be the proximity to major urban centers in the Northeast region such as New York City which suggests that producers certify in response to customer demand.

One important contribution to the literature is the finding that producers who who say that their most economically important market is a direct market are significantly less likely to certify, even if they use organic practices. Certified producers are more likely to sell through wholesale markets where certification is required if they are to label their product as organic.

The variable associated with uncertainty obtaining organic price premiums is significant and positive. One explanation for is that there are not reliable or easy ways to get price information for organic produce. However this difficulty in obtaining price information is also prevalent even in conventional producers, specifically those that produce vegetables and melons. The research also suggests that a there may be a need for better price reporting for organic products.

References

Allen, I.E., Seaman, C.A., 2007. Likert scales and data analyses. Qual. Prog 40, 64–65.

American Association for Public Opinion Research, AAPOR, 2009, Standard Definitions: Final Dispositions of Case Codes and Outcome Rates for Surveys, Ann Arbor, MI: AAPOR.)

Burton, M., D. Rigby, and T. Young, 1999. Analysis of the determinants of adoption of organic horticultural techniques in the UK. *J. Agric. Econ.* 50(1), 47–63.

Chavas, J.P., J.L. Posner, and J.L. Hedtcke. 2009. Organic and Conventional Production Systems in the Wisconsin Integrated Cropping Systems Trial: II. Economic and Risk Analysis 1993–2006. *Agronomy Journal* 101 (2):288-295.

Clark, S., K. Klonsky, P. Livingston, and S. Temple. 1999. Crop-yield and economic comparisons of organic, low-input and conventional farming systems in California, Sacramento Valley. *Am. J. Altern. Agric.* 14:109–121.

Constance, D. and Choi, J. 2010. Overcoming the barriers to organic adoption in the United States: A look at pragmatic conventional producers in Texas. *Sustainability,* 2(1): 163–188.

Darnhofer, I., W. Schneeberger, and B. Freyer. 2005. Converting or not converting to organic farming in Austria: Farmer types and their rationale. *Agriculture and Human Values 22:39 –52.*

Diebel, P.L., J.R. Williams, and R.V. Llewelyn 1995. An economic comparison of conventional and alternative cropping systems for a representative Northeast Kansas farm. *Review of Agricultural Economics* 17:323-335.

Dillman, D. A., Smyth, J. D., & Christian, L. M. 2009. Internet, mail and mixed-mode surveys: The tailored design method (3rd ed.). New York: Wiley.

Dimitri, C., and C. Greene. 2002. *Recent Growth Patterns in the U.S. Organic Foods Market*, Agriculture Information Bulletin No. 777, U.S. Department of Agriculture, Economic Research Service, September.

Dimitri, C, and L. Oberholtzer. 2005. Market-Led Growth vs. Government-Facilitated Growth: Development of the U.S. and EU Organic Agricultural Sectors. USDA-ERS Outlook Report No. (WRS0505) pp. 26. August.

Dimitri, C., and L. Oberholtzer. 2008. *The U.S. Organic Handling Sector: Baseline Findings of the Nationwide Survey of Manufacturers, Processors, and Distributors.* EIB-36, Economic Research Service, USDA.

Dobbs, T.L., R.C. Shane, and D.M. Feuz. 2000. Lessons learned from the Upper Midwest organic marketing project. *American Journal of Alterative Agriculture* 15(3):119-128.

D'Souza, *G.*, D. Cyphers, and T. Phipps. 1993. Factors Affecting the Adoption of Sustainable Agricultural Practices, *Agricultural and Resource Economics Review*, 22, 159-165.

Duram, L.A. 1999. Factors in organic farmers' decision making: Diversity, challenge, and obstacles. *American Journal of Alternative Agriculture* 14(1):2-10.

Furman, C., Roncoli, C., Crane, T., Paz, J., & Hoogenboom, G. (2009). Managing Risk and Climate Variation among Georgia Organic Farmers. Retrieved April 14, 2012, from http://www.seclimate.org/pdfpubs/secc%2009%20003%20furman%20et%20al%20post.pdf

Gardebroek, C. 2006. Comparing risk attitudes of organic and non-organic farmers with a Bayesian random coefficient model, *European Review of Agricultural Economics*, Vol. 33, pp. 485–510.

Getz, C., & Shreck, A. 2006. What organic and Fair Trade labels do not tell us: towards a placed-based understanding of certification. *International Journal of Consumer Studies, 30*(5), 490-501.

Greene, C., Dimitri, C., Lin, B., McBride, W., Oberholtzer, L., & Smith, T. 2009. Emerging Issues in the U.S. Organic Industry [Electronic version]. Economic Information Bulletin No. (EIB-55), 36.

Greene, W. 2007. Econometric analysis. Upper Saddle River, NJ: Prentice Hall.

Hanson, J., R. Dismukes, W. Chambers, C. Greene, and A. Kremen. 2004. Risk and risk management in organic agriculture: Views of organic farmers. *Renew. Agric. Food Syst.* 19:218-227.

Hartman Group. (2008, July 7). *Organics Today: Who's Buying and What's Next*. Retrieved April 16, 2012 from http://www.hartman-group.com/hartbeat/2008-7-23

Klonsky, K. 2000. Forces impacting the production of organic foods. *Agriculture and Human Values 17:233-243.*

Klonsky, K. and C. Greene, 2005. "Widespread Adoption of Organic Agriculture in the US: Are Market-Driven Policies Enough?" Paper prepared for presentation at the American Agricultural Economics Association Annual Meeting, Providence, Rhode Island, July 24 – 27.

Klonsky, K., and L. Tourte. 1998. "Organic Agricultural Production in the United States: Debates and Directions." *American Journal of Agricultural Economics* 80:1119-1124.

Kremen, A., C. Greene, and J. Hanson. 2004. *Organic produce, price premiums, and eco-labeling in U.S. farmers' markets* (USDA-ERS Electronic Report No. VGS-301–01). Washington, DC: U.S. Government Printing Office.

Low, S. A., & Vogel, S. 2011*Direct and Intermediated Marketing of Local Foods in the United States*. USDA-ERS Electronic Report No. ERR-128). Washington, DC: U.S. Government Printing Office.

Mahoney, P., K. Olsen, P. Porter, D. Huggins, C. Perillo, and R. Crookston. 2004. Profitability of organic cropping systems in southwestern Minnesota. *J. Renew. Agric. Food Syst.* 19:35–46.

MarketMaker Linking Agriculture Markets. University of Illinois, 2012. Web. 11 Apr. 2012. <http://national.marketmaker.uiuc.edu/about.php>.

McFadden, D. (1973). *Conditional logit analysis of qualitative choice behavior. In P. Zarembka* (Ed.), Frontiers in econometrics (pp. 105–142), New York: Academic Press.

Oberholtzer, L., C. Dimitri, and C. Greene. 2005. *Price Premiums Hold on as U.S. Organic Produce Market Expands*. VGS-308-01. U.S. Department of Agriculture, Economic Research Service, May.

OTA's Organic Industry Survey Executive Summary. 2009. In *Organic Trade Association*. Retrieved November 1, 2010, from http://www.ota.com/pics/documents/01a_OTAExecutiveSummary.pdf

OTA's Organic Industry Survey Executive Summary. 2010. In *Organic Trade Association*. Retrieved November1, 2010, from http://www.ota.com/pics/documents/2010OrganicIndustrySurveySummary.pdf

Padel, S. 2001, *Conversion to Organic Farming: A Typical Example of the Diffusion of an Innovation?*. Sociologia Ruralis, 41: 40–61.

Park, T. A. 2009. Assessing the Returns from Organic Marketing Channels. *Journal of Agricultural and Resource Economics*,*34*(3), 483-497.

Park, T. A., & Lohr, L. (2006). Choices of Marketing Outlets by Organic Producers: Accounting for Selectivity Effects. *Journal of Agricultural and Food Industrial Organization*, *h*(h).

Richards, T. J., R. Acharya, and I. Molina. 2009. "Retail and Wholesale Market Power in Organic Foods" Agricultural & Applied Economics Association 2009 AAEA & ACCI Joint Annual Meeting. Milwaukee, WI. July 26-29.

Sierra, L., K. Klonsky, R. Strochlic and S. Brodt. 2008. "Factors Associated with Deregistration Among Organic Farmers in California." Davis, CA: California Institute for Rural Studies.

Smith, E.G., M.J. Clapperton, and R.E. Blackshaw. 2004. Profitability and risk of organic production systems in the northern Great Plains. *Renewable Agriculture and Food Systems* 19:152–158.

Strochlic, R., & Sierra, L. 2007. "Conventional, Mixed, and "Deregistered" Organic Farmers: Entry Barriers and Reasons for Exiting Organic Production in California." Davis, CA: California Institute for Rural Studies.

Swisher, M.E. and R. Koenig. 2005. The National Organic Standards: What Service Providers Need to Know. In Press (EDIS).

Treadwell, D. D. 2010. Introduction to Organic Crop Production. In *Vegetable Production Guide for Florida*. Retrieved November 17, 2010, from EDIS of UF/IFAS Extension (SP170).

U.S. Department of Agriculture, Economic Research Service. 2007 and 2008 Agricultural Resource Management Surveys (ARMS).

U.S. Department of Agriculture, Economic Research Service. Retrieved November 1, 2010, from http://www.ers.usda.gov/data/organic

U.S. Department of Agriculture, Economic Research Service. Retrieved April 12, 2012, from http://www.ers.usda.gov/data/education/

U.S. Department of Agriculture, National Agricultural Statistics Service. Retrieved April 12, 2012, from http://www.agcensus.usda.gov/Publications/2007/Online_Highlights/Fact_Sheets/Demographics/women.pdf

Walz, E. 2004. *Fourth National Organic Farmers' Survey: Sustaining Organic Farms in a Changing Organic Marketplace.* Organic Farming Research Foundation, Santa Cruz, CA. Available at *http://ofrf.org/publications/pubs/4thsurvey_results.pdf*

Wolf, T. 2006. "Assessing producer options and obstacles for organic agriculture," *Crop Management*, doi: 10.1094/CM-2006-0921-04-PS.

Wooldridge, Jeffrey M. (2002) *Introductory Econometrics*, South-Western, New York.