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To certify or not to certify? Separating the organic production and certification decisions

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ABSTRACT

This article separates the decision to be certified organic into the decision to use organic practices and the subsequent decision to certify those practices, using data from a survey of US fruit and vegetable producers. We document that many producers are using organic practices but choosing not to certify. Philosophical beliefs and perceived risk of losses due to disease, weeds, and insects have the largest impact on the decision to use organic practices. Producers who use organic practices and direct market are less likely to certify. Moreover, we find that the certification *process* discourages certification.

1. Introduction

Most policymakers and researchers view the organic production and certification decision as a single decision. Legally, in both the United States (US) and European Union (EU), a producer must be certified organic to market their production as organic. However, nothing prevents a producer from using organic production practices and marketing their production as conventional. Thus, we can separate the decision to be certified organic into two parts, a production decision to use organic practices and a marketing decision to certify. These organic production and marketing decisions are interrelated but separate business decisions.

The decision to certify organic will vary by the legal regulations pertaining to certified organic production and marketing in each country. Lohr and Salomonsson (2000) provide a useful comparison of the policy approach in the US and EU. The EU approach has been to provide substantial financial assistance for farmers to be certified organic; while the US approach has been market driven with little to no financial assistance.

Focusing on the US context, this article contributes to the literature by separating the decision to use organic practices from the decision to certify those practices under the United States Department of Agriculture (USDA) National Organic Program (NOP). This article clearly documents that there is a substantial segment of US producers who are committed to using organic practices but have no intention to certify. For US producers who use organic practices, the decision to certify or not to certify is based on their perception of the costs and benefits of organic certification. These producers perceive substantial costs associated with certification including the financial cost, dealing with a confusing process and interacting with the certifier. Notably, we find that producers who report that their most economically important market is a direct market have significantly less production under certification. One explanation is that the producer's relationship with his/her customer is a substitute for certification. A second explanation is that consumers who purchase directly from producers are willing to pay a premium for local that may be larger than the premium for certified organic products, i.e. "local is the new organic" (Darby et al., 2008; Greene et al., 2009; Low and Vogel, 2011; Onozaka and Thilmany McFadden, 2011).

2. Literature

We review the US and European literature to identify the factors that influence the farmer's decision to adopt certified organic production. With the exception of Sierra et al. (2008) and Strochlic and Sierra (2007) who focus on California producers' decisions to decertify, most of the literature does not separately identify the factors that influence the producer's decision to use organic practices from the decision to certify. Further, the literature on barriers to organic certification categorizes organic production challenges as a barrier to certification.

Many studies have found that conversion to organic farming reflected both the relative profitability of organic and conventional systems and the philosophical beliefs of producers (Burton et al.,

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1999; Darnhofer et al., 2005; Klonsky, 2000; Läpple and Van Rensburg, 2011; Mzoughi, 2011; Padel, 2001; Schneeberger et al., 2002; Sierra et al., 2008; Strochlic and Sierra, 2007; Walz, 2004). Several studies have documented the importance of non-financial motivations, such as concern for the environment, in producers' decisions to adopt more environmentally-friendly practices (Läpple and Van Rensburg, 2011; Mzoughi, 2011; Sheeder and Lynne, 2011) and even the willingness of producers to give-up some profits to achieve conservation goals (Chouinard et al., 2008). Sierra et al. (2008) found a strong relationship between farm size and the motivations behind using organic practices; roughly half of producers farming less than 50 acres were motivated primarily by their philosophical beliefs compared to none of those farming above 50 acres.

Previous research identified some demographic patterns among certified organic producers. Organic producers tended to be younger and had less experience than their conventional counterparts (Burton et al., 1999; D' Souza et al., 1993; Genius et al., 2006; Parra-Lopez et al., 2007). There were a larger proportion of females among organic producers than among conventional producers (Burton et al., 1999; Padel, 2001; Walz, 2004). The relationship between education and adoption of organic practices was less clear; some studies found a positive relationship (D' Souza et al., 1993; Genius et al., 2006), and some found no significant relationship (Burton et al., 1999).

The relationship between farm size and organic production is complex. Several researchers have found that partial adopters of certified organic production are larger than total adopters and non-adopters (Burton et al., 1999; Genius et al., 2006). Other research has shown that large farms tend to certify while small farms do not (Klonsky and Tourte, 1998). Sierra et al. (2008) found that almost half of the California producers who decertified reported less than $5000 in total farm revenues, which means they were exempt from the NOP certification requirements.

There were multiple barriers to organic certification including the three year transition period, the financial and time cost of certification, and paperwork (Burton et al., 1999; Sierra et al., 2008; Strochlic and Sierra, 2007). Organic certification requires producers to manage the land using organic practices for three years and during this transition period producers cannot obtain certified organic price premiums though they may be able charge a higher price for being "transitional" (Oberholtzer et al., 2005). Other reasons included marketing strategies that did not involve certification, lack of access to organic markets or handlers, and a belief that the benefits of certifying did not outweigh the costs (Dimitri and Oberholtzer, 2008). Finally, Burton et al. (1999) also found that some producers preferred to be free of certification requirements.

The NOP requires certified organic producers to have longer rotations and more crop diversity. Organic producers rely on these longer rotations and crop diversity to provide soil fertility and to mitigate production risks from disease, insects and weeds (Hanson et al., 2004; Oberholtzer et al., 2005). 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).

Organic producers tend to have higher operating costs than conventional producers. Due to the fast-paced growth of the organic industry, organic producers may face a shortage of organic seed, pesticides and other inputs or may face higher prices for these inputs (Greene et al., 2009; Hanson et al., 2004). Organic producers also have high production costs because of relatively intense use of labor, specialized equipment and other substitutes for synthetic chemicals (Oberholtzer et al., 2005).

Small farms tend to use different marketing techniques than larger farms. According to Dimitri and Greene (2002), 60% of farms with fewer than 10 acres used direct marketing compared to only 12% of farms with more than 10 acres. The producer can earn a higher share of the consumers' dollar by selling directly and not through a broker (Dimitri and Greene, 2002). Direct marketing enables the producer to gain price premiums and consumer trust for his/her product without the paperwork and financial cost of certification (Kremen et al., 2004; Park and Lohr, 2006). Larger farms were more likely to use multiple marketing channels and farms with multiple marketing channels tended to earn more than farms using only one marketing channel (Park and Lohr, 2006; Park, 2009).

Farm location has been shown to influence the decision to be certified organic, for both production and marketing reasons. Kremen et al. (2004) found that producers who rely on direct marketing may choose to certify depending on their location and the local consumer perception of certified organic products; markets at an early stage of awareness may have negative perceptions of organic products and/or organic product pricing. Parra-Lopez et al. (2007) found that location was an important predictor of timing of organic certification for organic olive groves in southern Spain.

US organic policy is primarily market driven. There is some financial support for organic certification; US producers are eligible to receive an organic certification cost share reimbursement of up to 75% but not to exceed $750 per year. By contrast, for European producers, the costs and benefits of organic certification differ substantially from the US context where there is either no or limited financial assistance. Under the European Common Agricultural Policy (CAP) certified organic producers receive subsidies or compensatory payments which have a substantial influence on their decision to adopt certified organic production. For instance, Lohr and Salomonsson (2000) found that a subsidy for conversion to organic agriculture in Sweden was influential for 27% of organic farmers in their sample. Pietola and Lansink (2001) found that direct subsidies were a significant factor in the decision of farmers in Finland to switch to organic production. Läpple (2010) used duration analysis to examine the decision of Irish drystock farmers to enter and exit organic production. Läpple (2010) found that subsidies were important to the decision to adopt organic production and that producers disadopted organic when their five-year subsidy contract expired and when they had improved off-farm income opportunities. Läpple and Van Rensburg (2011) examined the differences between early and late adopters of organic drystock production in Ireland. They found that later adopters, who adopted organic production after the CAP subsidies for organic production were introduced, were strongly motivated by profits. In contrast, while all organic adopters were motivated by environmental attitudes, early adopters were less motivated by profit. In some cases, the compensatory payments may become a barrier to adoption of certified organic production. Schneeberger et al. (2002) found that cash-crop producers in Austria cite concern about dependence on compensatory payments as a barrier to adoption of organic production.

3. Data

The population for this survey was obtained from a list of fruit and vegetable producers in 16 states who are registered in Food Industry MarketMaker. The list contained 4312 addresses of which 3015 also had an email address. Registered members of Food Industry MarketMaker tend to be small and medium-sized farms that intend to direct market food products to consumers. A total of 1559 producers responded to the survey and the overall response rate was 36.15%. Our sample is a convenience sample of fruit and vegetable farmers in 16 states from the MarketMaker

database. Our data include a significant proportion of the certified organic producers in these 16 states. Based on the 2011 Organic Production Survey (USDA-NASS, 2012) in these 16 states there are 495 certified organic vegetable producers and 313 fruit producers, compared to our survey where we have 123 and 113 certified organic vegetable and fruit producers, respectively. The 2011 Organic Production Survey reports 817 certified organic operations that sell direct to consumers; however, these include all organic farms and not just fruit and vegetable operations. By comparison, our survey includes 102 certified operations that sell direct to consumers.

The survey was implemented using a mixed-mode design, with a mail invitation to an online survey conducted with Qualtrics software. The invitation letter was sent by mail containing an incentive of a two dollar bill on January 4, 2012, with email reminders on January 10, January 18, and February 1. According to Dillman et al. (2009) a cash incentive at the time of the survey request can significantly increase the response rate, and the mixed-mode design has been shown to increase response rates over a purely internet survey. Dillman et al. (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. Reminders were only sent to those with email addresses due to cost constraints.

The respondents were asked what percentage of their production was conventional, certified organic, transition to certified organic, or under organic practices but not certified. We removed 48 respondents from the analysis because they had previously been certified but had chosen to decertify. Ideally we would model this group of decertified producers as having a negative percent of production under organic practices or certification, but that is an econometric challenge beyond the scope of this article.

We asked the respondents what crops they produce and created a count variable for the total number of crops. We created a dummy variable if the producer has perennial crops because we believe that the managerial skills and investment needed for perennial crops are similar to those for certification.

Respondents were asked to report their marketing channels and rank their top three most economically-profitable marketing channels. The dummy variable *econdirect* is "1" if the respondent ranked a direct marketing channel (at the farm, producers market, community supported agriculture (CSA) or Internet/Mail-order) as his/her most economically important channel. We created a count variable for the number of market channels the producer uses. We also asked respondents to report their average distance to market.

We asked respondents demographic questions including gender, highest level of education, and number of years farming. We asked respondents about their farm business structure and created a dummy for farms that are incorporated. To control for location effects, the respondents were grouped into four 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.

To control for farm size, the respondents were grouped based on their annual gross sales: *very small* (<$5000), *small* ($5000–$49,999), *medium* ($50,000–$249,999) and *large* (>$250,000). Farms with less than $5000 in gross sales are permitted to label their products as organic without being certified by an NOP accredited certifier but they must follow the national standards for production, labeling, and recordkeeping. We use gross sales as a proxy for farm size instead of total acres because the survey respondents have very different crop mixes with some farms having very high value, high management crops and others having lower value, lower management crops. In addition, gross sales and total acres are highly correlated, validating that gross sales is a measure of farm size.

Respondents were asked a series of attitudinal questions to capture their beliefs about organic agriculture based on a 5-point Likert scale from strongly disagree to strongly agree. They were also asked about their perceptions of the marketing, production and certification barriers on a 3-point Likert scale from not a barrier to a severe barrier. For several groups of variables, we created index variables for each group of attitudinal questions to minimize the number of explanatory variables and reduce the number of missing observations. We confirmed the validity of

Table 1
Frequencies and means of variables used in index variables.

Index variables		*N*	Means	St. Dev.
Philosophy[a]	Philosophy index	1016	3.43	1.05
	I support the philosophy of organic farming	1009	3.82	1.28
	Using organic practices is healthier for me and my family	993	3.90	1.25
	My family supports organic production	944	3.58	1.24
	Organic practices are more sustainable than conventional	997	3.34	1.43
	Organic farming is viable for me	988	2.86	1.44
	Organic farming is profitable	987	3.18	1.12
Losses[b]	Losses index	1016	2.02	0.50
	Disease-related losses	1010	2.14	0.72
	Insect-related losses	1016	2.20	0.71
	Weed-related losses	1013	2.08	0.77
	Weather-related losses	1011	2.01	0.70
	Fertility-related losses	1004	1.64	0.70
Highinputcosts[b]	High input cost index	1016	1.82	0.57
	High equipment costs	1010	1.83	0.74
	High fertilizer costs	1014	1.88	0.75
	High seed costs	1010	1.71	0.69
LackofKL[b]	Lack of capital and labor index	1016	1.79	0.55
	Lack of availability of equipment	1013	1.54	0.67
	Lack of availability of organic processing facilities	1007	1.84	0.82
	Lack of reliable labor	1015	1.96	0.78

Data source: Purdue 2012 survey of Market Maker growers.
[a] Indicates 5-point Likert Scale-Strongly Disagree, Somewhat Disagree, Neither, Somewhat Agree, Strongly Agree.
[b] Indicates 3-point Likert Scale- Not a Barrier, Moderate Barrier, Severe Barrier.

Table 2
Descriptive Statistics for Model of Use of Organic Practices.

Variable	Description	Total Sample Mean (St. Dev.)		Conventional		Mixed		Organic	
Female	1 = female	0.32	(0.47)	0.21	(0.41)	0.28	(0.46)	0.47	(0.50)
Very small	1 = gross sales < $5000	0.19	(0.39)	0.16	(0.36)	0.16	(0.37)	0.24	(0.43)
Small	1 = gross sales between $5000-$49,999	0.41	(0.50)	0.37	(0.49)	0.44	(0.50)	0.44	(0.50)
Medium	1 = gross sales between $50,000-$249,999	0.27	(0.45)	0.28	(0.45)	0.27	(0.45)	0.27	(0.45)
Large	1 = gross sales larger than $250,000 (Reference Group)	0.15	(0.36)	0.22	(0.41)	0.15	(0.35)	0.07	(0.25)
Percentown	Percent of land owned	0.80	(0.35)	0.77	(0.36)	0.83	(0.33)	0.83	(0.35)
Yearsfarming	Number of years farming	20.12	(14.27)	23.33	(14.63)	21.24	(14.69)	15.53	(12.28)
Incorporated	1 = Business Structure is LLC (limited liability corporation), Sub-Chapter (S), or Corporation	0.34	(0.48)	0.32	(0.47)	0.33	(0.48)	0.36	(0.48)
Education	Continuous variable 8 for grade school through 20 for Graduate school	15.94	(2.56)	15.87	(2.58)	15.65	(2.38)	16.18	(2.62)
South	1 = in South region (Reference is Midwest)	0.18	(0.38)	0.16	(0.36)	0.15	(0.36)	0.22	(0.41)
Delta	1 = in Delta region	0.09	(0.28)	0.09	(0.29)	0.09	(0.28)	0.07	(0.26)
Northeast	1 = in Northeast region	0.21	(0.41)	0.17	(0.38)	0.19	(0.39)	0.28	(0.45)
Avedistance	Average distance to markets (miles)	27.72	(68.15)	30.04	(91.67)	26.53	(45.73)	25.44	(35.83)
Numcrop	Number of crops produced	17.26	(12.55)	10.95	(9.79)	20.83	(10.83)	23.29	(12.79)
Nummarket	Number of markets used	2.46	(1.18)	2.18	(1.03)	2.83	(1.22)	2.62	(1.24)
Perennial	1 = grows perennial crops	0.57	(0.50)	0.56	(0.50)	0.59	(0.50)	0.58	(0.50)
Econdirect	1 = most economically important marketing channel is a direct market	0.80	(0.41)	0.77	(0.43)	0.83	(0.38)	0.81	(0.39)
Philosophy[a]	Philosophy index (see Table 1)	3.43	(1.05)	2.67	(0.79)	3.46	(0.76)	4.38	(0.58)
Losses[b]	Losses index (see Table 1)	2.02	(0.50)	2.19	(0.50)	2.03	(0.46)	1.79	(0.42)
Highinputcosts[b]	High input cost index (see Table 1)	1.82	(0.57)	1.88	(0.59)	1.87	(0.54)	1.71	(0.55)
LackofKL[b]	Lack of capital and labor index (see Table 1)	1.79	(0.55)	1.83	(0.57)	1.81	(0.52)	1.72	(0.53)
Diseaseweedcontrol[b]	High disease and weed control costs	2.21	(0.75)	2.48	(0.68)	2.26	(0.69)	1.85	(0.71)
Orginput[b]	Lack of available organic inputs	1.77	(0.72)	1.89	(0.73)	1.91	(0.68)	1.54	(0.67)
N		1016		458		193		365	

Data source: Purdue 2012 survey of Market Maker growers.
[a] Indicates 5-point Likert Scale-Strongly Disagree(1), Somewhat Disagree(2), Neither(3), Somewhat Agree(4), Strongly Agree(5).
[b] Indicates 3-point Likert Scale- Not a Barrier(1), Moderate Barrier(2), Severe Barrier(3).

these index variables using factor analysis (available on request).These index variables were created by summing multiple Likert-scale questions and dividing by the number of answered questions and are presented in Table 1.

4. Methods

We assume producers maximize their utility in their decisions to use organic practices and for those producers who use organic practices, their decision to certify. We use a two-limit Tobit model where the dependent variables are the percentage of production under organic practices, and the percentage of production that is certified organic, both of which range from 0 to 100 percent. The two-limit Tobit model is used when there is a continuous latent variable that is censored at both ends (Greene, 2007).

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

$$y_{ji}^* = \beta_{j0} + x_{ji}'\beta + \varepsilon_{ji}.$$

Here y^* is a vector of the latent variable that is not observed for values less than 0 and greater than 100%, x_i' represents a vector of the independent variables, β is a vector of the unknown parameters, ε_i is a vector of the error terms that are distributed normally with mean 0 and variance σ^2, $i = 1, 2, 3, \ldots, n$ represents the number of observations, and $j = 1$ or 2 represents two independent models that are estimated which are the proportion of production under organic practices or certification, respectively.

If y_{ji} is the observed variable, representing the proportion of production under organic practices or certification, its value is censored from below at 0 and above at 100%. Thus,

$$y_{ji} = 0 \text{ if } y_{ji}^* \le 0$$

$$y_{ji} = y_{ji}^* \text{ if } 0 < y_{ji}^* < 100$$

$$y_{ji} = 100 \text{ if } y_{ji}^* \ge 100$$

However, the Tobit coefficients do not directly give the marginal effects of the independent variables on the dependent variable. Therefore, following Wooldridge (2006), if x_j is a continuous variable, its marginal effect can be expressed as

$$\frac{\partial E(y_i)}{\partial x_j} = \Phi\left(\frac{\beta' x_i}{\sigma}\right)\beta_j$$

where x_j is the jth independent variable. If x_j is a binary variable, the effect is obtained as the difference between $E(y_i|y_i > 0, x_j = 1)$ and $E(y_i|y_i > 0, x_j = 0)$. To measure goodness of fit, we follow McFadden (1973) and use the likelihood ratio index.

Previous research categorized producers by the extent of their organic adoption; Genius et al. (2006) grouped producers into three categories of organic production, non-adopters, partial adopters, and full adopters. In contrast, we investigate the producer's decision regarding the percent of production he/she has under organic practices and under organic certification. By analyzing the percent of production under organic practices and under certification using a two-limit Tobit we use the full range of information available that would otherwise be lost by categorizing producers. The two-limit tobit measures not only the probability that a producer will use organic practices or certify but also the extent of use.[1]

5. Results and discussion

The overall survey results clearly document that there is a sizeable group of producers who use organic practices but choose not to obtain USDA certification. There were a total of 1016 usable

[1] We also considered using Cragg's two-tier alternative to the tobit, commonly referred to as the double hurdle model. The likelihood ratio test indicated that the Tobit model was a better fit.

Table 3
Tobit regression results on decision to use organic Practices.

	Coefficient	Std. Err.	Marginal effects	Std. Err.
Female	21.11**	(8.97)	8.76**	(3.72)
Very small	32.03*	(17.63)	13.39*	(7.39)
Small	32.45**	(15.13)	13.40**	(6.22)
Medium	22.11	(15.12)	9.19	(6.31)
Percentown	−0.54	(12.57)	−0.22	(5.18)
Yearsfarming	−0.52*	(0.31)	−0.21*	(0.13)
Incorporated	8.76	(9.35)	3.62	(3.87)
Education	0.55	(1.63)	0.23	(0.67)
South	19.86*	(11.49)	8.28*	(4.81)
Delta	15.26	(14.83)	6.37	(6.23)
Northeast	38.72***	(11.34)	16.17***	(4.67)
Avedistance	−0.04	(0.06)	−0.02	(0.03)
Numcrop	3.11***	(0.41)	1.28***	(0.16)
Nummarket	10.05***	(3.76)	4.14***	(1.53)
Perennial	−11.44	(8.51)	−4.72	(3.51)
Econdirect	−1.71	(10.49)	−0.70	(4.33)
Losses	−41.33***	(11.33)	−17.02***	(4.59)
Highinputcosts	19.00**	(9.13)	7.83**	(3.75)
LackofKL	1.98	(8.90)	0.81	(3.67)
Diseaseweedcontrol	−19.44***	(7.45)	−8.01***	(3.06)
Orginput	−24.4***	(6.59)	−10.05***	(2.68)
Philosophy	100.76***	(7.02)	41.50***	(2.20)
_cons	−300.38***	(46.82)		
Log Likelihood	−1464.90			

Total $N = 1016$ observations.
458 Left-censored observations at $y^* \leqslant 0$.
193 Uncensored observations.
365 Right-censored observations at $y^* \geqslant 100$.
Data source: Purdue 2012 survey of Market Maker growers.
Notes:
* $p < 0.10$.
** $p < 0.05$.
*** $p < 0.01$.

observations of which 45% of the producers use only conventional practices, 19% use a mix of conventional and organic, and 36% use only organic practices. Of those who use any organic practices, 71% choose not to certify.

5.1 Organic practices decision model

We first model the producer's decision to use organic production practices based on producer demographics, farm characteristics, marketing practices, and attitudinal variables. Table 2 presents the descriptive statistics for each independent variable by producer type. We find that organic producers tend to be smaller and have less farming experience than conventional and mixed producers. Substantially more women use organic practices. Also, mixed and 100% organic producers use direct marketing channels more than conventional producers.

Table 3 presents the Tobit model results and marginal effects. We find that the most statistically significant explanatory factor in the producers' decision to use organic practices is the index variable capturing their philosophical beliefs. Producers that are highly attuned to the philosophy of organic have on average 41.5% more production under organic practices than those who are not.

We find producers' perceptions of production risks and costs influence their decision to use organic practices. The indexes on losses, high input costs, disease and weed control and organic inputs were all statistically significant. Producers who perceive that losses due to disease, insects, weeds, fertility, and weather are a barrier to organic markets have 17.02% less production under organic practices. In addition, producers who report that disease and weed control costs are barriers have 8.01% less production under organic practices. Producers who report that availability of organic inputs such as equipment and labor are a barrier to organic have 10.05% less production under organic practices which provides evidence that a shortage of organic inputs impedes the adoption of organic practices. By contrast, producers who report that high input costs such as seed and fertilizer are a barrier to organic have 7.83% more production under organic practices. One explanation for this counterintuitive result is that only those producers who use organic practices are aware of the higher cost for some organic inputs.

We find that gender, experience, and farm size are statistically significant. Women have on average 8.76% more production under organic practices than men, which is consistent with the literature that women are more likely to be organic producers (Burton et al., 1999; Padel, 2001; Walz, 2004). Producers with more years of farming experience have less production under organic practices; since age and farming experience are correlated this may indicate that producers who use organic practices tend to be younger and have less farming experience. Small-scale producers tend to have more of their production under organic practices than large-scale producers.

As expected, crop and market diversity are statistically significant. Producers who grow a larger number of crops tend to have on average 1.28% more production per crop under organic practices because longer crop rotations and more crop diversity are necessary for effective organic production. Moreover, producers who use more market channels tend to have 4.14% more production under organic practices for each market channel.

We find that farm location is statistically significant in explaining the use of organic practices. Producers in the Northeast and South regions have on average 16.17% and 8.28% more production under organic practices than producers in the Midwest. This can be attributed to the fact that 60% of producers in the South and 64% in the Northeast use organic practices compared to 50% in the Midwest. Moreover, the Northeast and South regions have major urban centers where organic produce is in higher demand, which may increase both producer awareness of organic agriculture and increase the market access for organic products.

5.2 Certification decision model

We model the second decision for producers who use organic practices, which is to obtain USDA certification. In addition to producer demographics, farm characteristics, marketing practices, and the philosophy index, we include variables that specifically focus on the barriers to certification. There are 556 usable observations where 109 respondents are 100% certified, 396 respondents have no organic production that is certified, and 51 respondents have a mix of certified and non-certified organic production.

Table 4 presents the descriptive statistics for each independent variable by producer type for this model. We find that non-certified and mix-certified organic producers perceive the barriers to certification, such as paperwork and cost, as more severe than certified producers. Certified farms and especially mixed farms are more likely to be large-scale than non-certified organic farms. We also find that 46% of certified producers are incorporated compared to 30% of non-certified organic producers. Interestingly, 79% of certified producers use direct markets versus 85% of non-certified organic producers.

Table 5 presents the tobit results for the certification model and marginal effects. As expected farm size influences the decision to certify. We find that producers who are very small (gross sales less than $5000) have on average 16.65% less production under certification than large producers (over $250,000 in gross sales). This is

Table 4
Descriptive statistics for model of the decision to certify.

Variable	Description	Sample total Mean	(St. Dev.)	Non-certified		Mixed		Certified	
Female	1 = female	0.47	(0.50)	0.41	(0.49)	0.29	(0.47)	0.44	(0.50)
Very small	1 = gross sales <$5000	0.24	(0.43)	0.26	(0.44)	0.08	(0.28)	0.07	(0.27)
Small	1 = gross sales between $5000–$49,999	0.44	(0.50)	0.47	(0.50)	0.32	(0.47)	0.40	(0.49)
Medium	1 = gross sales between $50,000–$249,999	0.27	(0.45)	0.22	(0.42)	0.36	(0.49)	0.39	(0.49)
Large	1 = gross sales larger than $250,000 (Reference Group)	0.09	(0.29)	0.06	(0.24)	0.25	(0.44)	0.14	(0.34)
Percentown	Percent of land owned	0.83	(0.35)	0.83	(0.35)	0.85	(0.29)	0.79	(0.37)
Yearsfarming	Number of years farming	15.53	(12.28)	16.23	(13.52)	22.29	(13.25)	19.89	(12.44)
Incorporated	1 = Business Structure is LLC (limited liability corporation), Sub-Chapter (S), or Corporation	0.36	(0.48)	0.30	(0.46)	0.46	(0.51)	0.46	(0.51)
Education	Continuous variable 8 for grade school through 20 for Graduate school	16.18	(2.62)	15.77	(2.52)	16.08	(2.78)	16.77	(2.39)
South	1 = in South region (Reference is Midwest)	0.22	(0.41)	0.21	(0.41)	0.18	(0.39)	0.14	(0.35)
Delta	1 = in Delta region	0.07	(0.26)	0.07	(0.26)	0.18	(0.39)	0.05	(0.21)
Northeast	1 = in Northeast region	0.28	(0.45)	0.18	(0.39)	0.28	(0.46)	0.46	(0.51)
Avedistance	Average distance to markets (miles)	25.44	(35.83)	20.33	(24.05)	54.99	(89.28)	32.09	(40.81)
Numcrop	Number of crops produced	23.29	(12.8)	21.95	(11.78)	17.02	(12.08)	26.71	(12.51)
Nummarket	Number of markets used	2.62	(1.24)	2.55	(1.19)	3.14	(1.36)	2.97	(1.25)
Perennial	1 = grows perennial crops	0.58	(0.50)	0.56	(0.50)	0.71	(0.47)	0.60	(0.49)
Econdirect	1 = most economically important marketing channel is a direct market	0.81	(0.39)	0.85	(0.36)	0.63	(0.49)	0.79	(0.42)
Philosophy[a]	Philosophy index (see Table 1)	4.38	(0.58)	3.94	(0.81)	3.85	(0.77)	4.59	(0.36)
Timerecordkeep	Percent of time spend recordkeeping	11.14	(11.26)	10.59	(11.16)	14.32	(14.61)	11.65	(10.79)
Mrktreliable[a]	I believe organic markets are reliable	3.78	(1.17)	3.31	(1.21)	3.34	(1.29)	4.23	(0.97)
Confusing[a]	The process of organic certification is confusing	3.35	(1.23)	3.74	(1.07)	3.46	(1.14)	2.67	(1.22)
Findreliablebuy[b]	Finding reliable buyers/market for my organic products	1.63	(0.71)	1.66	(0.70)	1.63	(0.73)	1.58	(0.67)
Priceinfo[b]	Difficulty obtaining organic price information	1.68	(0.70)	1.65	(0.67)	1.75	(0.69)	1.62	(0.72)
Uncertainprem[b]	Uncertainty in obtaining organic price premiums	1.86	(0.72)	1.99	(0.76)	1.97	(0.73)	1.73	(0.68)
Distance2mrkt[b]	Distance to available organic markets	1.57	(0.68)	1.58	(0.70)	1.61	(0.73)	1.63	(0.69)
Freedom[b]	Loss of freedom of what I can and cannot do	1.73	(0.76)	2.02	(0.76)	1.93	(0.66)	1.33	(0.55)
Paperwork[b]	Paperwork	2.26	(0.73)	2.45	(0.68)	2.36	(0.66)	1.84	(0.69)
Cost[b]	Cost of certification	2.31	(0.74)	2.51	(0.68)	2.20	(0.81)	1.79	(0.64)
Interaction[b]	Interaction with certifier	1.58	(0.71)	1.80	(0.75)	1.57	(0.71)	1.19	(0.42)
Lackofinfo[b]	Lack of information about certification	1.50	(0.69)	1.77	(0.74)	1.63	(0.78)	1.15	(0.38)
3yrtrans[b]	3-year transition period	1.60	(0.76)	1.93	(0.81)	1.83	(0.79)	1.23	(0.51)
N		556		396		51		109	

Data source: Purdue 2012 survey of Market Maker growers.
[a] Indicates 5-point Likert Scale-Strongly Disagree(1), Somewhat Disagree(2), Neither(3), Somewhat Agree(4), Strongly Agree(5).
[b] Indicates 3-point Likert Scale- Not a Barrier(1), Moderate Barrier(2), Severe Barrier(3).

expected since these very small producers are exempt from the NOP, i.e. they can market their product as organic as long as they follow the national standards for production, labeling and record-keeping. Small producers (gross sales between $5000 and $50,000) have 12.95% less production certified than large producers. Human capital has a statistically significant influence on organic certification. Each additional year of farming or year of education increases the production under certification by 0.33% and 1.15%, respectively.

We find that among producers who use organic practices, those producers who strongly believe in the philosophy of organic have on average 13% more production under certification. The philosophy index variable was the most significant variable in explaining producers' decision to use organic practices. The finding that producers who rank more highly on the philosophy index are more likely to certify contradicts the growing perception that producers who truly believe in organic are rejecting the NOP standards and choosing not to certify (Strom, 2012).

Interaction with the certifier, cost of certification, and confusion over the process are negative and statistically significant at the 5% level. Producers who agree that cost and interaction with the certifier are barriers to entry for organic markets have on average 5.85% and 6.39% less production under certification, respectively. Moreover, producers who agree that "the process of organic certification is confusing" have on average 3.26% less production under certification. The certification process and requirements are clearly barriers to certification even for those producers already using organic practices.

Distance to market and location are important influences on organic certification. We find that producers who agree that distance to market can be a barrier to organic markets have 6.33% more production under certification. One explanation is that certified organic producers are more aware of the distance to organic markets. Producers in the Northeast and Delta regions on average have 8.85% and 17.81% more production under certification than producers in the Midwest. One explanation is that producers in these regions are responding to their customers who may be more likely to demand organic certification than consumers in the Midwest region. Delta region producers are farther from their markets than those in the Midwest, which may increase the value of certification for Delta producers relative to the Midwest. Dimitri and Oberholtzer (2008) show higher concentration of organic handlers are located in the Northeast region, which indicates the strength of demand for certified products in this region.

We find that producers who report their most economically important marketing channel is a direct market have 7.44% less production under certification. Producers who market at the farm, producers' markets and CSAs (community-supported agriculture) and have a face-to-face relationship with their consumers, can communicate their production practices directly which may substitute for certification. Alternatively, consumers may be willing to pay a premium for local, which reduces the benefit of certifying (Darby et al., 2008; Greene et al., 2009; Onozaka and Thilmany McFadden, 2011). Producers using organic practices clearly recognize the difficulty in marketing organic products and the need for the certification label when customers are wholesalers.

Table 5
Tobit regression results on decision to certify.

	Coefficient	Std. Err.	Marginal effects	Std. Err.
Female	21.55	(29.40)	2.35	(3.22)
Very small	−218.45***	(71.32)	−16.65***	(3.48)
Small	−125.13**	(54.73)	−12.95**	(5.20)
Medium	−60.26	(50.09)	−6.02	(4.56)
Percentown	4.17	(42.38)	0.45	(4.56)
Yearsfarming	3.09***	(1.17)	0.33***	(0.12)
Incorporated	42.19	(30.23)	4.70	(3.43)
Education	10.72*	(5.69)	1.15*	(0.60)
South	21.88	(39.48)	2.44	(4.54)
Delta	129.34**	(52.11)	17.81**	(8.04)
Northeast	74.61**	(34.13)	8.85**	(4.29)
Avedistance	0.34	(0.30)	0.04	(0.03)
Numcrop	0.75	(1.19)	0.08	(0.13)
Nummarket	17.98	(12.02)	1.94	(1.27)
Perennial	40.20	(29.64)	4.26	(3.04)
Econdirect	−62.65*	(36.38)	−7.44*	(4.61)
Timerecordkeep	−0.55	(1.22)	−0.06	(0.13)
Mrktreliable	−3.02	(14.82)	−0.33	(1.59)
Confusing	−30.26**	(14.23)	−3.26**	(1.49)
Findreliableby	−8.98	(22.96)	−0.97	(2.47)
Priceinfo	34.01	(25.03)	3.66	(2.66)
Uncertainprem	−37.09	(25.76)	−3.99	(2.73)
Distance2mrk	58.83**	(23.54)	6.33***	(2.42)
Freedom	−24.14	(23.48)	−2.60	(2.51)
Paperwork	−28.71	(23.85)	−3.09	(2.56)
Interaction	−59.39**	(24.86)	−6.39**	(2.59)
Cost	−54.4**	(26.83)	−5.85**	(2.78)
Lackofinfo	−10.12	(27.21)	−1.09	(2.93)
3yrtrans	−20.88	(22.45)	−2.25	(2.40)
Philosophy	120.76***	(28.91)	12.99***	(2.73)
_cons	−424.24**	(181.14)		
Log likelihood	−538.85173			

Total $N = 556$ observations.
396 Left-censored observations at $y^* \leqslant 0$
51 Uncensored observations
109 Right-censored observations at $y^* \geqslant 100$.
Data source: Purdue 2012 survey of Market Maker growers.
Notes:
* $p < 0.10$.
** $p < 0.05$.
*** $p < 0.01$.

6. Conclusions

The major contribution of this article is to separate the producer's decision to be certified organic, into the first decision to use organic practices and the second decision to obtain USDA certification. An important policy implication of separating these decisions is that policymakers should determine whether current incentives are aligned with desired outcomes. In other words, are incentives meant to increase organic production or organic certification? We have demonstrated that these are two distinct outcomes influenced by different producer characteristics and perceptions.

An additional contribution is a better understanding of what drives producers to certify organic. We find that women have more production under organic practices but gender does not influence the decision to certify. Less experienced producers have more production under organic practices, but more experienced organic producers have more production that is certified. Small-scale producers have more production under organic practices, and less production under certification. While education does not influence the use of organic practices, producers with more years of education have more production that is certified organic. Producers who grow a larger number of crops and use more market channels have more production under organic practices; however, the diversity of crops and market channels does not influence the decision to certify. Finally, relying on direct markets does not influence the decision to use organic practices, but it does decrease the likelihood of obtaining USDA certification.

If policymakers and food retailers want to increase certified organic production in the US, one strategy would be to target producers who are already using organic practices but are not certified. This article documents that this group perceives substantial barriers to certification. The financial cost is a barrier to certification which highlights the importance of state programs that share the cost of certification. The EU literature on certified organic production documents that direct financial subsidies increase certification. In the US context of market driven policy where tax payers are unlikely to support direct payments for organic certification, retailers could choose to provide financial incentives to increase the volume of US products that are certified organic.

Another barrier to organic certification is the certification process. The same producers who strongly agree the process of certification is confusing also say interaction with the certifier is a severe barrier. This suggests that some certifiers may increase confusion. One policy implication is that the USDA could offer training to certifiers to improve their communication with producers, and could make information about the certification process more accessible to producers.

Policymakers in the US are actively promoting local food production, from the USDA "Know your farmer, know your food" program to a myriad of state and community programs. Many of these same policymakers also have programs to support certified organic production. This article documents that producers who use organic practices and whose most economically important market is a direct, local market are choosing not to obtain USDA certification. Thus, policies that promote local food may discourage organic certification.

Producers may be using the local brand as a substitute for the organic certification label. The direct relationship with the consumer may allow producers to garner a premium for being local as consumers assume that food purchased at local farmers markets is "organic". Moreover, this lack of consumer awareness may allow producers to "pick and choose" which organic practices to follow, while still marketing their products as organic. Thus, as clearly "local" has become the new "organic" more consumer education is needed on what the organic certification label means. Should consumers at local markets demand certified organic products and be willing to pay a premium for certified organic products, producers who use organic practices will have a strong incentive to make the decision to certify.

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References

Burton, M., Rigby, D., Young, T., 1999. Analysis of the determinants of adoption of organic horticultural techniques in the UK. J. Agrc. Econ. 50 (1), 47–63. http://dx.doi.org/10.1111/j.1477-9552.1999.tb00794.x.

Chouinard, H.H., Paterson, T., Wandschneider, P.R., Ohler, A.M., 2008. Will producers trade profits for stewardship? heterogeneous motivations for farm practice selection. Land Econom. 84 (1), 66–82.

Darby, K., Batte, M.T., Ernst, S., Roe, B., 2008. Decomposing local: a conjoint analysis of locally produced foods. Am. J. Agrc. Econ. 90 (2), 476–486. http://dx.doi.org/10.1111/j.1467-8276.2007.01111.x.

Darnhofer, I., Schneeberger, W., Freyer, B., 2005. Converting or not converting to organic farming in Austria: farmer types and their rationale. Agrc. Human Values 22, 39–52.
Dillman, D.A., Smyth, J.D., Christian, L.M., 2009. Internet, Mail and Mixed-Mode Surveys: The tailored Design Method, 3rd ed. Wiley, New York.
Dimitri, C., Greene, C., 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., Oberholtzer, L., 2008. The U.S. Organic Handling Sector: Baseline Findings of the Nationwide Survey of Manufacturers, Processors, and Distributors. EIB-36, Economic Research Service, USDA.
D'Souza, G., Cyphers, D., Phipps, T., 1993. Factors Affecting the Adoption of Sustainable Agricultural Practices. Agr. Resour. Ec. Rev. 22, 159–165.
Genius, M., Pantzios, C.J., Tzouvelekas, V., 2006. Information Acquisition and Adoption of Organic Farming Practices. J. Agrc. Resour. Econom 31 (1), 93–113, http://econpapers.repec.org/RePEc:ags:jlaare:10150.
Greene, W., 2007. Econometric Analysis. Prentice Hall, Upper Saddle River, NJ.
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), p. 36.
Hanson, J., Dismukes, R., Chambers, W., Greene, C., Kremen, A., 2004. Risk and risk management in organic agriculture: views of organic producers. Renew. Agrc. Food Syst.. http://dx.doi.org/10.1079/RAFS200482.
Klonsky, K., 2000. Forces impacting the production of organic foods. Agrc. Hum. Values 17, 233–243. http://dx.doi.org/10.1023/A:1007655312687.
Klonsky, K., Tourte, L., 1998. Organic agricultural production in the united states: debates and directions. Am. J. Agrc. Econ. 80, 1119–1124. http://dx.doi.org/10.2307/1244215.
Kremen, A., Greene, C., Hanson, J., 2004. Organic produce, Price Premiums, and Eco-Labeling in U.S. Producers' Markets. USDA-ERS Electronic Report No. VGS-301–01. Washington, DC: U.S. Government Printing Office.
Läpple, D., 2010. Adoption and abandonment of organic farming: an empirical investigation of the Irish drystock sector. J. Agrc. Econ. 61 (3), 697–714. http://dx.doi.org/10.1111/j.1477-9552.2010.00260.x.
Läpple, D., Van Rensburg, T., 2011. Adoption of organic farming: are there differences between early and late adoption? Ecol. Econ. 70, 1406–1414. http://dx.doi.org/10.1016/j.ecolecon.2011.03.002.
Lohr, L., Salomonsson, L., 2000. Conversion subsidies for organic production: results from Sweden and lessons for the United States. Agrc. Econ. 22, 133–146. http://dx.doi.org/10.1111/j.1574-0862.2000.tb00013.x.
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.
McFadden, D., 1973. Conditional Logit Analysis of Qualitative Choice Behavior. In: Zarembka, P. (Ed.), Frontiers in Econometrics. Academic Press, New York, pp. 105–142.
Mzoughi, N., 2011. Farmers adoption of integrated crop protection and organic farming: do moral and social concerns matter? Ecol. Econ. 70, 1536–1545. http://dx.doi.org/10.1016/j.ecolecon.2011.03.016.
Oberholtzer, L., Dimitri, C., Greene, C., 2005. Price Premiums Hold on as U.S. Organic Produce Market Expands. VGS-308-01. U.S. Department of Agriculture, Economic Research Service, May.
Onozaka, Y., Thilmany McFadden, D., 2011. Does local labeling complement or compete with other sustainable labels? a conjoint analysis of direct and joint values for fresh produce claims. Amer. J. Agrc. Econ. 93 (3), 693–706. http://dx.doi.org/10.1093/ajae/aar005.
Padel, S., 2001. Conversion to organic farming: a typical example of the diffusion of an innovation? Sociol. Ruralis 41, 40–61. http://dx.doi.org/10.1111/1467-9523.00169.
Park, T.A., 2009. Assessing the returns from organic marketing channels. J. Agrc. Resour. Econom. 34 (3), 483–497, http://purl.umn.edu/57626.
Park, T.A., Lohr, L., 2006. Choices of marketing outlets by organic producers: accounting for selectivity effects. J. Agrc. Food Industrial Org. 2006 (4). http://dx.doi.org/10.2202/1542-0485.1129.
Parra-Lopez, C., De-Haro-Gimenez, T., Calatrava-Requena, J., 2007. Diffusion and adoption of organic farming in the southern Spanish olive groves. J. Sust. Agrc. 30 (1), 105–151. http://dx.doi.org/10.1300/J064v30n01_09.
Pietola, K.S., Lansink, A.O., 2001. farmer response to policies promoting organic farming technologies in Finland. Eur. Rev. Agric. Econ. 28 (1), 1–15. http://dx.doi.org/10.1093/erae/28.1.1.
Schneeberger, W., Darnhofer, I., Eder, M., 2002. Barriers to the adoption of organic farming by cash-crop producers in Austria. Am. J. Alternative Agrc. 17 (1), 24–31.
Sheeder, R.J., Lynne, G.D., 2011. Empathy-conditioned conservation: "walking in the shoes of others" as a conservation farmer. Land Econom. 87 (3), 433–452.
Sierra, L., Klonsky, K., Strochlic, R., Brodt, S., 2008. Factors Associated with Deregistration Among Organic Producers in California. California Institute for Rural Studies, Davis, CA.
Strochlic, R., Sierra, L., 2007. Conventional, Mixed, and "Deregistered" Organic Producers: Entry Barriers and Reasons for Exiting Organic Production in California. California Institute for Rural Studies, Davis, CA.
Strom, S., 2012, July 7. Has 'Organic' Been Oversized? The New York Times. Retrieved on July 8, 2012 from: http://www.nytimes.com/2012/07/08/business/organic-food-purists-worry-about-big-companies-influence.html.
USDA-NASS (United States Department of Agriculture, National Agricultural Statistics Service). 2012. 2011 Certified Organic Production Survey. Retrieved on June 5, 2013. http://usda01.library.cornell.edu/usda/current/OrganicProduction/OrganicProduction-10-04-2012.pdf.
Walz, E., 2004. Fourth National Organic Producers' Survey: Sustaining Organic Farms in a Changing Organic Marketplace. Organic Farming Research Foundation, Santa Cruz, CA. http://ofrf.org/publications/pubs/4thsurvey_results.pdf.
Wooldridge, J.M., 2006. Introductory Econometrics. South-Western, New York.