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Who produces organically and why? An analysis of California citrus growers

Abstract

Organic products have experienced strong growth in demand over the past two decades, but the growth in supply of organic products has lagged behind due to impediments such as risk, limited knowledge, and lack of infrastructure. Previous work has shown that growers choose to adopt organic practices for a variety of reasons, but a thorough analysis of these motivating factors has not yet been done. Using a 2010 survey of California citrus growers, this paper models the respondents' choice of whether or not to adopt organic practices and then fills the gap in the literature by analyzing their ratings for a variety of motivational factors. The analysis shows that growers with smaller citrus acreage, females, growers with college degrees, and growers who have the majority of their acreage in grapefruit are more likely to adopt organic practices than other growers. Women are more likely to rate the importance of health motivations above economic motivations compared to men, and growers with more experience are more likely to rate philosophical or intellectual motivations higher than economic motivations compared to less experienced growers.

Keywords: agriculture, citrus, organic, technology adoption.
JEL Classification: Q12.

Introduction

During the 1990s, demand for organic products increased an average of 20% annually. This growth in demand fueled growth in organic crop acreage. Between 1992 and 2005, organic cropland more than quadrupled, increasing from 403,400 acres to just over 1.7 million acres (USDA, 2008). Prior to the current recession, demand was predicted to increase annually by an additional 9% to 16% through 2010 (Dimitri and Oberholtzer, 2005). Since the beginning of the recession, total sales have continued to increase, but at a slower rate (California Certified Organic Farmers, 2009). Despite rapid growth in demand, growth in supply has lagged behind, and handlers are experiencing shortages of products. In 2007, 36% of organic handlers reported supply shortages ranging from minor to critical (Dimitri and Oberholtzer, 2009). This shortage in supply is driven by a variety of factors, including limited knowledge about organic production, risks inherent with changing production practices, and challenges with new marketing outlets and infrastructure (Willer and Yussefi, 2007).

A 2004 survey of organic growers provides evidence that many organic growers are not profit driven, but rather choose to grow organically for environmental or health reasons (Walz, 2004). A more thorough understanding of the factors motivating organic adoption is necessary to encourage increased adoption of organic practices to meet the increasing demand for organic products while keeping prices affordable. Using a 2010 survey of California conventional and organic citrus growers, this paper analyzes the factors that affect growers' adoption of organic production. The analysis shows that growers with smaller citrus acreage, females, growers with college degrees, and growers who have the majority of their acreage in grapefruit are more likely to adopt organic practices than other growers. However, among growers who adopt organic practices, motivations vary from economic reasons to health or environmental reasons.

The peer-reviewed literature contains little work that addresses why growers choose to adopt organic production in the United States. Sullivan et al. (1995) interviewed thirteen conventional and twelve organic growers in southeastern Michigan. Using t-tests, they compared conventional and organic growers' beliefs about the environment, benefits and drawbacks of farming, appreciation of nature, and connection to the land. They found that organic growers tend to be more connected to the land, less worried about financial issues, and have a stronger appreciation for nature than conventional growers. Lockertz and Madden (1987) surveyed Midwestern farmers in both 1977 and 1987. Using t-tests, they compared production practices and the respondents' stated preferences about the advantages and disadvantages of organic farming.

The peer-reviewed literature pertaining to adoption of organic methods in countries other than the U.S. is a bit richer. Studies have been conducted on adoption of organic practices in horticultural crops in the United Kingdom (Burton et al., 1999), olives in Spain (Lopez and Requena, 2005), a variety of crops in New Zealand (Fairweather, 1999), and a variety of crops in Norway (Storstad and Bjorkhaug, 2003). Lopez and Requena (2005) and Storstad and Bjorkhaug (2003) estimate logit models for the adoption of organic practices. Burton et al. (1999) has three groups of growers: conventional, organic and certified, and organic but not certified. In addition to estimating a logit model for organic adoption, they also estimate a multinomial logit model to estimate the choice of growers to join one of the three possible groups. Finally, Fairweather (1999) uses decision tree modeling to analyze growers' motivations. Lohr and Salomonsson (2000) consider a slight different research question for Swedish growers. They analyze whether or not a subsidy is necessary to promote adoption of organic production.

This paper contributes to the literature by undertaking a more thorough analysis of growers' motivations. The analysis that follows will contain two components: estimation of models of organic adoption (as done in previous work) and estimation of models of the individual and relative importance of economic versus other possible factors that motivate growers' decisions.

1. Models

This paper contains three classes of models: a classic technology adoption model, a model of the importance of individual motivating factors, and a model of the importance of economic factors relative to non-economic factors.

1.1. Technology adoption. I consider three types of growers: growers with all acres under conventional production, growers with all acreage under certified organic production, and growers with a combination of conventional and certified organic acreage[1]. For the first technology adoption model, I only consider the first two types of growers and model grower *i*'s decision to adopt production type *j*. Grower *i*'s utility from management type *j* can be written as:

$$V_{ij} = \beta_j{}' F_i + \gamma_j{}' G_i + \varepsilon_{ij}, \tag{1}$$

where F_i is a vector of farm characteristics, G_i is a vector of grower characteristics, and ε_{ij} is a random shock for grower *i* and production type *j*. Farmer *i* will adopt organic production, $j = o$, over conventional production, $j = c$, if:

$$V_{io} > V_{ic} \tag{2}$$

implying that the probability that grower *i* chooses organic is:

$$Prob\left(Organic = 1 \mid F_i, G_i\right) = Prob\left(V_{io} > V_{ic}\right) = \\ = Prob(\beta' F_i + \gamma' G_i + \varepsilon_i > 0), \tag{3}$$

where $\beta = \beta_o - \beta_c$, $\gamma = \gamma_o - \gamma_c$, and $\varepsilon_i = \varepsilon_{io} - \varepsilon_{ic}$ following equation (3) can be estimated with a probit model under the assumption that ε_i is normally distributed.

The second type of technology adoption model considers the possibility of partial adoption. Growers may choose to convert a portion of their acreage into organic production, but leave the remaining under conventional production. This yields three management types: all organic (*o*), all conventional (*c*) or mixed organic and conventional (*m*). These management types can be ranked in terms of the proportion of organic acreage. Grower *i*'s optimal proportion can be written as:

$$P_i^* = \delta' F_i + \alpha' G_i + \varepsilon_i. \tag{4}$$

When grouping growers into three production types, we observe:

$$P_i = \begin{cases} c \text{ if } P_i^* \le \tau_1 \\ m \text{ if } \tau_1 < P_i^* \le \tau_2, \\ o \text{ if } \tau_2 < P_i^* \end{cases} \tag{5}$$

which can be estimated with an ordered probit model.

Lastly, we can estimate equation (4) directly with a tobit model. Since growers' proportions are limited to the range zero to one, and since large probability masses will exist at these endpoints, the censored regression Tobit model is preferred to an ordinary least squares model. While one might argue that the Tobit model is preferred to the ordered probit model of equation (5), if growers with a mix of conventional and organic are similar regardless of the actual proportions, the ordered probit model may be the best approximation of reality. If grower characteristics vary as their proportions vary, then the Tobit model will be the preferred model.

1.2. Importance of motivating factors. A variety of factors motivate growers to adopt organic practices. Using Likert scale ratings to approximate the level of importance grower *i* attributes to factor *j*, one can estimate the determinants of the level of importance of each factor. For grower *i*, and motivating factor *j*, the level of importance can be written as:

$$L_{ij}^* = \mu_j{}' F_i + \pi_j{}' G_i + \varepsilon_{ij}. \tag{6}$$

Since most Likert scales use integer divisions instead of continuous variables, we observe:

$$L_{ji} = \begin{cases} 1 \text{ if } L_{ij}^* \le \tau_1 \\ 2 \text{ if } \tau_1 < L_{ij}^* \le \tau_2 \\ \quad . \qquad\qquad , \\ \quad . \\ \quad . \\ m \text{ if } \tau_{m-1} < L_{ij}^* \end{cases} \tag{7}$$

where *m* is the maximum possible rating. Equation (7) can be estimated with an ordered probit model for each motivating factor *j*.

1.3. Relative importance of motivating factors. In addition to the level of importance of each individual

[1] Growers falling into the third category can have any amount of organic ic acreage as long as it is greater than 0% and less than 100% of their total acreage.

motivating factor, the relative importance of each factor is of interest. This is particularly true if we are interested in analyzing how economic factors motivate growers relative to environmental and health factors. To analyze the relative importance, we can utilize a Tobit model for the difference in levels of importance. Since the difference is bounded between –(m – 1) and m – 1 due to the bounds on the Likert scale, the Tobit model is necessary to account for the truncation of possible differences. From equation (6), the Tobit model for the importance of factor j relative to factor k will be:

$$L_{ij}^{*} - L_{ik}^{*} = (\mu_j - \mu_k)' F_i + (\pi_j - \pi_k)' G_i + \varepsilon_{ij} - \varepsilon_{ik} = \qquad (8)$$
$$= \mu_{jk}' F_i + \pi_{jk}' G_i + \varepsilon_{ijk}.$$

2. Data

This paper makes use of a 2010 survey of California citrus growers. Growers' addresses were obtained from eighteen county agricultural commissioner's offices, and these counties contain 99.1% of California citrus acreage (U.S. Department of Agriculture, 2007). The survey was mailed to 3,959 growers, and a reminder postcard was mailed four weeks after the initial mailing. Of the number of surveys mailed, 479 were undeliverable, mailed to growers who did not or no longer grew citrus, or were consolidated onto other forms by managers who managed multiple farms. Overall, 429 growers responded, resulting in a 12.3% overall response rate. Among the survey recipients, I identified 166 growers as organic using the California Certified Organic Farmers' Grower Directory and the agricultural commissioner's offices records. In addition to the reminder postcard, these growers received a phone call and/or email reminder, depending on the public availability of phone numbers and email addresses. Sixty-five organic growers returned the survey, resulting in a 39.2% response rate for organic citrus growers.

All survey questions pertained to the 2009 pre-bloom to harvest season. The survey gathered information on farm characteristics including acreages of each citrus variety, total citrus acreage, and total crop acreage. It gathered information on grower characteristics including education, farming experience, age, gender, ethnicity, and the percent of the household income coming from farming. The survey also asked about received prices, but for citrus, the price received is a function of the quality of the citrus, and consequently, the price received will be a function of grower ability. In order to have an exogenous measure of prices, I constructed an expected per acre conventional revenue using revenue data at the county level obtained from county agricultural commissioners' reports[1]. The individual grower's expected revenue is weighted by his crop composition mix, regardless of the grower's organic/conventional mix. This variable is included in the farm characteristics vector and represents the grower's baseline expected value per acre. If the grower chooses to produce organically, he may achieve a higher per acre value due to organic price premiums. One would hypothesize that a higher expected conventional value would decrease the probability that a grower chooses to adopt organic management. The survey also asked about land tenure. One would hypothesize that growers who rent would be less likely to convert to organic production given the required 3-year transition period. Only three of the organic respondents rented land, supporting this hypothesis, but preventing the inclusion of a land tenure variable from the analysis. Table 1 (see Appendix) contains summary statistics of farm and grower characteristics.

Organic respondents were asked to complete an additional section. This section contained questions pertaining to their transition to organic and the percent of their citrus that they sell at an organic price premium. The section also contained Likert scale questions, asking respondents to rate how important 10 factors were in their decision to farm organically. Respondents rated importance on a scale of 1 to 5, with 1 being "not important" and 5 being "very important." Two factors, *farm diversification* and *reduced input costs* will not be analyzed here because several growers wrote in comments instead of choosing a number, resulting in a smaller sample size and possible sample selection bias from the non-numerical responses. Table 2 (see Appendix) contains summary statistics for these Likert scale variables.

To determine the relative importance of economic versus other kinds of motivating factors, I grouped the eight motivating factors into four categories: economic (consumer demand, price premiums, and increased profitability), health (personal, family, or farm work health and consumer health), environmental sustainability, and intellectual/philosophical (intellectual appeal and philosophical or spiritual reasons). For each group, I created an index that equals the mean of the respondent's responses for the factors contained in that index. I also created an index for all of the non-economic factors (health, environmental sustainability, and intellectual/philosophical combined). Table 2 contains summary statistics for the index variables as well as for the differences in index variables. Figure 1 contains histograms for the difference between the economic index and each of the other four indexes. A positive value indicates that the economic index exceeds the non-economic index. From the histograms in Figure 1 and the summary statistics in Table 2, it is apparent that economic factors, on average, are equally or more important than the non-economic factors.

[1] Similar data on organic prices were not available.

However, there are individual growers who rank non-economic factors as more important than economic factors. The analysis that follows will shed light on the characteristics of growers who are motivated by economic factors relative to non-economic factors.

3. Results

3.1. Technology adoption. Table 3 (see Appendix) presents the results for the three models of organic adoption. Most results are qualitatively robust across the three specifications. Growers with a majority of their acreage in grapefruit are more likely to adopt organic production. This may be due to a larger organic market for grapefruits than for other crops. Increasing total citrus acres decreases the probability that a grower adopts organic production (mixed or full) and decreases the percent of acreage allocated to organic production. The decrease occurs at a decreasing rate as acreage increases, and the turning point occurs between 10,230, and 11,125 acres. 99% of the respondents had acreage less than this turning point. Organic production may be more difficult to implement on a larger scale, resulting in this negative relationship between size and organic adoption. Growers with a college degree and females are more likely to manage a mixed or fully organic farm and are more likely to have a higher percentage of their acreage under organic production than those growers without a college degree or male growers. Organic production might involve more complex decision-making that growers with college degrees are more capable of undertaking. Conversely, growers with college degrees may be more aware of or have different beliefs regarding off-farm effects of agricultural production, motivating them to choose to produce organically. The significance of the female dummy variable suggests that females prefer organic production over conventional production. An economic explanation for the significance of this variable is unlikely. Males and females are most likely equally capable of successful organic production, on average.

In the probit model for 100% organic production, the Hispanic dummy variable is statistically significant and negative, but Hispanic ethnicity is not significant in the ordered probit or Tobit models. Like the female dummy variable, this variable is likely driven by preferences for farming type rather than ability to farm organically.

From these three models, it is clear that a mix of economic and non-economic factors influence a grower's choice of organic adoption. Consequently, the decision is a utility maximization problem with profit as one variable in the utility function rather than the decision being a strict profit maximization problem as one might assume the production decision to be.

3.2. Importance of motivating factors. Table 4 (see Appendix) contains the results from the ordered probit estimation of the importance of individual factors in the organic grower's decision to produce organically. While every explanatory variable is statistically significant in at least one model, none are statistically significant in more than half of the models. Different farm and grower characteristics affect how highly a grower rates any individual motivator. Interestingly, even within categories of motivating factors, different variables are statistically significant for different individual motivating factors.

3.2.1. Economic motivations. Within the economic motivations category, only two farm characteristics variables are significant in any model. An increase in the expected conventional value per acre is associated with a decrease in the level of importance of organic price premiums and consumer demand. This makes intuitive sense because as the conventional value per acre increases, the net gain from organic production decreases. Growers who have the potential to receive high prices for conventional products are probably less motivated by the economic benefits of organic production. Growers with the majority of their production in oranges rate the importance of consumer demand lower than growers with a majority of their acreage in the more specialized varieties of citrus.

A variety of grower characteristics are statistically significant in the models of economic motivations. Not surprisingly, increasing the share of the grower's household income that comes from farming increases the level of importance they place on the profitability of farming organically. A quadratic relationship exists between experience and the importance of organic price premiums. The minimum occurs at 21.8 years of experience. About 70% of the organic respondents have less than 21.8 years of experience. Similar relationships exist between age and the importance of demand and profitability. The minimums occur at 64.4 and 50.0 years of age respectively. About 60% of the organic respondents are less than 64.4 years old, but only about 20% of respondents are less than 50.0 years old. For the majority of respondents increasing age is associated with the increase in the importance of consumer demand, and likely marketing outlets, for organic products, but a decrease in importance of profitability.

While females are more likely to adopt organic production than males, this variable is only statistically significant in the model for the importance of organic price premiums. Females place a higher level of importance on price premiums than males. Similarly, minority ethnic groups place a higher level of importance on economic motivations than white growers. Asian, Hispanic, and growers of "other" ethnicity all rate the importance of organic price premiums higher than white growers. Asian and Hispanic growers rate the importance of consumer demand higher than white growers, and Hispanic growers rate the importance of profitability higher than white growers.

3.2.2. Environmental motivations. None of the farm characteristics statistically significantly affect the level of importance given to environmental sustainability. In terms of grower characteristics, there exists a quadratic relationship between the importance of the environment and grower experience. The maximum occurs at 22.9 years of experience. Among the ethnic group variables, growers of "other" ethnicity rate the importance of environmental sustainability higher than white growers.

3.2.3. Health motivations. The results for the importance of consumer health and the importance of personal, family, or farm worker health are similar to each other. Increasing citrus acreage decreases the importance rating given to the two health-related motivators. However, increasing total acres increases the rating given to the two health-related motivators. This relationship is quadratic, with the turning point occurring at the 97th percentile of total acreage. In terms of grower characteristics, growers with a college degree rate the importance of the health motivators lower than growers without a college degree, but females and growers of "other" ethnicity rate the importance of these factors higher than males and white growers, respectively.

3.2.4. Intellectual/philosophical motivations. There is more variation in the results for the two intellectual/philosophical motivations. The one similarity occurs with the relationship between total citrus acres and the importance of intellectual appeal and philosophical or spiritual reasons. For both motivating factors, increasing total citrus acres decreases the importance of the factor. For the philosophical reasons model, the relationship is quadratic, with the turning point occurring at the 97th percentile of total citrus acreage. Growers with a higher percentage of their household income deriving from farming, growers with more experience, and female growers all rate the importance of philosophical or spiritual reasons higher than their counterparts. Growers with more total acres and Hispanic growers rate the importance of intellectual appeal higher than their counterparts.

3.3. Relative importance of motivating factors. Table 5 contains the results of the Tobit estimation of the difference between the economic importance index and the indexes for health, environment, philosophy/intellect, and all non-economic factors as motivations for farming organically. Increasing a grower's citrus acreage is associated with an increase in the importance of economic factors relative to all four other indexes. This relationship is quadratic for all but the environment model, but the turning point occurs at the 97th percentile of citrus acreage. Likely, growers with large citrus acreage farm largely for economic reasons, making economic factors more important than other possible motivations for farming organically.

Growers with a higher expected value from farming conventionally are more likely to rate environmental motivations higher than economic motivations, relative to growers with lower expected conventional value. Increasing grower experience decreases the importance of economic factors relative to both philosophical/intellectual factors and the all factors index, but does so at a decreasing rate. The turning point occurs at about the 71st percentile of grower experience. Finally, females rate the importance of economic factors relative to health factors lower than males growers, while Hispanic growers rate the importance of economic factors relative to health and the all factors index higher than white growers.

Conclusions and policy implications

Converting to organic production is a risky venture with a three-year lag time on any economic benefits by way of price premiums or organic market outlets. At present, the supply of organic products does not always satisfy demand, suggesting that policy tools might be needed to reach an equilibrium that does not simply involve high prices for organic products. Understanding the probabilities with which different growers are likely to adopt organic production and understanding what motivates different growers to do so would help inform policy about ways to encourage increased organic supply.

This paper shows that there are several groups of growers with differing probabilities of adopting organic and among those who do adopt organic production, motivations differ. Citrus growers with large citrus operations and Hispanic growers are less likely to adopt organic production than growers with small citrus operations or white growers, respectively. Among large citrus operations and Hispanic growers, those who do adopt organic practices place a higher importance on economic motivating factors than health, environmental, or intellectual or philosophical reasons. Obviously, targeting the conversion of larger conventional operations for organic production would increase supply faster than targeting smaller growers, but these larger growers are less likely to adopt organic practices, creating an interesting problem. For these growers, economic incentives would be imperative. One possibility might be the creation of a "transitional" label for growers are no longer using non-organic inputs, but otherwise would not be able to obtain any price premiums. If consumers are willing to pay even a small price premium for transitional produce, this would increase the benefit of converting to organic production and might encourage more large growers to make the transition.

Women are more likely to adopt organic and are more likely to rank health motivations higher than economic motivations compared to men. Policies to encourage more women to adopt organic production might include disseminating information about consumer and farm worker health.

Interestingly, growers with a college degree are more likely to adopt organic practices, but no individual factor is particularly motivating for this group of growers. For growers without a college degree, if the decreased rates of adoption are due to less training or less experience with the types of complex decision-making involved with organic production, training workshops and other educational opportunities are likely ways to increase adoption.

The shortages of organic products suggest that increased organic production would increase social welfare, but the conversion to organic should be made by those growers whose conversion would yield the largest social benefit.

Given the fact that some growers rank non-economic motivations higher than economic motivations, some growers for whom it is not socially optimal to convert to organic may do so anyway. Such scenarios might include citrus growers in California where growers are attempting to confine the spread of the Asian citrus psyllid through the use of conventional pesticides. An organic grower has no adequate control for the psyllid, so conversion to organic would likely not be socially optimal in this case. While policies utilizing non-economic motivations should be employed for the case of growers whose conversion to organic yields a large social benefit, they should be used with caution for certain growers.

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Appendix

Table 1. Summary statistics (conventional $N = 282$, organic $N = 58$)

	Conventional		Organic	
Variable	Mean	St. dev.	Mean	St. dev.
All organic acreage*	0.00	0.00	0.79	0.41
Mixed organic and conventional acreage*	0.00	0.00	0.21	0.41
Expected conventional value per acre ($1,000s)	6.43	3.28	5.69	3.49
Majority of crop in				
Orange*	0.62	0.49	0.52	0.50
Lemon*	0.17	0.38	0.19	0.40
Grapefruit*	0.05	0.22	0.16	0.37
Mandarin*	0.08	0.27	0.03	0.18
Other*	0.05	0.22	0.03	0.18
Total citrus acres (100s)	0.97	3.90	0.15	0.29
Total acres (100s)	2.01	8.91	0.51	2.34
% income from farming	32.56	36.26	28.06	36.14
Butte*	0.02	0.16	0.00	0.00
Fresno*	0.06	0.24	0.02	0.13
Glenn*	0.02	0.14	0.02	0.13
Kern*	0.03	0.17	0.00	0.00
Kings*	0.00	0.06	0.00	0.00
Madera*	0.01	0.10	0.00	0.00
Orange*	0.71	0.45	0.69	0.47
San Bernardino*	0.07	0.26	0.00	0.00
San Diego*	0.16	0.37	0.41	0.50
San Joaquin*	0.37	0.48	0.09	0.28
San Luis Obispo*	0.01	0.10	0.09	0.28
Santa Barbara*	0.02	0.13	0.03	0.18
Ventura*	0.27	0.44	0.17	0.38
College Degree*	0.65	0.48	0.79	0.41
Experience	26.64	15.94	18.60	12.69
Age	64.95	12.82	59.43	13.46
Female*	0.15	0.35	0.34	0.48
Asian*	0.04	0.20	0.03	0.18
Hispanic*	0.07	0.25	0.03	0.18
Other ethnicity*	0.03	0.18	0.05	0.22

Notes: *Indicates binary variable.

Table 2. Importance of reasons to produce organically

	Average	Standard deviation	Min	Max
Economic factors				
Consumer demand for organic products	4.3	1.1	1	5
Price premiums for certified organic products	4.3	1.1	1	5
Increased profitability of growing organically (relative to conventional production)	4.2	1	2	5
Index	4.3	0.9	1.7	5
Environmental factors				
Environmental sustainability	4.2	1.1	1	5
Index	4.2	1.1	1	5
Health factors				
Personal, family, or farm worker health	4.1	1.3	1	5
Health of consumers	4	1.2	1	5
Index	4.1	1.3	1	5
Intellectual/philosophical factors				
Intellectually appealing	3.5	1.4	1	5
Philosophical or spiritual reasons	3.3	1.5	1	5
Index	3.5	1.3	1	5

Table 2 (cont.). Importance of reasons to produce organically

	Average	Standard deviation	Min	Max
Difference in indexes				
Economic – health	0.1	1.5	-2.7	4
Economic – environmental	<0.01	1.5	-2.7	4
Economic – intellectual/philosophical	0.8	1.7	-2.3	4
Economic – all non-economic	0.4	1.5	-2.3	4

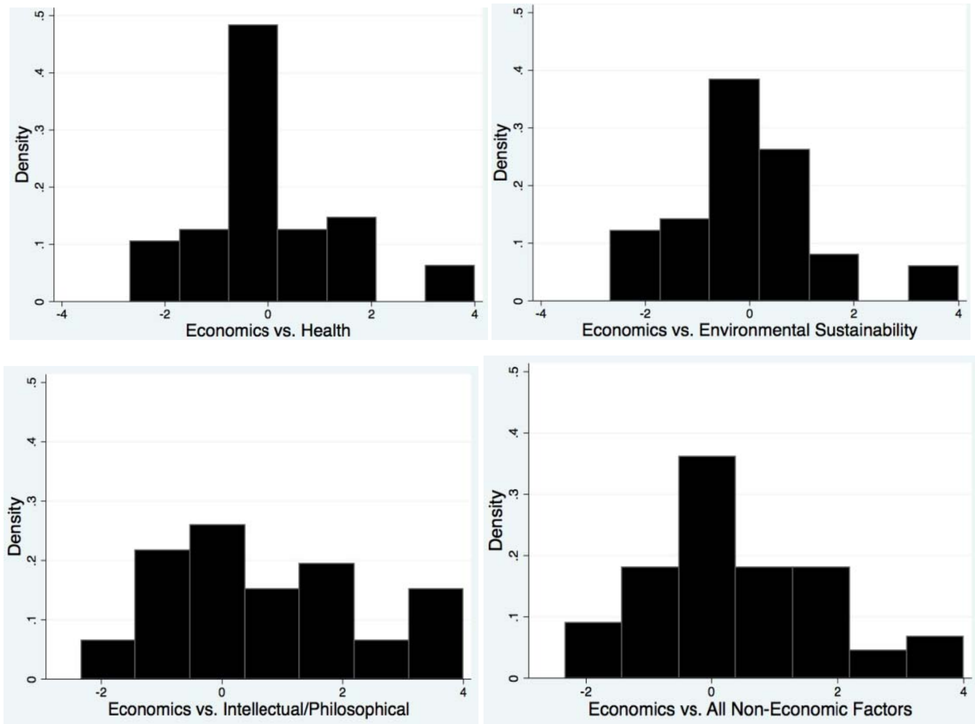

Fig. 1. Histograms of the relative importance of economic and non-economic factors as motivations for adopting organic production

Table 3. Determinants of organic adoption

	Organic adoption		C, M, O	% Organic
	Probit		Ordered probit	Tobit
	Coefficient	Marg. effect	Coefficient	Coefficient
E[Conv. value]	-0.0214	-0.0009	-0.0139	-0.0647
	(0.0474)	(0.0021)	(0.0498)	(0.2385)
Majority of crop in lemon	0.3651	0.0194	0.0133	0.0305
	(0.3865)	(0.0262)	(0.3814)	(1.8189)
Majority of crop in grapefruit	1.1363**	0.1264	0.9554**	4.5091**
	(0.3654)	(0.0996)	(0.3505)	(2.0951)
Majority of crop in mandarins	-0.2424	-0.0082	-0.3230	-1.5532
	(0.4247)	(0.0134)	(0.4060)	(1.9464)
Majority of crop in other	-0.4629	-0.0129	-0.4388	-2.1681
	(0.5454)	(0.0138)	(0.5430)	(2.6355)
Total citrus acres	-2.9634**	-0.1248**	-0.8187**	-3.9433*
	(1.1591)	(0.0581)	(0.3344)	(2.1647)
Total citrus acres^2	0.1448**	0.0061**	0.0368**	0.1773
	(0.0581)	(0.0028)	(0.0174)	(0.1076)
Total acres	-0.2894	-0.0122	-0.0355	-0.1828
	(0.2571)	(0.0143)	(0.0483)	(0.2370)
Total acres^2	0.0145	0.0006	0.0012	0.0062
	(0.0115)	(0.0007)	(0.0012)	(0.0060)
% income from farming	0.0060	0.0003	0.0038	0.0187
	(0.0044)	(0.0002)	(0.0033)	(0.0163)

Table 3 (cont.). Determinants of organic adoption

	Organic adoption		C, M, O	% Organic
	Probit		Ordered probit	Tobit
College degree	0.3664	0.0137	0.4154*	1.9544*
	(0.2576)	(0.0134)	(0.2172)	(1.1561)
Experience	-0.0133	-0.0006	-0.0097	-0.0455
	(0.0250)	(0.0011)	(0.0223)	(0.1082)
Experience^2	0.0002	0.0000	0.0001	0.0003
	(0.0004)	(0.0000)	(0.0004)	(0.0019)
Age	-0.0807	-0.0034	-0.0375	-0.1838
	(0.0662)	(0.0035)	(0.0534)	(0.2592)
Age^2	0.0004	0.0000	0.0001	0.0005
	(0.0005)	(0.0000)	(0.0004)	(0.0021)
Female	0.4040	0.0227	0.6222**	2.9841**
	(0.2519)	(0.0249)	(0.2195)	(1.1730)
Asian	0.6069	0.0460	0.0595	0.2775
	(0.5321)	(0.0721)	(0.5171)	(2.4807)
Hispanic	-1.0677*	-0.0186	-0.7281	-3.5547
	(0.6206)	(0.0167)	(0.4456)	(2.3576)
Other ethnicity	0.4553	0.0300	0.2922	1.3587
	(0.4458)	(0.0464)	(0.4411)	(2.1530)
Constant	2.3590			3.7504
	(2.0151)			(7.5209)
Controls for grower's county	Yes		Yes	Yes
N	268		340	297
Pseudo R^2	0.301		0.252	0.217

Notes: *, **, *** represent significance at the 10%, 5%, and 1% level, respectively. Robust standard errors are reported in parentheses.

Table 4. Ordered probit estimation of the level of importance of motivating factors

	Premium	Demand	Profit	Environ.	Cons. health	Fam. health	Intellect	Philosophy
E[Conv. value]	-0.1505**	-0.1305*	-0.0990	0.1162	-0.0299	-0.0904	-0.0997	-0.0029
	(0.0767)	(0.0703)	(0.0620)	(0.1304)	(0.1379)	(0.1607)	(0.0912)	(0.0833)
Majority oranges	-0.7286	-1.0281**	-0.3283	0.0040	-0.1184	-0.4839	-0.4474	0.1313
	(0.5034)	(0.4883)	(0.4559)	(0.4963)	(0.4593)	(0.5155)	(0.4703)	(0.4057)
Total citrus acres	5.2764	6.8848	1.0307	-2.7050	-14.2969**	-11.3349**	-6.8577**	-7.5694***
	(5.1972)	(5.0335)	(4.1549)	(2.6160)	(6.0826)	(4.6143)	(2.6915)	(2.2198)
Total citrus acres^2	-6.1964	-6.3360	-1.4722	1.7969	4.0982	1.8450	1.3230	3.0702**
	(5.3482)	(4.8041)	(4.0739)	(1.6374)	(2.7961)	(1.1260)	(1.4166)	(1.0952)
Total acres	-0.4511	-4.7534	0.8475	0.1859	8.9766**	7.6438**	5.1115*	1.5897
	(3.4530)	(3.7810)	(2.7547)	(2.8141)	(4.1238)	(3.5605)	(2.6388)	(2.3143)
Total acres^2	1.6464	3.7095	-0.0238	-0.0110	-0.4845**	-0.4133**	-0.2773*	-0.0902
	(2.4936)	(2.4264)	(1.9019)	(0.1538)	(0.2236)	(0.1943)	(0.1437)	(0.1264)
% income from farming	0.0006	0.0099	0.0107*	0.0048	0.0087	0.0108	0.0020	0.0169**
	(0.0071)	(0.0072)	(0.0058)	(0.0062)	(0.0064)	(0.0074)	(0.0065)	(0.0057)
College degree	0.0082	0.4092	-0.4939	0.0159	-1.4835**	-1.6005**	-0.0795	-0.6033
	(0.4908)	(0.5379)	(0.4483)	(0.4772)	(0.5470)	(0.5420)	(0.5731)	(0.4723)
Experience	0.1003*	0.0245	-0.0840	0.0780*	0.0935	0.1899**	0.0790	0.2857***
	(0.0600)	(0.0580)	(0.0596)	(0.0446)	(0.0669)	(0.0735)	(0.0601)	(0.0800)
Experience^2	-0.0023**	-0.0002	0.0016	-0.0017**	-0.0016	-0.0039**	-0.0015	-0.0062***
	(0.0011)	(0.0011)	(0.0011)	(0.0007)	(0.0013)	(0.0013)	(0.0012)	(0.0018)
Age	-0.1575	-0.2319*	-0.2802*	-0.0684	0.0356	0.0118	0.0729	0.0997
	(0.1184)	(0.1203)	(0.1640)	(0.1048)	(0.1137)	(0.1000)	(0.1290)	(0.1328)
Age^2	0.0014	0.0018*	0.0028*	0.0005	-0.0005	-0.0002	-0.0005	-0.0011
	(0.0010)	(0.0010)	(0.0015)	(0.0009)	(0.0010)	(0.0009)	(0.0011)	(0.0011)
Female	0.7716*	0.0462	0.3360	0.5387	1.2685**	0.9188*	0.1526	0.7615**
	(0.4624)	(0.4900)	(0.3891)	(0.3981)	(0.4221)	(0.5312)	(0.4084)	(0.3864)

Table 4 (cont.). Ordered probit estimation of the level of importance of motivating factors

	Premium	Demand	Profit	Environ.	Cons. health	Fam. health	Intellect	Philosophy
Asian	7.2973***	5.1727***	0.3312	-1.1365	-1.3898	-1.5206	-1.5392*	-0.6610
	(0.7557)	(0.7778)	(1.1159)	(1.3591)	(1.2079)	(1.2236)	(0.9181)	(0.7307)
Hispanic	8.1690***	5.3634***	6.9335***	-0.2327	-0.9235	-0.6413	1.2799**	0.4939
	(0.5669)	(0.8360)	(0.4996)	(1.0016)	(0.7213)	(0.5245)	(0.6035)	(1.2861)
Other ethnicity	8.9916***	0.2092	0.6492	5.4401***	6.1431***	5.3983***	-0.0257	0.8099
	(0.4493)	(0.8227)	(0.8202)	(0.5057)	(0.5206)	(0.5214)	(0.4407)	(0.9301)
N	55	53	53	56	55	53	54	53
Pseudo R^2	0.232	0.142	0.188	0.127	0.210	0.191	0.108	0.219

Table 5. Tobit estimation of the difference in importance of motivating factors

	Importance of economic factors relative to:			
	Health	Environment	Philosophy/intellect	All
E[Conv. value]	-0.0946	-0.1533*	-0.1054	-0.1052
	(0.0738)	(0.0888)	(0.0828)	(0.0720)
Majority of oranges	-0.7431	-0.6781	-0.3699	-0.6247
	(0.6450)	(0.6637)	(0.6771)	(0.6318)
Total citrus acres	7.6545***	3.8834*	7.9582***	6.9157***
	(1.8834)	(2.2906)	(2.0491)	(1.7576)
Total citrus acres^2	-3.1441*	-2.1516	-3.3017**	-2.9412*
	(1.5905)	(1.8284)	(1.5232)	(1.5515)
Total acres	-2.1059	-0.2969	-2.4246	-1.8704
	(2.1317)	(2.7086)	(2.2119)	(2.1281)
Total acres^2	0.1076	0.0104	0.1284	0.0974
	(0.1168)	(0.1486)	(0.1210)	(0.1167)
% income from farming	-0.0053	-0.0004	-0.0063	-0.0046
	(0.0077)	(0.0084)	(0.0089)	(0.0080)
College degree	0.5048	-0.0527	0.2148	0.1814
	(0.5541)	(0.6125)	(0.7089)	(0.6118)
Experience	-0.0759	-0.0691	-0.1152*	-0.1001*
	(0.0587)	(0.0579)	(0.0621)	(0.0580)
Experience^2	0.0014	0.0013	0.0022*	0.0018*
	(0.0010)	(0.0009)	(0.0011)	(0.0010)
Age	-0.0641	-0.0935	-0.2056	-0.0969
	(0.1200)	(0.1143)	(0.1588)	(0.1185)
Age^2	0.0006	0.0009	0.0019	0.0010
	(0.0011)	(0.0010)	(0.0013)	(0.0010)
Female	-0.8242*	-0.5676	-0.2713	-0.5558
	(0.4671)	(0.4687)	(0.5749)	(0.4667)
Asian	1.0671	1.8335	1.9666	1.4962
	(1.6006)	(1.6581)	(1.2912)	(1.4011)
Hispanic	2.1643***	0.8058	-0.2195	1.7316**
	(0.5701)	(0.9320)	(1.0067)	(0.5608)
Other ethnicity	-0.4043	-0.2644	0.0697	-0.1097
	(0.6609)	(0.6811)	(0.7442)	(0.6472)
Constant	2.9646	4.0686	7.5579	4.2077
	(3.2777)	(3.1408)	(4.6805)	(3.1293)
N	50	52	51	49
Pseudo R^2	0.113	0.088	0.114	0.121

Notes: *, **, *** represent significance at the 10%, 5%, and 1% level, respectively. Robust standard errors are reported in parentheses.