# ADOPTION OF CERTIFIED ORGANIC PRODUCTION: EVIDENCE FROM MEXICO

Caroline E. Hattam and Garth J. Holloway
Department of Agricultural and Food Economics, University of Reading, PO Box 237, Reading, RG6 6AR, UK.
Tel: +44 (0)118 931 6775
e-mail: c.e.hattam@reading.ac.uk/garth.holloway@reading.ac.uk

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## Abstract

Adoption of organic production and subsequent entry into the organic market is examined using Mexican avocado producers as a case study. Probit analysis of a sample of 183 small-scale (<15ha) producers from Michoacán suggests that adoption is positively influenced by management and economic factors (e.g. production costs per hectare and making inputs), but also by social factors (e.g. membership of a producers' association). Experience in agriculture has a significant but negative effect. Effective policy design must be therefore be aware of both the economic and social complexities surrounding adoption decisions.

## Introduction

Adoption of organic agriculture and organic certification allow farmers to obtain access to the fastest growing sector of the international food market and obtain a premium for their produce (FAO, 2002). However, the organic market has high entry costs. The decision to adopt requires significant changes and, although reversible, has long-term implications. Nevertheless, the organic market is promoted by NGOs, donor organizations and increasingly governments as an opportunity for producers in less developed countries to improve their incomes (FAO, 2002; Parrot and Marsden, 2002).

What remains unclear is the extent to which this dynamic market can be exploited by producers in the less developed regions and especially by the small-scale, rural poor (Harris *et al.*, 2001). To ensure that the rural poor do benefit from this opportunity, there needs to be understanding of the multifarious aspects (social, economic, technical and institutional) that impact the adoption decision. The search for this understanding is the subject of this exercise. Using small-scale (<15ha) avocado producers in Michoacán, Mexico, we explore the factors determining the adoption of organic production with a view to determining the types of interventions that are likely to encourage conversion. In what follows, we briefly detail the nature of avocado production in Mexico; describe the survey and data used in the probit investigation; outline the methodology used to implement the model; present the results and close with a discussion and conclusions. Extensions are discussed.

## Avocados in Mexico

Mexico is the world's largest producer of avocados, almost 90 percent of which come from one state: Michoacán. At the end of 2004, the avocado zone of Michoacán covered 87 359 ha, producing 847 653 tonnes of fruit and involving over 6000 producers (SIAP 2004), yet only 8-10 percent of this is exported (Torres *pers. comm.*). The vast majority of producers are small-scale with low yields, poor quality fruit and sell almost exclusively to the national market (Stanford, 1998). Organic avocado production began in the 1980s as a response to falling prices and increasing costs, but at this time there was no recognised organic market for the produce. The first commercial efforts began in 1997, coinciding with the opening of the US market to Mexican avocados. Adoption, however, has been slow and today only approximately 100 producers and 1265 ha are certified as organic. Of these 100 producers, about half are small-scale organic producers, although some of these also have large scale conventional operations.

## The survey data

Data collection was completed in two stages. Initially, in early 2004, 32 semi-structured interviews were conducted with key economic actors, including organic and conventional avocado growers, members of avocado producers' associations, buyers and packers of avocado, organic certification agencies, researchers and government officials. This was followed by an in depth household survey of 233 small-scale avocado producers, 186 conventional (non-adopters) and 47 certified organic (adopters). The survey collected information on household demographics, attitudes to organic production, avocado production and yields, assets and access to credit and information. The definition of "organic" is important. Here, "organic producers" are those who are fully certified as organic and selling on the organic market, and producers who are in the so-called "transition period", the period in which an adopter has committed to enter the organic market, but has yet to receive full certification.

## Modelling the decision to adopt organic production

Briefly, the economic model underlying the empirical investigation presupposes expected utility maximisation and the notation $E\left(U_{ij}\right)$ where $E\left(U\right)$ denotes expected utility, $i\left(=1,2,...,N\right)$ denotes an individual in the sample and $j\left(=1,\text{ if the agent adopts, }=0,\text{ otherwise}\right)$ denotes action. Using this notation, individual *i* adopts organic production if the expected utility from adoption exceeds the expected utility from non-adoption, or, in other words, if $E\left(U_{i1}\right) \geq E\left(U_{i0}\right)$. This is a standard interpretation of the binary responses in a structured survey (Feder *et al.*, 1985) and a standard set of techniques is available for investigating the factors that influence the adoption decision (Greene, 2003). The probit model is implemented by defining $y_i^* = U_{i1} - U_{i0}$ as the unobserved (latent) difference in expected utilities, assuming that the respective actions depend on observed covariates $x_i = \left(x_{i1}, x_{i2}, ..., x_{iK}\right)'$ and random error, $\varepsilon_i$, and by assuming, in turn, that the random error is normally distributed. Accordingly, with $\beta = \left(\beta_1, \beta_2, ..., \beta_K\right)'$ a set of corresponding (unknown) adoption coefficients, $y_i^* = x_i'\beta + \varepsilon_i$ models the adoption decision and we observe $y_i = 1$ if $y_i^* \geq 0$ and observe $y_i^* = 0$, otherwise. Estimates of the location and scales of the unknown coefficients are retrieved using a standard procedure (Albert and Chib, 1993) and indicate the direction in which the explanatory variables influence the adoption decision, their relative importance and their statistical significance.

## Results and discussion

Due to missing data, the model was run on a reduced data set of 147 conventional producers and 36 organic producers, representing 77 percent of small-scale organic producers in Michoacán. The results of the probit analysis are summarised in Table 1. Four of the selected variables have a significant impact on the decision to adopt organic agriculture. The other variables included in the model, while being significantly different between groups, are not significant, however they can be used to complement the model output (Hair *et al.*, 1998).

The result that making inputs and, to a lesser extent, exporting fruit and registering costs positively influence the decision to adopt organic production is as expected, but could be construed as a consequence of being an organic producer. The only market for organic fruit where it obtains a premium is the export market; registering costs and transparent administration are necessities for obtaining organic certification, and making inputs forms part of the organic ideology of closing the agricultural system. However, having experience of such activities will make the transition to organic production and entering the organic

market a much easier venture. Learning and experience are important factors in the adoption process (Feder and Slade, 1984; Lindner *et al.*, 1979).

**Table 1. Binomial probit results for the adoption of organic agriculture**

| Variables $(x_i)$ [1] | $\beta$ estimates | Highest posterior density interval (95%) | |
|---|---|---|---|
| **Experience in agriculture (years)** | **-0.029** | **-0.056** | **-0.003** |
| Orchard size (ha) | 0.024 | -0.091 | 0.134 |
| Export fruit (1=yes, 0=no) | 0.443 | -0.283 | 1.186 |
| Number of full time contracted labourers (not family) | -0.126 | -0.488 | 0.233 |
| Register costs (1=yes, 0=no) | 0.489 | -0.325 | 1.326 |
| Register harvest volume (1=yes, 0=no) | 0.034 | -0.812 | 0.865 |
| Management plan (1=yes, 0=no) | 0.385 | -0.290 | 1.079 |
| Other crops (1=yes, 0=no) | 0.565 | -0.057 | 1.215 |
| Other sources of income (non farm) (1=yes, 0=no) | 0.618 | -0.029 | 1.295 |
| Information source other than agronomist (1=yes, 0=no) | 0.469 | -0.161 | 1.111 |
| **Membership of association (1=yes, 0=no)** | **1.032** | **0.402** | **1.678** |
| Age (scaled by 10) | -0.105 | -0.385 | 0.172 |
| Education | -0.295 | -0.636 | 0.031 |
| Most educated family member | 0.035 | -0.254 | 0.326 |
| **Total costs/ha (inputs, administration, rental of farm machinery) (in thousands of pesos)** | **0.034** | **0.000** | **0.068** |
| **Make own inputs (1=yes, 0=no)** | **1.774** | **1.061** | **2.517** |

[1] Variables in bold indicate significant $\beta$ estimates (calculated with a Gibbs sampler run for 25 000 iterations) confirmed by the highest posterior density intervals not crossing zero. The sign of the $\beta$ estimates indicate the direction of the impact of the variable.

The insignificance of age suggests that organic production is suitable for all, but at the same time, producers with more experience in agricultural work are less likely to adopt. This finding agrees with the literature that organic producers are newer entrants to farming (Padel, 2001; Burton, 1999). The literature also states that smaller land holdings are the norm among organic producers (Padel, 2001), contrary to mainstream adoption theory (Feder e*t al.*, 1985). Nevertheless, the data presented here show orchard size to be unimportant to the adoption decision, indicating that any orchard size within the class of "small-scale producer" is feasible for conversion.

In contrast to adoption and diffusion theory (e.g. Rogers, 1983) and previous research into the adoption of organic production (e.g. Burton *et al.*, 2003; de Souza *et al.*, 1999), education is shown to have a negative and insignificant influence on the adoption decision. This is in fact an encouraging result, especially for Michoacán, where 59.9% of the population has only primary education or less (INEGI, 2001) and for less developed countries as a whole, suggesting those with limited schooling may convert with success. Having educated family members is also not significant to the adoption decision.

Costs per hectare have a positive significant effect on the decision to adopt organic production, implying higher costs for organic producers. As Table 1 shows, alternative sources of income have a positive influence (although insignificant), which may be particularly important in providing extra income to aid adoption. Likewise cultivating other crops positively influences the decision. This could be interpreted as making optimal use of space within the orchard, but in actual fact, the "other crop" is usually a commercial one, such as peaches, grown conventionally on another plot of land, again suggesting the importance of additional income. Furthermore, being an organic producer and growing other crops indicates a greater demand for labour (Lampkin and Padel, 1994), but the results show that the number of full-time contracted employees is insignificant to the adoption process. This may mean that organic farmers rely more heavily on family labour, but more probably reflects some risk or uncertainty in the labour market.

Membership of a producers' association increases the likelihood of conversion to organic production, aided by obtaining management information from more diverse sources. This coincides with other studies (Rigby *et al.* 2001, Burton *et al.* 2003) which suggest that normal channels of information flow (via agronomists) are not suitable for organic producers. However, other sources are available and associating with other producers may improve their flow. Avocado producers' associations are also concerned with fruit sales and bulk purchasing of inputs. These roles are critical for the small-scale organic producer whose individual production may not be sufficient to supply demand, but also because of the relative scarcity and cost of locally available "ready to apply" organic inputs.

## Conclusions

If organic production is to be promoted, then understanding the key factors affecting the adoption decision is paramount to designing projects and policies. Using probit analysis, this work demonstrates that interventions should focus on the social capital of producers, strengthening producers' associations and networks for information flow, and increasing the availability of more diverse information sources. However, introducing organic production into mainstream information channels (i.e. training agronomists in organic production) can also be expected to be beneficial.

Fortifying producers' management, planning and accounting skills should also increase adoption by encouraging a more commercial outlook to avocado production, especially export orientation. Promoting the elaboration of homemade inputs will also positively influence adoption, while at the same time help to reduce the costs of organic production. These results clearly demonstrate the simultaneous need to deal with both the social and economic factors affecting adoption if small scale producers in developing countries are to reach the certified organic market.

The findings presented here will be extended in two ways. First, we will assess the relative contributions of each of the significant variables to the adoption decision by computing marginal probabilities of entry (Greene, 2003), and second, we will evaluate the posterior odds of a model that includes only economic factors against one that includes only social factors and the one above, which considers that both economic and social factors are significant in the adoption decision.

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